SANREM CRSP

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Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program

External Evaluation Panel Program Review
January 2008

SANREM CRSP Long-term Research Awards, FY 2007

USAID
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VirginiaTech
Invent the Future

SANREM CRSP
External Evaluation Panel

Year Four Program Review, January 25, 2008

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Executive Summary

The EEP team is very impressed by the new knowledge generated, the excellent graduate training, and scientific staff commitment to engage in multidisciplinary research. We believe that the SANREM program is a suitable instrument to capitalize on the strong disciplinary knowledge base and development research expertise at American universities in addressing complex issues of developing country contexts through an inter- and trans-disciplinary approach. As we place more stress on the environment due to rapid change, there are often unintended consequences for these linked people-agricultural-environmental systems. The inter- and trans-disciplinary approach to research exemplified by SANREM is the most viable way to address the complexity that is the real world.

Following the interchange with the LTRAs on the Interim Report, the EEP commends the research teams for the constructive way in which they responded to the numerous suggestions made in the report. Particularly promising are the efforts made in developing the conceptual models for the projects to guide the process of analyzing the data collected so far and the priority setting for additional data collection. The EEP encourages the LTRAs to continue to develop these conceptual models in the remaining time of the projects. These models should help in generating general concepts that emerge from the research. These should also be helpful to ensure that the projects maintain high standards of scientific quality, which should be a hallmark for US University driven projects. The EEP is also encouraged by the increasingly prominent role that the LTRA partners in the host countries are playing in the planning and execution of the projects. The EEP sees this as an essential component of capacity building at the institutional level.

As a means of capitalizing fully on the investments made in the LTRA projects, the EEP suggests that, towards the end of this SANREM phase, each of the projects are asked to identify and extract general concepts that are outcomes of their research work. Using these generalizations as a basis for discussion, it is suggested that the ME organize a final synthesis meeting with the principal investigators of the LTRAs in order to identify the common principles (models and metrics) that SANREM III has developed or can develop to add to the international discourse on Natural Resource conservation and use

Recommendations for SANREM

The specific recommendations below focus on issues that emerged from the evaluation, with emphasis on elements that could be improved based on our insights obtained from the existing programs. These are aimed at further strengthening the SANREM program as a whole. We believe that investment in future SANREM programs should be augmented, and that future programs will benefit from the following recommendations. We recommend:

- The continued development of instruments to extract cross-cutting public good from the research projects. Those should include knowledge related to soils, water, biodiversity and ecosystem services, governance, institutions, and gender.

- The development of a mechanism for learning across SANREM LTRA project experiences, including analytical papers on what worked and what did not, and how local institutions were recruited and integrated into the SANREM program.

- Each project should continually reassess its activities in the research-extension continuum within TOP and clearly identify the range of research activities where U.S. universities have their greatest contribution to make. This should result in a planned balance between fundamental and applied research, and in the articulation of a philosophy and strategies for scaling and outreach of integrated systems and their technologies.

- More preparatory work should be done to establish an agreed upon integrated framework of objectives leading to hypotheses, with output and deliverable due dates becoming project milestones. Clearly identified knowledge gaps could then be filled where possible from associated research. A set of deliverables corresponding to the SANREM core funding should be identified, as well as additional desired deliverables subject to more funding through the many leveraging channels.

- The relationship between PIs and their respective researchers needs attention. The ME may need to make clear to all researchers that projects, despite differences in disciplines or seniority between PIs and their colleagues, the PI needs to lead the research. PIs and researchers need to agree on what outputs are needed, and when. Milestones for each researcher's work need to be set and met. PIs are not simply facilitators, they must exert leadership. The ME needs to support PIs in their leadership roles.

- As mentioned in the Collaborations section, above, better communication is needed so that people in all parts of each project know about the work of others and how it all fits together. Also, more and better inter-project communication is needed.

- One essential objective is to build the capacity to conduct interdisciplinary science and, as mentioned above, to leave behind the capacity to carry on work begun under SANREM projects. The selection of students for academic training and their venues of training need to be reviewed to assure the strong likelihood of contributing to the scientific capacity of SANREM host countries. Graduate education should be done by exposure to cutting-edge science.

- Considering the complexity of this type of research program — serving the interfaces of agriculture, people, and the environment — the EEP recommends to extend the program beyond the five years' research of the first phase, particularly for those projects where the promotion of sustainable institutional change and policy modifications on the basis of the research have a realistic chance of being realized.

- There may be merit in reorganizing the reporting on these projects. The reporting under categories of objectives seems not to be sufficient. As the projects develop a conceptual framework they might report in a more functional fashion using these frameworks. Specifically, the project reports should comprise the objectives, hypotheses, activities,

research protocol, and capacity building. It might be useful to report using the model components as a framework. Reporting should be more detailed.

- Because SANREM is a flagship program of USAID, the EEP recommends that funding for SANREM be maintained at contractual levels. If any cuts in funding should be made, the Technical Committee should ensure that this not be done at the expense of core activities and scientific rigor. The EEP recognizes the value of leveraging SANREM funding but also registers that leveraging can contribute to mission drift.

- The SANREM Knowledge and Information System is well documented and conveniently accessible. The ME and researchers need to encourage the use of the knowledge base by as many means as possible. The ME in cooperation with researchers should issue news releases regarding research findings as appropriate, useful and especially to draw attention to the expanding SANREM Knowledge Base.

- In country collaborators need to be full partners. The EEP wishes to see the partners to assume full participation in the SANREM science, its design and implementation.

Recommendations for USAID and the Donor Community

The SANREM program should be seen in the context of an increasing public awareness of the vulnerability of the world's Natural Resource base, brought to the fore by the Millennium Ecosystem Assessment. The investments made by the donor community in the development of Sustainable Agricultural Systems should not only be of benefit to the stakeholders in the partner countries, but should equally add to the body of knowledge that will guide policy makers in managing the conservation and use of the worlds heritage in natural resources. The body of work that is currently being undertaken by SANREM CRSP researchers has the potential to make an important contribution in this regard with important new discoveries based on quality science about the interrelationships of natural resources, technology and human livelihoods. The external review panel identified several overarching areas for continual emphasis and improvement in the ongoing SANREM work.

Our review of this ongoing research also indicates to us the pressing need for the donor community to respond more vigorously and effectively to the necessity for research on sustainable agriculture and natural resources management. The research and findings are badly needed throughout the world, to help people emerge from poverty and conflict, and to prevent communities and nations from falling into poverty and conflict. Some of the needs are the following: More long-term research with long term objectives; greater emphasis on long-term impacts; increased funding to support the quality of science; and more integration of previous findings into new initiatives.

1. The effects of human activity on natural resources evolve slowly, but can spell life or death to people and other communities. Our research must be planned and supported for the long term in order to understand life processes, and protect society from disaster.

2. Much investment is made for the purpose of short term impacts. Planning and investing for quick impacts often requires shortcutting diligence in understanding the probable effects of investments, and diminishing accountability for actions that prove wasteful and destructive in the long run. Investment for short term impact needs to be balanced by greater investment for long term impact.

3. Evaluations of research on the environment and human activity, in SANREM and elsewhere, abound with cases of too little invested for understanding complex and seriously consequential problems. It is our judgment that funding for research like that in SANREM is many orders of magnitude less than the costs of the consequences for not understanding and solving the environmental problems that we face.

4. The SANREM Knowledge and Information System is well documented and conveniently accessible. It will be useful for the donor community to always encourage through their funding activity, the utilization of present knowledge in new initiatives. It is remarkable that funding initiatives by donors does not sufficiently build upon parallel or previous work funded or known by the donor, which could make new investment more productive. Better integration of knowledge is needed at the donor level.

The Mission of the EEP

The SANREM EEP is charged with providing technical guidance and evaluation of program activities. SANREM EEP assessments provide the ME with an independent perspective to ensure the highest-quality SANREM CRSP programming.

The EEP's Goals

The objectives of an EEP review are to:

- Maintain programmatic focus and effective scientific balance of research toward achievement of objectives;
- Identify inadequate performances;
- Identify activities that are irrelevant or marginal to CRSP objectives;
- Consider effective balance between research and training for development of institutional research capability;
- Assess the balance of domestic versus overseas research in terms of effectiveness in removing constraints in developing countries;
- Evaluate the cost-effectiveness of the entire CRSP operation in terms of actual cost of doing business versus costs of alternatives that may be less expensive, more efficient, and more effective; and
- Examine ways of disseminating research results and determining the appropriateness of the research.

The Team Members

The SANREM CRSP EEP is composed of five members with different disciplinary expertise and regional experience. The EEP was initially selected to review the LTRA applications. Its members were selected for the high quality and recognition of their scientific work, the diversity of their expertise, and the lack of conflict of interest with LTRA application teams. For this LTRA review, the EEP team members and their area of expertise are:

- **Ron Cantrell,** former Director General International Rice Research Institute, agronomy (EEP Chairperson);
- **Richard Harwood,** Michigan State University, Emeritus, agronomy and sustainable farming systems (former EEP Chairperson);
- **Kathleen Galvin,** Colorado State University, anthropology;
- **Robyn Burnham,** University of Michigan, ecology and botany;
- **Edwin Price,** Texas A&M University, economics, policy and farming systems; and
- **Paul Vlek,** University of Bonn, soil science, agronomy.

Harwood, Galvin, and Burnham were original LTRA application reviewers. Price succeeded Don Winkelmann, the original economist on the EEP. Vlek and Cantrell were added to the EEP to replace Harwood, who retired in 2007.

Methodology for the Evaluation

The SANREM CRSP EEP Program Review consisted of two components:

1. Interim LTRA Review, May 1- July 10, 2007; and
2. Overall Program Review, July 11, 2007 to January 15, 2008

Interim LTRA Review

The Interim LTRA Review's purpose was to evaluate the progress and potential of the individual SANREM LTRA activities. These 3.5-year projects form the core of SANREM CRSP primary research. They were initiated during the spring of 2006 and run through September 2009. The Interim LTRA Review covered their progress during their first year and a quarter and involved a desktop review of reports and documents, as well as face-to-face discussions with LTRA activity PIs and Co-PIs at the SANREM CRSP annual meeting. Information from the Interim LTRA Review was made available to the SANREM Management Entity (ME) and LTRA PIs in July 2007 to allow the LTRAs to make midcourse corrections, to plan for a USAID proposed 14% reduction in FY2008, and to ensure that research results could be applied in USAID projects for greatest impact.

The Interim LTRA Review consisted of two stages:

1. **Desktop assessment of the progress of the five LTRAs through May 2007.** The desktop review considered what the PIs originally proposed, how their research evolved, their accomplishments to date, and the potential for future accomplishments. Interim LTRA Review materials were:
   - Original research proposals;
   - TOP framework instructions;
   - FY 2006 annual and quarterly reports;
   - Trip reports;
   - FY 2007 work plan;
   - FY 2007 quarterly reports to date; and
   - FY 2007 progress report covering Oct. 1, 2006, to June 1, 2007.

2. **EEP participation in the SANREM CRSP annual meeting.** LTRA PIs presented progress reports covering the first year or so of activities. The EEP participated in public discussions of LTRA progress after individual LTRA presentations and then met with the individual LTRA PIs and their partners to discuss their activities in private. These sessions covered not only research progress but also cross-cutting themes of soil quality, biodiversity conservation, water resources management, and the role of gender in SA and

Later the EEP members met to review their findings, develop a consensus on key issues, and draft common report sections before composing their separate sections of this report.

Interim LTRA Review Criteria

- How (potentially) successful is each individual LTRA in achieving its intended outcomes?
- What is the potential for achieving future impacts, and what are those likely to be?
- Based on review of goals and expected results of each proposal, what are the most significant outcomes achieved to date?
- What are the strengths and weaknesses of each LTRA activity?
- How well does each LTRA project achieve a SANREM-type integrative approach?
- How can each LTRA activity be improved?
- Summary of the LTRA integrative approach and overall recommendations for the LTRA portfolio.

SANREM CRSP Response to Interim LTRA Review

At the 2007 SANREM CRSP annual meeting, the EEP presented preliminary recommendations of the Interim LTRA Review, which included the need for updated conceptual models of the LTRA research activities and more detailed descriptions of the experimental designs and methods. The SANREM CRSP Technical Committee (TC) then met at the annual meeting and agreed to the following. After receiving the written Interim LTRA Report:

1. Each LTRA and the ME would prepare written responses to the Interim LTRA Review questions and recommendations pertaining to their activities.
2. Each LTRA would develop an updated conceptual model of their research strategy and a description of how the various research sub-activities contribute to the overall research strategy.
3. Each LTRA would update their experimental designs and methodologies and document the experimental designs, research methods, and research hypotheses in the FY2008 annual work plan.

These responses would then be reviewed by the EEP during the Overall Program Review.

Overall Program Review

For the Overall Program Review, the EEP is charged with providing technical guidance and evaluation of all of SANREM's activities.

In general, the goals of Overall Program Review are to:

- Maintain programmatic focus and effective scientific balance of research toward achievement of objectives;
- Identify inadequate performances;
- Identify irrelevant, marginal activities to CRSP objectives;

- Consider effective balance between research and training for development of institutional research capability;
- Assess the balance of domestic versus overseas research in terms of effectiveness of solving constraints in developing countries;
- Evaluate the effectiveness of the entire CRSP operation in terms of actual cost of doing business versus costs of alternatives that may be lower, more efficient, and more effective; and
- Examine ways to disseminate research results, and the effectiveness of utilization, a measure of the appropriateness of the research.

The SANREM CRSP Year Four Overall Program Review builds on Interim LTRA Review conducted from May 1 through July 10, 2007. The SANREM CRSP components reviewed in the Overall Program Review include:

- Overall SANREM CRSP conceptual research/development model;
- Bridging Grants Program;
- LTRA Planning Award Program;
- Long-Term Research Awards Program (update the interim review using FY2007 annual report, responses to EEP interim review comments, and FY2008 work plans with EEP requested research strategy and experimental methods);
- SANREM knowledge dissemination activities;
- Cross-cutting activities
    - Thematic
    - Funded with supplemental FY2008 funds
- ME led research activities
    - Associate Awards (Biodiversity/Ecosystem Services - Global Assessment of Best Practices in Payments for Ecosystem Services);
    - USAID Mission technical assistance activities (Madagascar project);
- SANREM engagement with USAID Missions; and
- Management Entity effectiveness in program coordination and knowledge dissemination.

Overall Program Review materials:

- SANREM CRSP EEP Report - 2002 Phase II
- USAID Request for Application (RFA) for the SANREM CRSP
- SANREM CRSP Technical Proposal
- CRSP Guidelines (2005 BIFAD-approved version)
- FY2007 SANREM CRSP Annual Report
- SANREM CRSP Budget Summary (FY2005 to FY2008)
- Bridging grants program materials
    - Bridging Grant request for applications
    - Bridging Grant award applications (funded)
    - Bridging Grant final reports and products
- Planning Awards program materials
    - Planning Award RFAs
    - LTRA RFAs
    - Supporting materials for Planning and Long-Term Research Award RFAs
    - TOP Framework instructions

- Synopses of funded Planning Awards
- LTRA program
  - EEP LTRA Interim Report, July 2007
  - LTRA PI responses to EEP LTRA Interim Report with
    - written response to EEP suggestions and comments
    - FY2008 work plans, which include:
      - conceptualization of research strategy
      - experimental designs and methods
      - FY2008 operational work plans (outcomes/tasks by objective)
  - ME response to EEP LTRA Interim Report
  - FY2007 LTRA annual reports
- Knowledge dissemination materials
  - SANREM CRSP website (http://www.oired.vt.edu/sanremcrsp/)
  - SANREM Knowledgebase (SKB) (http://www.oired.vt.edu/sanremcrsp/menu_information/knowledgebase.php)
  - SANREM CRSP publications: books, newsletters, reports, research briefs, research notes, and working papers http://www.oired.vt.edu/sanremcrsp/menu_information/publications.php
  - SANREM Landscape Systems book outline and draft chapters(https://secure.hosting.vt.edu/www.oired.vt.edu/sanremcrsp/team_PI/system-book.php
  - SANREM CRSP website use statistics summary
- Cross-cutting activity material
  - Summaries of SANREM cross-cutting activities from FY2007 Annual Report
  - Funded cross-cutting activity proposals (gender, soil resources, water resources, knowledge to action)
  - Key SANREM reports and publications
- ME led research/outreach activities
  - Biodiversity Conservation in Agriculture Symposium (http://www.oired.vt.edu/sanremcrsp/other/biodsymposium.php)
  - Payments for Environmental Services Associate Award
    - Payments for Environmental Services Associate Award Work Plan
    - Payments for Environmental Services Policy Seminar materials(http://www.oired.vt.edu/sanremcrsp/menu_research/PES.PolicySeminar.presentations.php)
    - Payments for Environmental Services Sourcebook (http://www.oired.vt.edu/sanremcrsp/menu_research/PES.Sourcebook.Contents.php)
    - Other payments for environmental services publications produced
  - USAID Mission technical assistance
    - Madagascar technical assistance activity scope of work
    - Madagascar technical assistance activity final report

Review Criteria

- Bridging Grants program
  - How effective was the Bridging Grants program in providing a link between SANREM Phase II and III activities? Was the program cost effective?

  - What were the most significant impacts of the bridging program? How successful were the individual grants in achieving their intended impacts? Base review on goals and achievements of each grant.
  - What were the overall strengths and weaknesses of the Bridging Grants program?
  - How could future Bridging Grants programs be improved?
- Planning Award Program
  - Did the Planning Awards process result in high-quality LTRA applications?
  - Was the application process sufficiently flexible to obtain creative and viable project proposals?
  - Did the highly detailed RFA result in projects with the diversity of project components requested?
  - Could the process be more efficiently organized to achieve the targeted multiplicity of project objectives? Should the objectives have been more narrowly focused?
  - Did the Planning Awards process facilitate improved communications and involvement by USAID Missions in the development of LTRA applications?
  - Did the Planning Awards process help research teams or PIs with limited international development research experience develop competitive LTRA applications?
  - What were the strengths and weaknesses of the Planning Awards program?
  - Was the Planning Awards program cost effective?
  - How could future Planning Awards programs be improved?
- LTRA Program
  - Assessment of LTRA PI responses to EEP LTRA Interim Report;
  - Assessment of ME responses to EEP LTRA Interim Report;
  - How has the LTRA progressed since the interim progress report of May 1, 2007?
  - Were the Planning Award and LTRA application processes sufficiently flexible to obtain creative and viable project proposals?
  - Did the RFA result in projects with the diversity of project components requested?
  - Could the process be more efficiently organized to achieve the targeted multiplicity of project objectives? Should the objectives have been more narrowly focused?
  - Did the Planning Awards process facilitate improved communications and involvement by USAID Missions in the development of LTRA applications?
  - Did the Planning Awards process help research teams or PIs with limited international development research experience develop competitive LTRA applications?
  - What were the strengths and weaknesses of the Planning Awards program?
  - Was the Planning Awards program cost effective?
  - How could future Planning Awards programs be improved?
  - Has USAID Mission engagement been appropriate and benefited the LTRA program?
- Knowledge dissemination activities
  - Does the SANREM website provide accessible and useful linkages for both SANREM and SA and NRM information resources?
  - Does the SANREM Knowledgebase provide a useful and accessible web-based information resource on SA and NRM?
  - Is the concept for the proposed SANREM Landscape Systems book sound? Comments on the strengths and limitations of the book, suggestions for improvement are appreciated.
  - What are the strengths and weaknesses of the various communication products (newsletters, briefs, notes, working papers, Landscape Systems book)?

- Is the information appropriate for target audiences, that is, development researchers and implementers?
- Is the developed knowledge being used/accessed? Evaluate using provided website statistics.
- How does the SANREM CRSP website compare with other CRSP websites? Links to other CRSP websites are available at http://crsps.org/crspdirs.htm.

- Cross-cutting activities
  Do these activities contribute to the overall SANREM CRSP program objectives?
  - What are the strengths and weaknesses of individual cross-cutting activities and the overall SANREM cross-cutting program?
  - Are the newly initiated SANREM crossing-cutting initiatives responsive to EEP interim review suggestions?
  - How well do the cross-cutting activities support cooperation across individual LTRAs?
- ME led research/outreach activities
  Do these activities contribute to the overall SANREM CRSP program objectives?
  - What are the strengths and weaknesses of the ME led research/outreach activities?
  - How well do the ME led research/outreach activities contribute to the overall SANREM CRSP program?

History of SANREM CRSP

In 1991, the U.S. Congress requested that the National Research Council (NRC) outline a strategy for U.S. universities to carry out research to support the needs of SA and NRM in developing countries. Recognizing the importance of multidisciplinary on-farm methodologies in the performance and sustainability of agro-ecosystems, the NRC recommended that U.S. universities collaborate with host country interest groups to employ integrated research organized across agro-eco-zones. The NRC also recommended that the universities design their research to involve the ultimate beneficiaries of research: the farmers and landowners themselves, by drawing on and actively engaging in-country expertise and indigenous knowledge, the small-scale farmer as well as the rural and urban poor would play a pivotal role in the research. These recommendations, reported in *Toward Sustainability* (NRC, 1991), led to the creation of the SANREM CRSP and the subsequent USAID cooperative agreement with a consortium led by the University of Georgia (UGA).

SANREM CRSP Phase I (1992-1997)

SANREM CRSP Phase I was developed as a program of training and information exchange with landowners and decision-makers in agricultural regions of developing countries. Researchers focused their activities on four principles that established the foundation for SANREM's focus:

- Participation;
- Interdisciplinarity;
- Multi-stakeholder involvement; and
- Landscape and lifescape scales.

During Phase I, SANREM's main projects were centered in the Philippines, Ecuador, and Burkina Faso, with smaller targeted activities in Cape Verde, Costa Rica, Honduras, and Morocco. Researchers sought to understand relationships and linkages in a landscape setting by combining agricultural, ecological, and social sciences for a mixture of views and ideas on NRM. Researchers focused on the participatory involvement of decision-makers and implementers by working to develop sustainable NRM at the farm, landscape, and provincial levels. This was achieved through:

- Characterizing landscape and lifescape parameters to better understand linkages and constraints to sustainability;
- Designing and evaluating alternative strategies with farmers and community stakeholders (multi-stakeholder training/participation); and
- Working to enhance individual and institutional awareness and capacity.

SANREM CRSP Phase II (1997-2004)

SANREM CRSP Phase II was marked by the expansion of efforts to promote sustainability and NRM. Continuing the programs started in Phase I, SANREM extended its reach to include key

decision-makers at national, regional, and global levels. While some projects continued in the same regions, researchers focused on including decision-makers and applying relevant, sustainable practices for agricultural livelihoods:

Southeast Asia. *Project Leader Ian Coxhead, University of Wisconsin*. The Manupali watershed in the Philippines was SANREM's first research site. Established in 1992, it was designed to support decision-makers at the watershed level to protect and enhance their natural resource base. Alternative management practices were tested and developed in circumstances where global and regional markets, as well as the devolution of authority, strongly influence local NRM.

Andes. *Project Leader Robert Rhoades, University of Georgia*. The Andes program was established in 1994 in a watershed about 100 km from Quito, Ecuador. In this area, residents were struggling with the decreasing ability of the watershed to support the local population and inadequate local knowledge of sustainable practices, coupled with a lack of government policies and interventions. These barriers to sustainable NRM gave researchers an opportunity to support local, regional, and global decision-makers concerned with sustainable development in this mountainous region.

West Africa. *Project Leaders Michael Bertelsen and Keith M. Moore, Virginia Tech*. During Phase II, the West Africa group provided research and methodological support to decision-makers facing stakeholder conflict over access to and use of resources in Mali. Researchers opened a dialogue with local leaders on issues of community development and sustainable NRM. These efforts focused on a Holistic Management™ approach, which understands overgrazing to be a result of the amount of time livestock spends on a patch of land, not the number of animals in the grazing herd.

Global Decision Support System. *Project Leader Neville Clarke, Texas A&M University*. This initiative developed and demonstrated the effectiveness of geo-referenced methods and related data/information bases for evaluating the effects of changes in technology and policy on agriculture and natural resource use. The project developed a global decision support system (GDSS) that included critical foundation data for spatially explicit analyses, access through global networking to other models, and sources of relevant information.

SANREM CRSP Phase III (2004-2009)

In 2004, Virginia Tech was named the CRSP's new management entity (ME), signaling the beginning of SANREM CRSP Phase III. The transition to Phase III opened a more competitive era of project selection and the building of the SANREM Knowledge Base (SKB), providing access to SA and NRM information resources. The Phase III research program is built on five LTRAs. Under the current ME, Phase III continues to apply the recommendations set forth by the NRC. Striving for stakeholder empowerment and improved livelihoods, the SANREM CRSP focuses on knowledge —its discovery, organization, and dissemination. The program is organized through a novel landscape systems approach initiated by the ME and a team of System Coordinators addressing field, farm, watershed, ecosystem, and policy/governance system levels.

Information resources generated through all phases of the SANREM CRSP can be found in the SKB. The theoretical framework for this approach is elaborated in the book on adaptive management for sustainable agriculture and natural resource management systems.

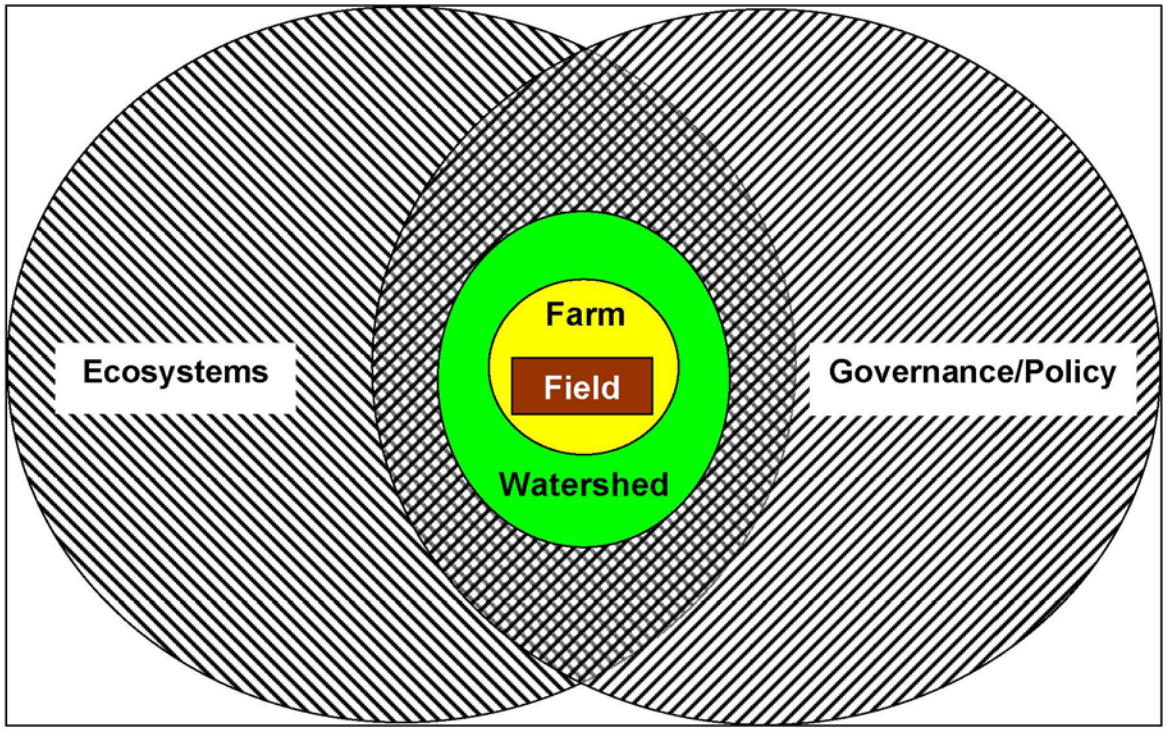
A Bridging Grants program was used to launch the new phase. These grants capitalized on earlier SANREM activities and contributed to current SANREM inquiry areas through expanded technology transfer interventions, policy or impact studies, additional publications, and/or contributions to the establishment of the Phase III SKB.

To establish a high-quality program, the SANREM CRSP launched a competitive program to identify, develop, and select promising SA and NRM research. The ME received 72 applications and awarded 18 Planning Awards on April 1, 2005. Each award supported the development of a partnership of U.S. universities, host country institutions, non-governmental organizations (NGOs), international agricultural research centers (IARCs), and the private sector to develop multidisciplinary, multidimensional SA and NRM LTRA applications by providing funds for travel and other support needed to address country development objectives in a participatory manner. A secondary goal of the Planning Awards program was to provide funds to institutions and teams that had not been previously engaged in international development research to enable them to develop competitive applications and expand the number of U.S. faculty involved in development research. Consultation with USAID Missions was a required component of the LTRAs to assure relevance to mission objectives. More information on the Planning Awards Program is available at http://www.oired.vt.edu/sanremcrsp/menu_research/planning.php. Eligible U.S. universities were allowed to submit LTRA applications regardless of whether they were Planning Award recipients. Twenty-eight LTRA applications were received by Sept. 30, 2005. In December 2005, the ME awarded five LTRAs after review and prioritization by the EEP.

SANREM CRSP Long-term Research Awards Program

Goals, objectives, and approach. The goals of the SANREM CRSP LTRA program involve the implementation of multidisciplinary and multi-institutional research and knowledge dissemination. Because of initial budget limitations, it is expected that SANREM CRSP research and knowledge dissemination activities funded through the LTRA program will build on existing development activities. Research activities that complement USAID Missions strategic objectives involving SA and NRM are high priorities. PIs have linked with ongoing projects and programs to address SANREM areas of inquiry at different system scales. LTRA partnerships besides USAID Missions are IARCs, NGOs and other private sector organizations; national agricultural research services (NARS), host country universities and research institutions; U.S. minority-serving institutions; other CRSPs; and ongoing projects across countries, regions, and landscapes. The LTRA teams also build on existing national- and regional-level systems knowledge and contribute toward greater scale integration and the application of meaningful knowledge on the ground. Development of these linkages is essential to the SANREM CRSP systems approach to sustainable development.

Systems approach and priority inquiry areas. LTRAs are structured by the SANREM nested-landscape systems approach and its priority inquiry areas as presented in the SANREM CRSP Proposal and other documents available on the SANREM CRSP website: http://www.oired.vt.edu/sanremcrsp/documents/TechnicalProposal.pdf. SANREM programs and their subsequent outcomes interact across the system; what happens in one system component has consequences in other components. To effectively integrate their research and interventions within this dynamic setting and assure immediate development applications of the knowledge acquired, research problem statements must be formulated within the context of one or more of the highest-level subsystems (e.g., ecosystem, governance/policy, and watershed). To assure that the research is livelihood driven, linkage with the field and/or farm/enterprise subsystems must be explicit.



SANREM Systems Approach

In addition to situating research applications within one or more higher-level subsystems, applicants must address one or more of these priority inquiry areas:

- **Technology integration**. Technologies needed by stakeholders and decision-makers to promote SA and NRM practices (i.e., biotechnology, GIS, decision support tools).
- **Governance**. Policies, regulations, and institutional arrangements enabling civil society to better manage natural resources.
- **Economic policy and enterprise development**. Supporting sustainable SA and NRM practices that develop niche markets, are eco-friendly and competitive.

- **Social and institutional capacity building**. Training and policies promoting improved SA and NRM leadership, NGO technology transfer, and increased civil society and government synergy.
- **Biodiversity conservation and environmental services**. Integrated management of agriculture and natural resources to promote synergistic relationships between production, biodiversity, and livelihoods.
- **Systems linkages**. The integrated SANREM CRSP systems approach demonstrating how linkages between gender, biophysical, technology, governance, economic, social, environmental, and globalization factors achieve sustainable development.
- **Globalization, vulnerability, and risk**. SA and NRM best practices to manage globalization and address risk and vulnerability caused by HIV/AIDS, food insecurity, and other factors.

All SANREM CRSP funded participants contribute to the SKB, which is a key component of the new SANREM project. It organizes SA and NRM knowledge into a searchable database, enabling its users to quickly locate information (articles, reports, books, projects, presentations, photos, videos) using specified keywords and criteria. All knowledge developed through the new SANREM program will be accessible through the SKB. An online project reporting system allows LTRA PIs to enter all SANREM-generated knowledge and products into the SKB. Details on the SKB are available at http://www.oired.vt.edu/sanremcrsp/menu_information/knowledgebase.php.

Technical and programmatic considerations. LTRA activities are expected to meet a wide range of expectations. The SANREM CRSP approach to research, education, training, and outreach includes both the biophysical and the social sciences. Though led by a U.S. university, LTRA activities include a wide range of institutional partners in both the United States and developing countries. Biodiversity and USAID priorities provide direction to research activities. However, to assure meaningful involvement, all SANREM CRSP activities apply participatory mechanisms that facilitate interactions among all men and women stakeholders. At least 50% of SANREM CRSP funds must be expended in or on behalf of the host countries or regions.

TOP framework for reporting and assessment. A clear, concise problem statement within a comparative framework, specifying research methods and testable hypotheses as appropriate, guides the formulation of annual work plans. These are organized by project objective and structured by the SANREM TOP framework. Outcomes assessment and reporting are integral to all SANREM CRSP supported research. More information is available at http://www.oired.vt.edu/sanremcrsp/menu_research/TOP.php. Both long- and short-term training constitute an integral component of LTRA activities and are designed to complement their research and outreach objectives.

Review of Individual SANREM CRSP LTRAs

Note: The EEP divided the team into lead reviewers for each project based on expertise and geographical knowledge of the project sites. Every panel member read all background materials and reviewed every project, submitting observations to the lead reviewer for incorporation.

LTRA-1: Decentralization Reforms and Property Rights: Potentials and Puzzles for Forestry Sustainability

Interim EEP LTRA Review

Lead Reviewer: E. Price
PI: Elinor Ostrom, Indiana University

Project Overview

The overall goal of this project is to understand how policies for decentralizing forestry governance and related property rights have affected natural resources and local communities; to improve capacity at all levels and among all actors related to forest governance; and to improve forest policies. Multiple sites in two African and two Latin American countries will be compared. Specific objectives include developing:

1. Capacity within resource user groups at the selected forest sites to enable differentiated actors, particularly women, the poor, and other marginalized groups, to identify, understand, and participate in forest governance, benefits and policy processes;
2. Capacity within key organizations in the forestry sector, especially government agencies and NGOs, to understand the impacts of policies on differentiated local actors and to adopt strategies for inclusion of such actors within broader policy processes; and
3. Effective monitoring techniques for use by resource user groups and their partners at the community level, including NGOs and local level-agencies, to assess the impacts of decentralization and other property rights reforms on livelihoods and natural resources, including biodiversity.

The researchers seek to learn what motivates decentralization policies in the forestry sector. They hypothesize that decentralization will occur when costs are reduced, revenues increased, or when such action gains support in an electorate, deflects blame, or further extends the influence of the state into social processes. Another hypothesis is that forestry reforms are more effective when they are supported by multiple levels of actors and reconcile the interests of different forest users. They also hypothesize that, because of the complexity of forestry systems, institutional arrangements that involve diverse actors at multiple levels are more effective than institutions that operate at a single level.

Collaboration

U.S. universities:

- Indiana University, lead; and
- University of Colorado.

International and developed-country organizations:

- International Food Policy Research Institute (IFPRI);
- Center for International Forestry Research (CIFOR);

- Kenya Forestry Research Institute (KEFRI);
- Uganda Forestry Resources and Institutions Center (UFRIC);
- Center for the Study of Economic and Social Reality (CERES), Bolivia; and
- National Autonomous University of Mexico (UNAM).

National advisory councils and user groups also are involved. Responsibilities are well distributed among the collaborators.

Accomplishments

Project activity to date comprises mainly the review and confirmation of the research approach among partners, in-country establishment of advisory groups and working relationships, multi-pronged survey data collection, extensive training of actors, and some preliminary analyses. Most activities contribute to all the project objectives:

- At a workshop among researchers in June 2006, project objectives and procedures were discussed and the methodology revised.
- Pre-existing datasets are being analyzed, and research formats and tools previously employed by partners have been found useful. Preliminary findings are being circulated among researchers.
- A new survey covering a larger geographical area and a greater number of respondents (large-n survey) was developed, and the survey has been completed in Mexico. The same survey is being initiated in Bolivia and may be used in Uganda and Kenya.
- Eight sites each in Uganda and Kenya, six each in Mexico and Bolivia have been identified at which households will be surveyed.
- The somewhat delayed household survey to be used at sites has been finalized and surveys begun.

Some delineation of research accomplishments according to objectives is suggested:

Objective 1. Capacity building among user groups. Local partners have been identified in all countries and communities at various levels, and interest in the research and its expected outcomes is uniformly expressed, resulting in an overall favorable environment for conducting research and utilizing the results. Regular meetings with in-country partners have been ongoing throughout the project, and user-community level discussions have been held. Pre-site visit meeting have been held. In-country research workers have been trained, along with about 300 community members and user group assistants. National advisory councils have been formed, and they have met. Early survey results have been shared with community members and forest users in Kenya. The findings that were shared include that:

- There is a high dependence on forest resources because of poverty, small land parcels, and high unemployment.
- Cash income from forests is not dependable, especially for emergencies.
- Despite problems in earning cash from forests, a majority of non-forest-dwellers believe forests should be kept for other benefits such as air, water, and soil conservation.
- Forest has a high potential eco-tourism value, but benefits from eco-tourism are not shared with the poor.

- There are bad relations between communities and some officials because of harassment and allegations of corruption.
- In some cases, information and forest benefits do not reach the poor and widows because they are unable to pay the costs to be members of the groups receiving the benefits and information.
- Coordination and communication are poor between community groups, NGOs and CBOs, causing competition rather than cooperation in obtaining forest benefits and resources.

Leaflets and brochures about the research, as well as reports of preliminary findings, have been prepared and disseminated

Objective 2. Capacity building among government, non-government and other organizations. National and regional policy round-tables have been held in some countries. Forest officials have been engaged in workshops to discuss forest management, especially with respect to the Yuracare plan. Researchers have found that decentralization processes, institutions and impacts vary quite widely among the countries. Some differential impacts with respect to gender have been tentatively identified.

Objective 3. Develop effective monitoring techniques. Major effort in this area has not been initiated.

Quality of Science

A shift in the design to reduce the number of sites from eight to six in Mexico and Bolivia and to add national large sample surveys of forest communities across those countries will help to better apply the findings from the site studies. The large-n surveys may also be conducted later in Africa if additional funds are identified. Nevertheless it is difficult to assess science quality based on preexisting data bases, for analyses have barely begun. Regression analyses of early data are preliminary. The household survey instrument, a key resource for this project, was still under development in the January-March period of 2007. The conceptual model is strong, but analytical methods are unclear.

The methodology would appear to be fairly strong in helping to identify the economic benefits that forest users at the local level may derive under decentralization, but it is not clear how the economic benefits to social groups under centralized forest governance can be assessed. It would seem necessary to know the latter to answer the first question: "What motivates decentralization?"

The researchers state three general hypotheses at the outset. It is apparent that, to achieve the depth of understanding of devolution of governance that is promised, many more and more detailed hypotheses need to be formed, articulated, and tested. Nevertheless, the reputation of the scientists, their confidence in and command of their theoretical model suggest that their work will be a respected and valuable scientific contribution.

Capacity building

Six students from five countries (Bolivia (2), Uganda, Canada, Netherlands, and the United States) are conducting thesis research associated with the project. During the first year, most of

the training has focused on people who will be involved in the research. Nevertheless there has been broad engagement of actors and communities at various levels to inform and involve them in the research and its prospective outcomes. High interest in the research is expressed by the contacted groups, and many wish to have training for forest policy and governance.

In addition to the six graduate students, 151 women and 217 men have been trained. About 60 of the trainees were workers on the project. About 275 trainees were community members who learned about their roles in the project, the laws and regulations concerning forestry and government, use of GPS units, roles of communities under decentralized forest management, and other matters. About 30 policymakers and officials were trained, mostly concerning a forest management plan that had been shelved but then implemented due to interest generated by the project. Thirteen forest user group assistants were trained in sampling and data collection methods.

The impact of this project heavily depends on the engagement of local community members and forest users in the sustainable use of forests for their respective interest. Early and continual investment in training of these groups, giving attention to poor and marginalized members, is essential to success. The researchers have begun this process aggressively and well.

Management

Researchers have regularly visited the sites with in-county partners. Trip reports and other reports are well written and comprehensive. The research is largely on track except for a delay in preparing the household survey, a major tool to be used in this research. The decision to reduce sites and add large-n surveys in Mexico and Bolivia is a good one if it does not slow overall progress with these massive undertakings. Whether changing the design was a good management decision remains to be seen.

Strengths and Weaknesses

The conceptual model is particularly strong, promising results that can be highly useful to policymakers, forest users, disadvantaged communities, and scholars. Some of these expectations will likely be realized. However, the time frame and the methodology (e.g., reliance on contemporary surveys without *ex ante* economic analysis of forest benefits) could prevent adequate tests of all the hypotheses.

The engagement of this project with local communities and actors across the forestry sector is a highly positive aspect. It has a good chance of empowering differentiated groups among the forest users. Further, the project design, which includes national advisory councils, clearly provides the opportunity and framework for scaling up the activities. Whether empowerment of local communities leads to more sustainable and more equitable management and governance of forest resources is yet to be seen; presumably this will be learned from the study.

Early indications from this research suggest that decentralization policies alone may not lead to more sustainable and equitable management. However, the policies and procedures for decentralization to date have not been complemented by the extent of capacity building expected from current work. This current work, therefore, is highly important for understanding and future efforts in decentralization and exercise of property rights.

In the project design, lessons learned from the study will be incorporated into policy recommendations and training of people at multiple levels in the forest sector. It is regrettable that earlier interventions cannot be undertaken to assess their effect. At the end of the project, it would seem that the major outcomes will be capacity and policy of untested potential. The methodology is unconvincing with respect to ability to understand a key possible factor in decentralization policies: economic benefits before decentralization is undertaken. Much depends on the site household surveys.

The language and concepts in this study are as complex as the systems examined. The researchers need to simplify the language and concepts to lay terms to effectively engage the communities they aim to help. Researchers need to impart useful concepts to community members and policymakers concerning their roles, rights, and potential outcomes under a decentralized system of governance.

Recommendations

It will be useful, possibly necessary, for the analysis of surveys and preexisting data bases to be complemented by an economic analysis of what were the benefits from forests and how they were distributed before decentralization. This will require an effort to describe and analyze the systems that were in play before new devolution processes began.

The three general hypotheses need to broken down into more detailed hypotheses that will guide the analysis of data. The analytical framework needs to be made clearer. For example, with respect to understanding the motivation to decentralize forestry governance, how will the different influences of the various possible motivations —economic incentive, deflecting blame, extension of influence —be discerned? How will the researchers identify the cases where competing interests were reconciled, leading to more effective governance? There are many exciting prospects in this research, and it is important that they be realized through the analytical framework.

The conceptual model for this research is sound. It postulates a framework within which forests are managed and benefits obtained across communities and actors differentiated by gender, well-being, and level of operation within the sector. Researchers suggest that, by building capacity among users to understand forestry governance and their rights and roles therein, more equitable and sustainable forest management and governance will emerge. However, for this process to be effective, forest users need to understand and use the model(s) that researchers postulate. But researchers observe that governance and outcomes are highly complex. What chance then do forest communities have to understand and utilize the system? It would seem incumbent on the researchers when findings are complete to articulate simple precepts consistent with the overall model that can be communicated easily to forest users and decision makers at all levels.

The study relies on at least four sources of information: IFRI and PEN data and findings, large-n surveys in Mexico and Bolivia, and household surveys from 28 sites. It would be useful for researchers to lay out in a concise manner the interrelationships of the data and information sources, and the analytical framework. The work should also be connected to specific hypotheses.

While the aims of this work relate to forestry governance, it would seem useful to relate forestry use to other property rights. What is the relationship to land rights, water rights, and rights to minerals, wildlife, and others natural resources? Are there commonalities? Are rights within some sectors more or less equitably exercised than those in forestry?

The timeframe of the research and dissemination of findings appear to place much of the impact, i.e., the application of findings and utilization of the capacity that has been built, after the end of the project. It is suggested that researchers try to disseminate findings and facilitate the utilization of the new understanding as early as possible so that they may observe the outcomes of their interventions.

Researchers allude to the different ways in which decentralization has proceeded in the four countries and the different outcomes. This can be a strength of their research if the reasons for the different processes and outcomes can be explained. It will be helpful in the next periodic reports to begin to elucidate the systematic differences in the national programs and the drivers of these differences.

The researchers are cooperating with other programs that have been underway for some time. They have leveraged their resources very effectively with the other programs. It will be helpful, however, to delineate carefully what SANREM resources are producing in the overall effort and the nature of the complementarity with other programs.

LTRA-1 Response to Interim LTRA Review

1. Nevertheless it is difficult to assess science quality based on preexisting data bases, for analyses have barely begun. Regression analyses of early data are preliminary. The household survey instrument, a key resource for this project, was still under development in the January-March period of 2007. The conceptual model is strong, but analytical methods are unclear. (p12)

   We agree with this assessment. We recognize that the nature of this project requires a heavy focus on data collection at the front end, with analysis focused in the final two years of the project. To address this limitation and to ensure that we deliver quality analytical products in the remaining two years of the project, we have included a number of analysis-focused tasks in the work plan for Year 3, including several proposed publications, and have proposed adding a meeting of the project PIs in Year 3 that will help project partners focus closely on evaluating the collected data. Regarding the household survey, the instrument was actually finalized in December of 2006, but we were still working on the database that will allow partners to enter collected data. The database is now complete and in use by the host country partners.

2. (a) The methodology would appear to be fairly strong in helping to identify the economic benefits that forest users at the local level may derive under decentralization, but it is not

clear how the economic benefits to the social groups under centralized forest governance can be assessed. It would seem necessary to know the latter to answer the first question: "What motivates decentralization?" (p12)
(b) It will be useful, possibly necessary, for the analysis of surveys and preexisting data bases to be complemented by an economic analysis of what were the benefits from forests and how they were distributed before decentralization. This will require an effort to describe and analyze the systems that were in play before new devolutions processes began. (p14)

In the "SANREM LTRA Review Questions and Recommendations" that spelled out suggestions for improvement to our proposal and conditions for funding (received in late 2005, before our award was finalized), the ME/EEP indicated the following: "Please note that with respect to your overarching hypotheses we are less interested in the motivations for decentralization policies than about their implementation." Because of these rather specific earlier instructions regarding the "What motivates decentralization?"-question, we have de-emphasized this aspect of the research, and focused more specifically on the various implemented forms of decentralization and their effects on resources and livelihoods. However, our over-time data include measurements of "economic benefits to the social groups under centralized forest governance" allowing us to look at and develop theories about the conditions that existed prior to decentralization. We agree with the EEP that this is indeed a critical analytical element of our research effort.

3. (a) It is apparent that, to achieve the depth of understanding of devolution of governance that is promised, many more and detailed hypotheses need to be formed, articulated, and tested. (p13)
(b) The three general hypotheses need to be broken down into more detailed hypotheses that will guide the analysis of data. The analytical framework needs to be made clearer.

We are hoping to develop these additional, detailed hypotheses through the analysis-focused tasks included in the Year 3 work plan. As we analyze the collected data for the numerous proposed papers, we expect to develop country and region-specific hypotheses that will contribute to our ability to analyze the broader hypotheses.

4. (a) However, the time frame and the methodology…could prevent adequate tests of all the hypotheses (p13)
(b) In the project design, lessons learned from the study will be incorporated into policy recommendations and training…It is regrettable that earlier interventions cannot be undertaken to assess their effect. At the end of the project, it would seem that the major outcomes will be capacity and policy of untested potential. (p14)
(c) It is suggested that researchers try to disseminate findings and facilitate the utilization of the new understanding as early as possible so that they may observe the outcomes of their interventions. (p15)

Given the scope and goals of this project and the short timeline, we agree that this is a risk. However, we are confident that we can deliver high-quality analysis to provide

policy makers and practitioners with meaningful input on decentralization policies by the end of the project. We will disseminate findings through local, national, and regional exchange meetings and policy round tables proposed for Years 3 and 4. And we will assess, in a qualitative manner, the impact of these policy dialogues.

5. (a) The language and concepts in this study are as complex as the systems examined. The researchers need to simplify the language and concepts to lay terms to effectively engage the communities they aim to help. (p14)
   (b) Researchers suggest that, by building capacity among users to understand forestry governance and their rights and roles therein, more equitable and sustainable forest management and governance will emerge. However, for this process to be effective, forest users need to understand and use the model(s) that researchers postulate. But researchers observe that governance and outcomes are highly complex. What chance then do forest communities have to understand and utilize the system? (p14)

   We believe that communities do not need to understand all of the most complex aspects of our conceptual model. More importantly, they will benefit more from a newly developed capacity to understand their rights and responsibilities under the policies that affect their livelihoods. In our view, it is far more important for our local partners to come to grips with the functioning of their particular governance system, supplemented by the knowledge of how other communities have coped with similar situations and policy interactions. That is the real challenge for our research project.

6. It would be useful for researchers to lay out in a concise manner the interrelationships of the data and information sources, and the analytical framework. (p15)

   We are systematically organizing our field observations in a relational database. In a similar fashion, we will put together a metadata base that organizes all the data sources according to country, region, and the specific hypotheses that will be tested for each component. This metadata base will allow all participating researchers to query the data base more easily, and forces the researchers to document all data sources collected and used for analysis.

7. …it would seem useful to relate forestry use to other property rights.

   This is a good idea and the proposed discussion has been included in our ongoing efforts to write a comparative paper on the forms of decentralization we are observing in the target countries. This paper is a first effort to clarify these relationships and will form the basis for future work, which will include efforts to "scale up" our findings by articulating these relationships in this and other research products.

8. It will be helpful, however, to delineate carefully what SANREM resources are producing in the overall effort and the nature of the complementarity with other programs

   We expect to have numerous products this year that are a direct result of SANREM research, and will attempt to articulate these relationships in our reports.

9. General concerns about timeline, number and quality of analytical products, project impacts

   In order to respond more effectively to EEP comments, we have requested to reduce the number of study sites in each country by one. Mexico and Bolivia will now each complete 5 sites, and Uganda and Kenya (who did not elect to include the national forest community survey in their scope of work at this time) will each complete 7. This will free up our partners to enable them to focus more on data analysis and dissemination.

Final EEP Assessment of LTRA-1

Summary: Researchers are addressing most of the issues that were identified in the August 2007 EEP assessment prepared in Cochabamba. Two areas continue to require attention. One is the early decision taken in concert with early reviewers, to de-emphasize "what motivates decentralization." This question is linked to the knowledge of what were the benefits realized by stakeholders prior to reforms. The researchers state that they were encouraged to focus on processes of decentralization and emerging patterns of benefits to stakeholders, rather than ex ante forces, distribution of benefits, and structure of governance. Point two below suggests the remedy that researchers are taking to this concern; that is, their analyses of reform processes will permit them to elucidate the pre-conditions to reform. The EEP accepts the suggestion and looks forward to the ensuing work.

The second area of concern, addressed in point 5 below, is the need for communicable models, lessons and tools to emerge from the research that can be applied in new and different regions by policy makers, NGOs and extension workers. The EEP is of the view that in order for the research to lead to effective change, there must be understanding of the researcher's approach that can be easily communicated among leaders at every level. The national councils that are formed within the project, it would seem, will need to conversant in the concepts and approach taken by researchers in order to guide the process. The EEP requests, in point 5 below, that researchers identify the essential elements of their model which they believe should be understood and utilized by decision-makers and rural workers.

The researchers state that valuable insight will be gained from the approach that is taken, with lessons learned that can be applied to new and different regimes of reform. The EEP concurs.

The researchers are appropriately confident in the conceptual model with which they began their work. This reviewer has found occasion to refer to the work in other contexts, and has recommended others seek published references concerning the model and to consider it in their own work. The EEP looks forward to the eventual impacts and conclusions of this study with great interest.

Specific responses:

1. Early phases of the study are heavily oriented to data collection and database development, with analysis coming late in the project. Researchers have responded to

this concern by including more analysis in year 3 for the work plan, with publications and a meeting of PIs focused on analysis.

2. With respect to the "ex ante" analysis referred to in the summary above, the researchers state that their "over-time data include measurements of 'economic benefits to the social groups under centralized forest governance' allowing us to look at and develop theories about conditions that existed prior to decentralization." The researchers and reviewer agree this is a critical aspect of the study.
3. The researchers plan to develop additional, detailed hypotheses, as suggested in the assessment, beginning in year 3. These will include country and region-specific hypotheses as may be suggested from early data analysis.
4. Researchers agree there is a risk that there will not be enough time to observe the effectiveness of policies that may be recommended as a result of the study. However they will endeavor to disseminate results through policy round tables in years 3 and 4 and hope to assess in a qualitative manner the impact of these policy dialogues.
5. It was suggested in the assessment that the language and concepts embodied in the model for examining the impact of decentralization of governance was complex and need to be communicated to stakeholders in simpler ways so that they might more effectively use the concepts and principles. Researchers respond that "communities do not need to understand all of the most complex aspects of our conceptual model." Additionally the researchers suggest that it is not the analytical model that is so important for partners to understand, but rather their rights and responsibilities within their own governance system, supplemented with knowledge of the experience of other communities. It is suggested here, then, that the researchers identify the most essential aspects of their model which they believe that partners should understand. This would be useful to their communities, national councils and reviewers of the study.
6. Researchers are organizing their data according to country, region and hypotheses to be tested, and this will help to understand the interrelationships of their data and information sources.
7. The researchers agree that it will be a good idea to relate their approach to forestry use to other resources and will endeavor to do so.
8. In Year 3 the researchers will be able to show numerous products of their research that are the result of SANREM research, as a separate effort from that in complementary programs.
9. In order to be better assured of achieving the intended results of the project with the resources and time available, a concern expressed in the review, the researchers are reducing the number of study sites in each country by one, still maintaining a sufficient number of study sites, a total of 24. This will allow more effort on data analysis and dissemination.

LTRA-2: Developing a Participatory Socioeconomic Model for Food Security, Improved Rural Livelihoods, Watershed Management, and Biodiversity Conservation in Southern Africa

Interim EEP LTRA Review

Lead reviewer: K. Galvin
PIs: Alexander Travis and Alfonso Torres, Cornell University

Project Overview

The overall goal of this project is to further develop a market-driven approach, Community Markets for Conservation (COMACO) to improve biodiversity conservation through improvements in food security and livelihoods. The focus has primarily been in Zambia, but the model might grow to include Malawi and/or other surrounding countries in southern Africa. The Wildlife Conservation Society (WCS) began COMACO in the Luangwa Valley of Zambia four years before this project began. At the start of the SANREM-funded project, COMACO covered 20,000 square km and included more than 17,000 households. COMACO initially partnered with the World Food Program, whereby poor households were supplemented with maize for one year in exchange for training in conservation farming (CF). Farmers were organized into local producer groups, and 10 to 15 of these groups sent their produce to a local depot. From the depot, the produce went to a regional trading center. At the start of this project there were three active regional trading centers, each operating as a limited company with major shares held by participating communities. Producer profits had increased by the time this project began.

Specific objectives were increased from three to four based on EEP review of the initial proposal:

1. To test whether the COMACO model can be economically self-sustaining, and the effectiveness of the different COMACO model components. (It is recognized that this analysis does not include start-up costs and the cost of capital improvements such as the new soy extruder);
2. To identify and integrate new technologies into the COMACO model to improve its profitability, food security, and rural incomes;
3. To test whether the COMACO model can provide self-sustaining social institutions and meaningful roles for COMACO participants; and
4. To test whether the COMACO model will improve biodiversity and watershed conservation.

Rationale and hypothesis. A community-owned enterprise that implements sustainable agricultural practices at the level of individual farms using extension support, marketing, and pricing strategies organized around regional trading centers will increase smallholder profits. Increased profits will reduce loss of biodiversity. Preliminary data suggest that these market

incentives are sufficient to foster sustainable agricultural practices and decrease the use of wildlife.

Collaboration

Partners:

- Dale Lewis, Wildlife Conservation Society (WCS)
- Conrad Heatwole, Virginia Tech

International and developed-country organizations:

- Tropical Soil Biology and Fertility Institute (TSBF)
- The University of Zambia (new links)

Accomplishments

Objective 1: Economics

- Data collected for business assessments found that capacity building is critically needed in presentations, and marketing and contract negotiations are needed for business expansion of the regional trading centers.
- A Cornell student is collecting data on cost analysis of biodiversity conservation.
- The 2006 October-December Quarterly Report's business analyses predicted that, on a single-year basis, the Lundazi regional trading center should break even within the next year.
- Data on poaching continues to be gathered.
- The 2007 January-March Quarterly Report stated that research questions are being developed and administered by COMACO's financial officers.
- John Fay was to travel to the area to perform an intensive research analysis of the costs associated with starting a regional trading center. (He has done this by now.)

Objective 2: New Technologies

- Evaluation of value-added food products found a need for improvement in sanitation and quality control.
- Ongoing soil and crop science research focused on maximum crop yields in different agro eco-zones; and the effect of different forms of composting.
- A Cornell veterinary student performed survey-based and diagnostic research to evaluate the mortality of poultry in villages.
- A training manual was developed to assess clinical signs and a small diagnostic lab was established.
- Web-based diagnostics are now available by V-sat linkage.
- The 2006 October-December Quarterly Report stated that efforts were undertaken to prepare all experimental plots for the wet season (mid-November) to capture ranges of soil types; and a soy extruder was purchased with other funds and installed.
- The 2007 January-March Quarterly Report stated that a Cornell graduate student continues assessment of soil in all experimental plots; the Virginia Tech consultant has

begun ground-truthing of satellite data; and a food scientist is preparing to begin research on new food products to be sold at the trading centers.

Objective 3: Social Institutions

- Co-PI Eloundou-Enyegue and a Zimbabwean graduate student at Cornell evaluated COMACO's survey data. The survey was edited and redesigned.
- At the SANREM annual meeting, gender sensitivity in selection of trainers and female farmers resulted in new efforts to diversify COMACO's extension officer pool.
- The 2006 October-December Quarterly Report stated that data was collected from COMACO participants and non-participants for comparison.
- The 2007 January-March Quarterly Report stated that data are being collected on participants and non-participants, including safari hunting clients; and that surveys regarding family health, economic equity and education are being written.

Objective 4: Biodiversity

- Aerial censusing has been extended to new regions.
- Multi-species assessment is ongoing.
- Data from the most current survey are being analyzed but need to be interpreted within the context of several years' data.
- Poaching surveys are being redesigned.
- The Virginia Tech consultant will ground-truth the satellite data.
- The 2006 October-December Quarterly Report stated that aerial wildlife surveys have been done. Results suggest that animal species frequently poached may be increasing slightly in number, but outside COMACO's area there is a paucity of wildlife.
- The 2007 January-March Quarterly Report cites ongoing research.

Quality of Science

To test the objectives above, the research seeks to use biophysical and social science research to test, optimize and eventually "export" the COMACO model for establishment in another country. The idea is that the research will inject new technologies and generate new knowledge that will improve food security, rural livelihoods, and biodiversity on a landscape scale. It seems that the team from the University has undertaken a thorough evaluation and amended the science that it was doing previously under COMACO. It is not possible at this time to assess the quality of those changes, as the results of the evaluation have not yet been reported.

Capacity Building

The project is already linked to an NGO, WCS. It is also linked to the Zambian Wildlife Authority and to the University of Zambia.

Year 1 training included:

- More than 550 villagers in improved poultry husbandry.
- Six COMACO extension officers in rudimentary veterinary diagnostics. COMACO has embraced suggested changes in its food production protocols.

- Establishment of broadband internet access at two locations by satellite linkage.
- Several ancillary workshops developed by WCS on nutrition, poaching, farmer field day training.

Management

It is hard to tell about coordination except through the reports and it appears effective. The project seems to be very cost-effective. The team has been able to leverage funds from elsewhere to add research to the current project such as the purchase of a soy extruder and use of expertise in such areas as in poultry.

Strengths and Weaknesses

A major strength of this research project is that it is piggybacking on an existing project with four years prior funding. This allows the team to get to work right away, add value, and make changes based on new circumstances. Furthermore, the lead institution is working to diversify funding and build a long-term support base for the research. This is really commendable!

The project is integrated conceptually in that it has economic, technological, ecological, and social components. The strength being given to soil degradation is really well placed. Providing soil background data (the setting) was excellent. Watershed analysis is a good addition.

The social component seems to be the weakest, though it may just be that it is not well reported. Nevertheless, while many social surveys are being conducted, there do not seem to be results or feedback to the communities nor have they impacted other project components. There is technology transfer based on perceived needs of the team, all kinds of ecological work is underway, and economic analyses are in process. However, where is the local population on this? There should be feedback between the local populations and the other parts of the project. There have been workshops on compost needs and food processing, on poultry production (husbandry/nutrition/disease prevention), and training is starting on goat production. It seems that for the most part that designed research on the social component is silent. The training and capacity building to date include both farmer and professional training, but it is not possible at this time to judge the balance between them.

There is disconnect between the people on the ground and the rest of the project. For example, one trip report (Lydiah Gatere) stated that 30% of the farmers she interviewed "did not have a good grasp of what CF entailed." In another trip report, Alex Travis writes that in Mfuwe the team learned how the COMACO model works, "with particular attention paid to how it integrates with a complex governance structure involving traditional rulers as well as regional/federal government." This is the only statement in all the documents or presentations that addresses the governance and institutions of the society that is one of the four objectives of the projects.

There is the assumption that it is the food-insecure and impoverished families who are most likely to use their natural resources in an unsustainable fashion. This is an empirical question and a questionable assumption. Data from other parts of Africa suggest that, regardless of the

economic state of the household, poaching is conducted opportunistically. Data from other areas also suggest that those people who are employed outside of the agricultural arena, such as school teachers and other wage workers, do not have the time to poach and thus are less likely to do so. Thus it will be important to assess how and why COMACO produces positive results.

Recommendations and Questions

Overall project:

- What criteria will be used to decide if COMACO is a good or bad model? How is it doing economically, socially? Is it meeting some set goals? Are current strategy and data collection going to answer all the objectives? Will the model be shown to work in two years? It is hard to tell what lessons were learned were from the past four years of data collection and how they were used to develop the objectives of this project.
- Can this model work in less remote areas? Competition would be good. Poor management can make it fail. There has been no replication elsewhere, but analysis of this experiment could easily help others replicate it. It would be useful to compare this model with other development models such as ecotourism or campfire-type projects and to other models such as the Millennium Village or to smaller-scale cottage processing of agricultural products to assess its relative advantages.
- COMACO will likely require a continual infusion of technology to respond to changes in the economic and physical environment. Eventual analysis should be done to show how COMACO operates across traditional and state institutions, and how it might contribute in the future. There seems to be a big gap between users of technology and university know-how. How do you bridge it? To be sustainable, COMACO needs to be linked to local sources of technology, such as the recent University of Zambia linkage. This needs to be done to attain sustainability of the project in the long run. Building COMACO's links with the university or other technology sources, and perhaps strengthening those sources, may need attention during the remainder of the project.
- The watershed model is said to tie it all together. Rather, it would seem that the product value chains should tie it all together in the minds of both local communities and researchers. There needs to be a clearer vision of these value chains; otherwise the activity appears to be a little bit of this and a little bit of that and not well linked.

Biodiversity:

- To what extent is the work affecting poachers? Safari hunters are questioned about quality of experience. What happens with profits from safari hunting, e.g., education, health?
- There were no reports on summaries of wildlife analysis. Isn't impact on wildlife indicator species one of the greatest contributions to ecosystem services?
- Doing some modeling with rainfall data seems an extraneous effort.

Technologies:

- For soils work, formulate clear hypotheses for the research portion. Differentiate between monitoring studies for the overall project as part of a database, and research on specific interventions.

- Carefully review the significant work in Africa on the basin planting method. Is this labor-intensive method really viable in the long term?
- There is an underlying tension between organic and conventional approaches, as seen in the reduced tillage without herbicide and in the design of fertility trials. It is strongly suggested that you look at integrated approaches, for example, for fertility, small amounts of fertilizer together with organic amendments. This really gives significant advantage. Also, a reduced tillage system with an herbicide like Roundup (which has low environmental impact if used sparingly) would dramatically enhance the longer-term effects of compost additions. These are integrated approaches that make the best of both worlds.
- You may have to add erosion work.
- If labor is truly limiting, (as suggested by the HIV incidence in the region, herbicide technologies if used in an integrated fashion make much sense.
- Not much was said about veterinary input beyond poultry. Will that be the future focus?
- The economics of soy processing may need attention, particularly if raw material is imported. Can local production of soybeans supplement imported supplies?
- Differences in corn yields were shown in pictures but were not explained. The project overall may need closer attention by agronomists.

Economics:

- Has the economic analysis bypassed the ecotourism activities? It is suggested to use a more broad definition of markets to include ecotourism, especially the provision of ecosystem services for which income might be derived from both international and national sources.

Social:

- How were stakeholders recruited? Was and is it done by compliance over time of sustainable methods (retention)?
- Do you really have buy-in from the local population? The first participants recruited were the marginalized. They benefited quickly, followed by buy-in. Demand now outstrips capacity. One center has 85% of the population covered. But sustainability will have to be judged over time. Because the goals of this model are to increase household income and increase biodiversity, show at all junctures how the activities are helping the locals. This may have been done; it may not yet have been documented, since the social questionnaires seem to be under continual revision. It would be useful to show results from this part of the project.
- Is there gender segregation of data?
- There is abundant training and an extensive extension network in place. How is the current training adding value in such a way that it benefits the farmers? Is it being adequately documented?

LTRA-2 Response to Interim LTRA Review

1. We would like to add several additional international and host nation partners with whom we are working:

International Rural Poultry Centre (IRPC)
Conservation Farming Unit (CFU)
Golden Valley Agricultural Research Trust (GART)

2. In Accomplishments for Objective 2 (new technologies) for year 1, I would add the training of over 520 villagers in poultry health and production. Our survey research was translated directly into an on-the-ground impact, improving host capacity and increasing poultry production in those villages by 50% versus the previous year.

3. In Accomplishments for Objective 3 (social institutions) for year 1, I under-reported our activities in an effort to distinguish between activities that were purely SANREM versus some that had been planned previously by COMACO. I see that this error has caused much misunderstanding in the written report, and I shall explain the complete scope of our social science activities below.

4. Quality of Science. We agree with the reviewers that the quality of science that SANREM has brought in has improved COMACO's previous efforts. The research methodologies that are being submitted now should provide additional information about the rigor of the various experiments underway.

5. Capacity Building. I respectfully disagree with the use of the word "ancillary" regarding our training of villagers and poachers. Improving crop yields and providing alternative livelihoods are critical elements of the COMACO mission. Our "non-degree training table" for year one describes the training of 759 smallholder farmers in composting, agro-forestry, alternatives to burning crop residues, etc. In addition, the training of professional poachers as "village scouts" is exceptionally important in providing new professions in the Valley so that sustainable natural resource management practices are economically preferred. The "poacher transformation project" is larger in scope than this training, but SANREM supported this activity.

   Finally, for year 2 training, we added new training topics in new regions of the Valley in goat nutrition, husbandry, veterinary care, and market access. I shall get the total numbers of villagers trained shortly, as the last member of our small ruminant team has just returned to Ithaca.

6. Management and Cost Effectiveness. We thank the EEP for their kind words regarding our management and cost-effectiveness. Leveraging other funds has been instrumental in helping us not only perform our work in the face of astronomically-rising fuel prices, but also to expand our scope of work.

7. Strengths and Weaknesses. It is commented upon that the social component seems to be the weakest, though this might be due to under-reporting. Indeed, I readily acknowledge under-reporting of many of the social science activities. As mentioned, this was largely due to my not wanting to take "credit" for activities that were planned prior to SANREM. SANREM social research seeks to go beyond what COMACO had been doing, while simultaneously aiding their survey design and data collection efforts. However, because

of this assistance the efforts are commingled and we have access to one another's data in our partnership, so I see that this was an error on my part. In particular, I regret our failure to portray the necessary reliance of both COMACO's and SANREM's individual and joint activities on information retrieved from social surveys.

At its core, COMACO is about improving food security and rural livelihoods. Evaluating the effects of the COMACO intervention on its participating families and collection of baseline data before an intervention have therefore been ongoing and taken a vast amount of COMACO's resources (even before SANREM). The preliminary business analysis performed during our planning award work highlighted that COMACO incurs costs far beyond those a "normal" business would, because it is continuously monitoring the effects on families, and using those data to direct extension officer training and capacity building through field days. A business that was not interested in the social impacts of its practices would incur none of these costs (such as maintaining data input staff and work rooms filled with the needed computers). As examples, below are some of the social surveys that have been performed in the past years since the planning award. Some are designed to be performed yearly, and some are performed once, and then repetition would depend on the data obtained.

Households Livelihood Assessment Surveys			
Period		**Study /Assessment**	**# of HHs Surveyed**
From	**To**		
4 Sept 2005	20 Sept 2005	A comparative study of Soya and Cotton	491
26 Apr 2005	14 May 2005	Food security assessment	1091
26 Apr 2005	14 May 2005	CF Assessment Compliance	1213
14 Feb 2006	06 Mar 2006	CF Assessment Compliance with No Incentives	314
1 Mar 2006	17 Mar 2006	Crop Damage Assessment	71
30 May 2006	16 Jun 2006	Crop Assessment Survey Phase 1 -3	689
28 Aug 2006	9 Sept 2006	PG Rice location Monitoring	254
12 Sept 2006	12 Oct 2006	Cotton Income Survey	75
15 Sept 2006	06 Oct 2006	Re- Baseline Survey- Lundazi Core Area	1331
16 Sept 2006	6 Oct 2006	Re- Baseline Survey Hunters	82
14 Oct 2006	6 Nov 2006	CF/PG Assessment Updates verification for certification	7375
12 Oct 2006	12 Nov 2006	Transformed Hunters Group Assessment	102
12 Oct 2006	21 Nov 2006	Cotton, Tobacco Switch to Other crop Assessment	759
23 Oct 2006	30 Oct 2006	Re- Baseline Survey (Mwanya)	709
23 Oct 2006	30 Oct 2006	Fishermen survey -Mwanya	74
19 Nov 2006	25 Nov 2006	Livelihood assessment PGs and TH	37
30 Jan 2007	8 April 2007	Crop Damage Assessment	106
18 Jan 2007	26 Jan 2007	Income Re-baseline Follow -up	62
9 Oct 2006	30 Nov 2007	Meat Trade Survey	111
24 Jun 2007	9 Jul 2007	Cassava Survey	500
10 Mar 2007	01 Apr 2007	End of Farming Season Transformed Hunters Assessment-COMACO Trained	30
10 Mar 2007	1 April 2007	Transformed Hunters Crop Assessment Non COMACO & COMACO Trained	53
30 Mar 2007	28 May 2007	Preliminary Crop Assessment Survey Phase 1 -3	300+
20 Mar 2007	6 Apr 2007	Snare Survey	166

There seems to be some confusion regarding COMACO staff being viewed as "professionals" and not being connected to the villagers. In fact, the vast majority of COMACO personnel are selected by the villagers from within their village area groups. The villagers themselves request different field day trainings, and are involved heavily in these participatory events. It should be restated that COMACO is owned by the villagers themselves, and their Community Resource Boards are the ones who determine how to grow COMACO in their village area groups and how to use the profits that come back to the community. There are differences between the CRBs in how they allocate their resources, and this itself could be a fascinating research question, though current funding doesn't allow it.

Social survey data has continuously driven the evolution of the COMACO model. The data from the original baseline survey suggested that poaching with wire snares primarily occurred during the months when families were least food secure, and this drove the initial concept of trading snares for training in conservation farming and supplemental maize from the World Food Programme. SANREM research has identified that one circumstance that is critically important to the success of the model in its current form is that the wire snares are not easy to replace (as opposed to the mining area known as "the Copperbelt;" this site-specific condition might impact what the EEP regarded later on page 19 as a questionable assumption that all farmers are not poaching regardless of food security, and that improving food security might not be reducing future poaching). Survey data have recently been used to demonstrate the relative profits of farming different kinds of crops, which can be used by the CRBs to modify planning for the next season, and help COMACO as a whole see how income from cotton and tobacco compare with profits from food crops. Another example of how surveys are put into action came from surveys of hunters' experiences, which reflected a one-year increase in wire snares in one area. This was directly attributable to introduction of solar fencing materials that were not properly stored or inventoried. These data were used to alter implementation of fencing programs in subsequent years. In addition to helping plan future activities, surveys also establish the compliance of farmers with sustainable practices regarding farming and poaching. To get accurate data on how much poaching with wire snares goes on, COMACO obtains direct data from ZAWA and safari hunters, and survey data from farmers who are asked not only about their own activities, but also about their perception of the activities of those neighboring their group. In this way, the surveys seek to lessen the desire to under-report their own poaching for fear of losing participation in COMACO.

8. It is stated that it is not possible to judge the balance between professional and farmer training. This is an accurate assessment because both are being performed and both are critically needed. I do feel it necessary to state again that "professional" COMACO staff members represent local Zambians; for example, the food production staff trained in hygienic food production this year comes from within the areas of the CTCs. Similarly, the officers chosen for additional training in poultry or goat production and health come from the Valley. So both the more technical training that COMACO provides as well as the farm-level training are all directed at Zambians living in the Luangwa Valley.

We respectfully disagree that there is a "disconnect between the people on the ground and the rest of the project." Over 1200 people on the ground have been trained in poultry and soils/crops improvements. Hundreds more have been trained in more "professional" activities, but they are still being drawn from within the community. Our soils research has produced some preliminary results that are strong enough to merit their inclusion in on-going training of conservation farmers. Our soils student, Ms. Lydiah Gatere, is incorporating these findings into a poster which will be used to assist in the training of the farmers by the extension officers. Although it might seem that technical research such as aerial surveys of wildlife might not impact a single farmer directly, the COMACO market linkage in fact does provide a direct connection: conservation improves game numbers, increasing safari hunting revenues and making non-consumptive eco-tourism possible (which is growing). Stopping the rampant deforestation leaves more flowering trees available, and the production of apiaries by transformed professional poachers has allowed the new crop of honey to produce significant incomes.

COMACO is a holistic project, and the SANREM research touches on all aspects of its methods and impacts. Therefore, we do not quite understand the "disconnect" that the reviewers mention. The report that 30% of farmers didn't completely understand CF (made in a trip report in July 2006 by soils student Lydiah Gatere) indicates that the training by COMACO did not have 100% penetration by that point in time. It does not reflect that the soil science research is not impacting the farmers. Indeed, the technical research at that time had not yet commenced. Rather, her observation shows the reality of a large organization (COMACO) operating on an enormous scale, and learning lessons as they go about how best to instruct farmers. This highlights the need for field days and visits to farms by extension officers, which do occur for this precise reason—to offer supplementary instruction to maximize yields. The practice of Conservation Farming in Zambia is labor intensive, and what Ms. Gatere noted from her communications with the farmers has impacted her research: as described in more detail below, there is a need to reduce the labor per farmer to increase adoption of all aspects of conservation farming, instead of just those pieces that are superficially the easiest. In this regard, efforts are being made to teach a minimum tillage approach, in which basins are not re-dug each year. Furthermore, Ms. Gatere also used knowledge from her communications with the farmers to help establish priorities for her initial host capacity building, influencing the topics covered in the field day training she provided.

9. Strength and weaknesses (second-to-last paragraph). There is a comment that we have only addressed issues of governance and societal institutions once in all our reporting, yet this is one of our central objectives. We respectfully disagree with this comment. Although governance and social institution issues are very interesting and important, they are not the major focus of our social science efforts. The question of whether COMACO is self-sustaining socially refers largely to whether it is accepted and embraced by both participating families and the existing governance structure of traditional rulers and the regional/federal government. Our social science research will tell us the effects of COMACO on family demographics, nutrition, education, and income. Our research and observations have already indicated that COMACO has extremely strong relations with

the vast majority of local traditional rulers and the current federal government structure, making research of these issues less of a priority in the short, 4 year term. Another LTRA focuses extensively on these issues, but our project has never indicated that they were a major priority. We strive to keep our social research targeted on those points that will best test the impacts of the COMACO model.

In the last paragraph, we do agree with the EEP that individuals who are "time-intensive" professionals are likely to generate sufficient income and less likely to have the time or need to poach. This is an important part of COMACO's poacher transformation program which identifies individuals who rely on poaching as their chief livelihood, and then trains them in another profession. Carpentry has been the major trade thus far, but additional professions will have to be added over time to ensure that an excess of people in one trade does not lead to under-employment. However, with regard to the majority of farmers, we would like to reiterate that there are behavioral linkages created within the COMACO model. People agree not to poach and demonstrate "buy in" by turning in snares and guns, so that they can become participants. It is not just an assumption that improving food security will decrease poaching, but an integral part of the model and one which is being tested by several approaches. Checks and balances are built into the model so that it can adapt to changing degrees of compliance as noted above with the one year aberration in one region, which demonstrated an influx of wire.

10. Recommendations and Questions. The EEP wonders what lessons have been learned and how they have been used to develop the objectives of the project. We have had the advantage that one of our Principal Investigators has been working and living in the Luangwa Valley for close to 30 years. The initial request for assistance with COMACO from WCS came about because of needs that he recognized in diverse disciplines. The exact points of research focus were crystallized from our research teams' observations and participatory meetings with farmers and traditional rulers/government officers which occurred during the planning award stage. Continued research and new developments have changed the focus of some of our training, such as the movement of food safety training from the US to Zambia, and the need to focus on soy product development because of the recent purchase of the soy extruder. Additionally, unforeseen circumstances have led to new research priorities (such as the devastating flooding this wet season and the need for a watershed analysis to link farming practices with flooding risk). However, overall, the research we proposed initially is still for the most part the research we are doing today. The fact that the research we described is relevant to such a high degree is not indicative of our failure to recognize changing conditions and adapt; rather, it shows that we had the advantage of decades of experience in this region to identify the core needs from project inception.

    Like any conservation or rural development project, the data we collect will indicate how the model works up to this point. Unforeseen externalities such as war in a neighboring country and mass migration of people, could lead to a changed population demographic that does not have interest in long-term resource maintenance. Therefore, one condition we have recognized for the model to work over an extended time frame is population stability, so that the model can be in place long enough to train and impact enough

farmers to stop the rampant depletion currently underway. Education, health and nutrition must all improve along with alleviating poverty and hunger to make COMACO sustainable.

11. We agree that comparison with eco-tourism or CAMPFIRE approaches, or models such as the Millennium Villages, all would be interesting. We shall make those comparisons in the Introduction and Discussion sections of an overview paper we are currently beginning to prepare.

12. We respectfully disagree that there is a big gap between users of technology and university know-how. The staff receiving training with COMACO's equipment is from the villages. The food science production experiments will be used by the staff to increase profits for all COMACO participants. The extension officers and farmers getting trained in poultry and goat husbandry and production are from the villages. The data we gather from soil and crop science experiments has been and is being used to guide the training of farmers in best composting and farming practices. The major criterion for all SANREM research (as WCS and Cornell began our partnership on this project) was that all of it needed to be practical in helping the people of the Luangwa Valley. Thus far, we have succeeded in designing rational research approaches to fulfill this objective. We agree completely with the EEP that partnership between COMACO and local sources of technology, such as the University of Zambia, would be ideal over the long-term. Our researchers have helped make many of these connections, as has the expansion of the COMACO business activities (particularly in food sciences). However, and most unfortunately, the University is not well outfitted and cannot contribute much new to COMACO. Indeed, it hopes to send its students to COMACO to have them train on the extruder in Lundazi. Soil analyses have been brought to the University, but some difficulties with equipment have manifested themselves. Participation of the veterinary school has been low, but this summer some new connections were made to try to improve this. We shall continue to make every effort to work with the University of Zambia and encourage partnership between them and COMACO, but only time will tell if the University has the institutional stability to maintain a relationship.

13. Concerning the discussion of a central role for watershed analysis versus product value chains, with a recommendation to clarify the value chains, we agree that fundamentally, markets are the driver for the COMACO model. The role of the watershed analysis in tying things together is in terms of the effects of unsustainable agricultural practices on the plateau having effects downstream (literally and figuratively) in the valley. Use of watershed modeling ties human activities to impacts on the environment and biodiversity conservation, which in turn influence the human condition. The EEP is of course correct that COMACO is organized around market linkages. Its infrastructure, distribution network, products generated, and markets made accessible are described in detail in our proposal.

14. Biodiversity. A question was raised regarding why there have been no reports on wildlife analyses. Yes, these are an essential aim of our project. COMACO is fundamentally a novel approach to biodiversity conservation. Yet it would be scientifically meaningless

to present one year of survey data and try to draw conclusions from that. Population assessments must be looked at over time. SANREM activities have only been underway for one year and the data gathered last year must be replicated over time to establish trends and confirm differences between control and intervention areas. Reports made from data sets with "n=1" are not reliable.

15. There is the suggestion that rainfall modeling seems extraneous. We are slightly confused by this comment in light of the rest of the report. Rainfall data is an important part of the watershed analysis. We believe that deforestation on the plateau is having important effects on the valley. However, this must be confirmed by research and modeling. These data will play an important role in developing a broader, eco-system scale management plan. In addition, at other points in the EEP report (such as below on page 20), it is suggested that we add erosion work. Earlier (page 18), it was mentioned that "Watershed analysis is a good addition." Because rainfall measurement is a contributor to erosion and represents a critical set of data for watershed modeling, we are a little confused as to what the EEP report is referring. We would be happy to discuss this further if questions remain.

16. Technologies. We shall respond to each bullet point.
    - Clear hypotheses for the soils work is presented in the research methodologies section.
    - We agree that a review of this system in Africa would be useful. Our soils team believes that the drudgery of the basin system can be minimized by promoting a system that doesn't re-excavate the basins every year but uses minimum or zero-digging and puts more of the residues in the small basins to promote better soil physical and biological properties. This reduced tillage system and mulch will likely need more research to confirm the hypothesis, and such questions can take several years to demonstrate positive effects.
    - We respectfully downplay the "tension" between organic and conventional farming approaches. The purpose of the inorganic treatment was not to provide a "normal" version of fertility management but rather to provide a control to evaluate the potential yield of a site to produce crops. The objective of this experiment was to assess the effects of different qualities of organic amendments. A combination of organic and inorganic amendments is certainly desirable, but requires prior information which does not exist. Also, expanding the experiments under the extreme working (and budget) conditions is not feasible. Farmers in Zambia have previously been used to commercial fertilizers which were highly subsidized; hence there is a need to sensitize/inform farmers regarding organic fertilizers. The majority of the farmers cannot afford to buy fertilizers on their own and often delay planting as they wait for handouts from the government or NGOs. In this regard, the facts that Zambia is land-locked and has truly terrible road infrastructure, coupled with the rising price of fuel, make investigation of use of alternative fertilizers more of a priority. We agree that integrated approaches are ideal, but the budget is insufficient to pursue them (approximately an additional $50,000/year would be needed). SANREM researchers also agree that use of an herbicide such as Roundup might be a useful component of an integrated weed control system (though its practicality in

these remote regions and long-term benefits would require study). What we intended, however, was not so much to test a certain best management practice with respect to nutrient additions in one single area, but to evaluate the effects of the quality of organic amendments on environmental gradients. Our soil team does not believe that there is ONE and only ONE system that works, but we need fundamental understanding about how rainfall, soil type and soil amendments influence effectiveness of organic matter quality in supplying nutrients and soil improvement benefits. The issue of integrated weed control is an important one since weeds are a major constraint to production, but pursuit of this additional question would require additional funding. Our Zambian partners, the Conservation Farming Unit and GART, have a device known as the "weed wipe," which looks like a broom but which releases herbicides where the brush should be. However, can the farmers afford both it, and refills on the herbicide? This device works perfectly well on a small scale. An alternative solution would be introduction of a cover crop that can be used economically or have comparative advantage or value (e.g. fodder). Farmers have commented that 'they cannot eat sunhemp.' A cover crop that can do well in the long winter period would be ideal.

- We agree that soil erosion studies would be an ideal addition to both the soil studies and watershed analysis. This would require additional funding. Would the implementation of reduced till basin systems result in less soil erosion? Such a project could be performed in conjunction with the University of Zambia given additional funding.
- We agree that reducing labor inputs are imperative. Promoting a system that requires minimal digging would be useful in this regard. At the moment, farmers re-dig their basins every year. An integrated weed management system is needed that might utilize herbicides at first, but should also use other systems. A spin-off project on weed control systems would produce significant impacts for southern Africa.
- In addition to significantly expanding our poultry work, we have undertaken ruminant husbandry, health, and market access studies and training in year 2. These activities have not yet been reported because our team has just arrived back in Ithaca this week.
- Local production of soy beans is growing. Now that the extruder technology is in place at the Lundazi CTC, and high energy protein supplement (HEPS) contracts are being put in place, adding value to the soybeans produced should greatly increase profitability and make soybeans a preferred crop to grow.
- Sample processing and analysis are still underway to assess whether yields are affected by the management practices.

17. Economics. A question is raised regarding inclusion of ecotourism activities. Because of the requests of the US AID mission in Lusaka, we are breaking out the various economic contributions made by COMACO into a number of sub-headings. First, are the costs and profits associated with the regional trading centers? Next, comes an analysis of the costs and profits generated by the eco-tourism lodges and the safari hunting revenues. After that will come an assessment of costs and savings associated with government anti-poaching patrols (preliminary data suggest that COMACO is saving the Zambian Wildlife Authority significant sums on anti-poaching patrols, trials, and incarceration). Finally, will come valuation of other ecosystem services. Together, these will be

assembled into a multi-part "equation" of the cost of biodiversity conservation associated with the COMACO model.

18. Buy-in. The question of "buy-in" from the local population is raised. This is of enormous importance. Demand to participate in COMACO certainly exceeds current training capacities. Therefore, the first indicator is positive: people want to join. The next aspect of "buy-in" is continued compliance. Preliminary data show that most people trained in the conservation farming techniques continue to employ them even after supplemental maize distribution terminates. In fact, in many places farmers want the training and want to join even in the absence of supplemental training. Finally, compliance regarding wildlife poaching is being monitored by multiple approaches, from aerial counts to hunter and ZAWA surveys, to surveys of poachers and farmers themselves. We look forward to continuing our data collection to answer these and all the important questions raised by the EEP.

    Because many of the suggestions of the EEP involve additional lines of study, our teams will put together brief summaries of several potential research activities that we could perform should additional funds be made available. These will be appended to our work scope for year three, and we shall try to fulfill the following criteria: 1) that the new work represents a complement to existing activities, 2) that the work fits with a number of the other long-term projects, 3) that the work is designed to produce publishable results, and 4) that the work is responsive to the suggestions of the EEP. We shall also endeavor to include University of Zambia students if at all possible.

Final EEP Assessment of LTRA-2

Summary: The research team addressed in some detail the comments made by the EEP. Overall, many of the issues raised by the EEP was due to the research team reporting on the SANREM funded part of the COMACO project only and not providing the necessary information of both COMACO's and SANREM's individual and joint activities. The researchers state that the project is holistic (to improve food security and rural livelihoods and thereby improve biodiversity) and their comments to the EEP review try to show this. The problem has been in the reporting, in that while the COMACO project goals were presented, the SANREM research has been emphasized to the detriment of the overall project. The PIs try to correct this in this document. The EEP commends researchers for effectively showing the interrelationships of program components and designing their cumulative impact. To sum the individual comments below, it seems that this next year will need to be one of data analysis, synthesis and writing to show the impacts of all the sub-projects on the livelihoods of the local people relative to those not involved (a control group) with COMACO.

Point by Point Response: The text that follows is a response to each of the 18 points (in brackets) the PIs made in response to the EEP review of the project:

The researchers added several additions that failed to make it into the yearly reports and include international and host nation partners (1), and yearly accomplishments, which were

underreported in annual documents (2, 3) and agree with the EEP notes of the strengths of the project (4, 6).

Upon the comment by the reviewers that "the social component seems to be the weakest" part of the project (5, 7), the PIs note in some detail that the social survey data have continuously driven the evolution of the COMACO model. They explain they did not portray the use of the data from the social survey to the extent they should have. They also report on the confusion between "professional" and "farmer" training and state that both are critical to the project and both groups represent local Zambians living in the Luangwa Valley.

There was clearly a lack of communication regarding the use of social science data in the project reports. Here, the researchers state that it has continuously driven the evolution of the COMACO model and demonstrate how it has been used to, for example, 1) trade wire snares for poaching for training in conservation farming, 2) show the relative profits of farming different kinds of crops, and 3) alter the fencing programs. The researchers demonstrate that there has not been "a disconnect between the people on the ground and the rest of the project" which was a major criticism of the EEP.

We accept that the social science is leading the research; however there is a need for scientific proof that the research activities such as training in new crop production, cropping techniques and poultry management are producing statistically significant differences relative to a control group (refer to bullet 1 under Recommendation, Questions in the EEP review).

Another critique of the EEP had to do with objective 3 of the project and that was 'to test whether the COMACO model can provide self-sustaining social institutions and meaningful roles for COMACO participants". The EEP suggested this was not addressed in the project and the researchers state that what this means is whether or not COMACO is self-sustaining socially refers to "whether it is accepted" by the existing governance structure. Again there was confusion.

The lessons learned (10) will still need to be demonstrated by comparing the results of the project to a control group as the researchers state "the data we collect will indicate how the model works up to this point". The soy product development is a bold effort as it is a transfer of relatively high technology. The EEP would like to be updated through time why and how it works and if not, why. There are important general lessons to be learned here from this project.

Comparisons with other models such as CAMPFIRE and the Millennium Villages will be made in an overview paper (11).

The researchers will continue to try and work with the University of Zambia if possible (12). The EEP would like to have continued information on efforts to work with the University.

The researchers clarify the difference between the role for the watershed analysis and product value chains (13). The researchers state that the watershed analysis is being done to tie the human land use, impacts on the environment and biodiversity conservation. Human land use and markets is however a central part of the SANREM project.

Wildlife population analyses will be analyzed through time (14).

The EEP questioned the rainfall modeling as extraneous but the researchers state that it is an essential part of the watershed analysis (15).

Questions regarding cropping strategies and suggestions for changes were addressed by the researchers as needing further funding or needing more longitudinal data gathering or analysis (16). The suggestions were for the most part accepted by the researchers but understood to be outside the scope of their current project.

There will be an analysis of costs and profits generated by lodges, hunting, anti-poaching patrols and valuation of ecosystem services as part of the 'multi-part equation of the cost of biodiversity conservation associated with the COMACO model (17).

Finally, as response to the question of whether or not there is buy-in from the locals the response was 'yes' because people want to join. The researchers state that because several of the EEP suggestions require further funds they will analyze in their next work scope what could be done if additional funds were available.

LTRA-3: Watershed-based Natural Resource Management in Small-scale Agriculture: Sloped Areas of the Andean Region

Interim EEP LTRA Review

Lead Reviewer: P. Vlek
PI: Jeff Alwang, Virginia Tech

Project Overview

Under the leadership of Virginia Tech, a proposal was formulated with the above title, which with some recommendations for change from the EEP was accepted for funding. The proposal lays out the problem of the region (one watershed each in Ecuador and Bolivia,) to be the "introduction of new technologies and innovative use of natural resources." The authors argue that to overcome this problem, a participatory research program is necessary. This leads to four objectives in the proposal, later reduced to three:

1. Create options for more effective NRM in sustainable livelihood activities;
2. Identify, evaluate, introduce, and propagate alternative (hopefully better) NR-based livelihood strategies; and
3. Build social capital and local governance for economic/social stability in degraded remote rural areas.

The Bolivian watershed ranges from 3,200 to 3,700 meters in elevation. The Ecuadorian counterpart ranges from 300 to 4,500 meters. The higher sub-basin in Ecuador is used for comparative studies between the two countries.

The proposal promises the following:

- Analysis of previous NRM projects in the region;
- Participatory appraisals (PA) for baseline analysis and agenda setting;
- A natural resource inventory;
- Spotting and analysis of alternative livelihoods (AL);
- Model relation between AL spread (land-use planning) and environmental quality (TMDL); and
- Monitoring and evaluation (M&E) of impact of economic change (KASAC).

The project will ensure stakeholder involvement in the implementation of the above activities through PA, M&E, land-use planning, outreach, and training. Particular attention will be given to gender as a cross-cutting issue. Knowledge dissemination will take place through workshops. The project translates this program in eight activities stated in Table 3 of the proposal:

- Participatory appraisal;
- Household modeling and analysis of livelihood alternatives;
- Constraints research (soils, crops, etc.);

- Biodiversity measurement;
- Watershed modelling — TMDL;
- Participatory watershed planning;
- GIS; and
- Outreach.

Due to the fact that the proposal emphasized participatory appraisal in the agenda setting of the project, it lacked a clear conceptual model and clear outputs. As it emerges, the project straddles a wide range from high-end to rather down-stream activities, and though these activities largely have value in and of themselves, it is hard to see how the proposed integration will come about so that the end result is more than the sum of the pieces.

Collaboration

Lead institutions:

- Virginia Tech
- Penn State University; and
- Florida A&M University.

International and developed-country organizations:

- International Potato Center (CIP);
- International Food Policy Research Institute (IFPRI);
- World Cocoa Foundation (WCF);
- Rainforest Alliance;
- Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP);
- Sistema de Información Geográfica Agropecuaria (SIGAGRO-MAG);
- Ecosistemas Tropicales (ECOPAR);
- Fundación para la Promoción e Investigación de Productos Andinos (PROINPA);
- Ecosciencia;
- Programa Manejo Integral de Cuencas (PROMIC); and
- Centre for Agroecology of the University of Cochabamba (AGRUCO).

The project works in an impressive and complex consortium that encompasses U.S. and Andean partners. The U.S. partnerships appear to focus on Penn State and Virginia Tech. Florida A&M participation seems to have not materialized. The Andean partnerships have been formalized, and though some partners seem to have dropped out, others came in to take their place. In the reporting it is not always clear what scientific contribution is made by the partners. In Ecuador, Ecosciencia seems to be actively supporting the watershed/GIS work, and INIAP is involved in the baseline survey. PROMIC plays the same role as Ecosciencia in Bolivia, whereas PROINPA is active in studying farming alternatives, but baseline work has stalled here. With offices established in both countries, the project is well set to create synergies from this cooperative arrangement from which, in the remaining 2.5 years, it should derive substantial benefits. The complaints by partners that personal contact between partners is insufficient should be taken seriously and needs to be addressed.

Accomplishments

According to the time schedule in Table 3 of the proposal, the project should have finalized A.1, the participatory appraisal, and initiated the other activities involving active data collection for A.2-A.5 and A.7 during the first year, the focus of the current evaluation. By this measure, the project seems to be on target. It is a bit disconcerting that the baseline survey work on Bolivia has not really started.

The following documents were assessed:

- Annual Report Year 1, October 2006;
- Quarterly report Year 1, December 2006;
- Quarterly report, March 2007; and
- Progress Report, June 2007.

These reports cover a total of 14 months. The authors of the reports made the writing assignment a bit easier on themselves as they carried large parts of the text forward from one report to the other. By and large, the reports are thin on reporting results, which makes assessment of accomplishments problematic. The reporting in Cochabamba did not substantially change this. All project reports are organized around the three objectives. The decision to report on that basis rather than the eight program activities defined above makes an assessment of progress rather cumbersome. However, the one output that was promised for Year 1 appears to have been delivered (PA) and data gathering in most other activities appears to be underway.

Quality of Science

The project does not seem to have conducted "analysis of NRM projects conducted in the region," which was promised in the narrative of the proposal. In a way, this is unfortunate, as it did seem to be a very reasonable way to start such a long-term project to help set the research agenda. Instead, the project leaned heavily on the participatory assessment carried out at the two sites from which a sweeping set of issues were identified that might require (research) attention. Soil erosion/productivity, water quality, high-value crop options, market access, and off-farm employment were listed as topics to be addressed.

The baseline data being collected through the survey work seem to be offering a quality resource for econometric modeling that seems to be well conceived. The models would be such that changes in alternative livelihoods and management of crops can be evaluated. This should help to optimize livelihood strategies. The PI expressed that ideally this type of modeling should be done in a watershed context so that a watershed plan could emerge. *This conceptual model needs explicit formulation at this point in the project on the basis of which the objectives and outputs of the research program are clearly identified with the necessary milestones.*

As it stands, the watershed component of this research is poorly defined, and the state of affairs is not discernable. Geo-referenced data is claimed to be collected, predominantly biophysical in nature. There is a lack of clarity about what this amounts to and what purpose it will serve. Fortunately, the last report states that baseline data are also being entered in a GIS-based database. Reference is made to watershed models, but these are not elaborated on; thus it remains unclear what kind of land-use advice will be derived from these models. Biodiversity work is

proceeding with the apparent aim to make a case for preservation of some land in its natural state. So far, it is qualitative in nature, and only impressions are given of the importance of (agro) biodiversity.

Objective 1. To meet the first objective, some more detailed research projects were formulated on the basis of the preliminary assessment. To address the fertility constraints identified in the PA, a survey on nutrient contents in various leaf tissue samples within the ecosystems of the Chimbo watershed was undertaken. The P content is claimed to be below critical level for all vegetation types, but there is no scientific basis provided for the critical level selected for this assessment (0.3% to 0.5%). The critical P concentration would be highly season-dependent. Such surveys by themselves are of little value. The story for Al toxicity is even more complex, as the Al tolerance of plants varies widely. Also, research is undertaken on the andesitic soils of the high Andes. The justification of this work is unclear. The single round of collecting 22 soil samples may not provide an adequate base for assessment of the carbon storage capabilities of these soils. Also, leaf litter is looked at. There may be more to this effort, but if so, this was not elaborated on. The idea that further work in this area may lead to carbon trading opportunities is farfetched. The research does not seem to pursue a clearly stated hypothesis.

The work on erosion seems rather fragmented. First, some samples of soils from different ecosystems are subjected to Cs analysis. These measurements are cumbersome, often expensive and should not be done casually. Interpretation of the results depends heavily on getting a reading of Cs from a credible reference site. No work in this field of research can be published or properly interpreted without finding an undisturbed reference plot. In addition, some runoff research is done to study the effect of soil/crop management on erosion. Ideally, this work should have been coupled with the Cs study. Finally, one of the national partners has undertaken to develop an erosion susceptibility map for one of the watersheds. There is no indication that this effort is linked to the previous two studies. *There is a clear need to coordinate erosion research in this project based on clearly formulated hypotheses.*

Field experiments for nutrient management for maize/bean associations and protocols for erosion have been established, though details are sketchy. Field experiments are established on “several soil conservation structures and alternative agronomic practices” in Bolivia involving cultivation, spacing, and management for potatoes and fava beans. Work is also done on “improved varieties for adoption.” Most of this work is apparently undertaken as a result of the PA priority-setting exercise and seems to deal with traditional commodities rather than new livelihood strategies. The experiments have little that seems novel but may have merit as demonstration work rather than long-term research. For alternative livelihood options, work on fruits, medicinal plants, seed potatoes, and fava beans has been identified. Overall, the selection of research topics seems a bit haphazard, and it remains unclear what fits where in the roadmap. Work on strawberries may qualify as novel, but how does one square hormone treatments of strawberries with the SANREM philosophy?

The cacao work being reported relates to the lowest part of the Ecuadorian watershed, which is least representative of the sloped Andean zone of this project. It is a crop of the humid tropical lowland that thrives only in temperatures between 25C and 28C degrees. Even in the coolest

month temperatures should exceed 20C. *This project, though interesting, might have been better placed in the IPM CRSP.*

Objective 2. For the second objective on alternative sustainable NRM-based livelihood strategies, the PAs were used to inventory the state of affairs in a social and institutional context. Information in the reports is rather sketchy, but research topics identified were market constraints for dairy, fruits, forage, and medicinal plants. The core of the Objective 2 activities focuses on baseline data and household models. Progress is made, as was foreseen in the plan of Table 3. Also, watershed boundaries were defined in this exercise, and the data needs for modelling were specified.

The watershed modeling work reported under Objective 2 remains vague. The RS-GIS work is reported to progress, but the PI had little information to substantiate this point. The reports claim to have produced digital elevation models (DEMs) and transformed data sets that the 1956 Provisional South American Datum (PSAD 56) is based upon, etc., but what purpose this eventually should serve remains unclear. Most modelers would define what the models should accomplish (the use) before tailoring a set of models to suit that use and test its usefulness (use case). In fact, the project PI expressed some ambivalence when it came to watershed modeling. *If work on watershed modeling is to continue, the project should be explicit on the role and application of the model that is selected.*

Newly introduced are experiment station activities with alternative crops (quinoa, kanawa, tarwi and avena). Apparently these crops are to rotate with seed potato. Strawberry research is taken up (does that fit under Andean fruits?). Is there a reason to pick up this horticultural crop?

Objective 3. Under the objective on social capital and governance of degraded areas, a six-week internship was used to conduct an institutional /governance assessment. The land-use planning assistance continues with thematic maps being offered (not specified which). The project has decided to rely on modeling and demonstration experiments, and on-farm research in two sub-watersheds in Ecuador (more than 3,000 meters above sea level). Sustainable management trials are underway there on seed potatoes, fava beans, and strawberries. The project claims good progress in building local support for these projects and other outreach efforts. Degree and non-degree training as well as networking seem to continue unimpeded. Overall, it is difficult to assess the quality of much of the work, as the reports offer little detail on outputs and outcomes. *The project is encouraged to make future reporting more content oriented, possibly organized according to the outputs of Table 3 of the proposal.*

Capacity Building

The formal training component involves a number of regional and North American students. Four Ecuadorian students from INIAP are pursuing their B.Sc. degrees at a local institution in the context of this project. The Bolivian side is losing out on such an arrangement. At present, four Ph.D. and three M. S. students are enrolled at U.S. institutions, with one Ph.D. student and one M.S. student coming from the region. *This balance may be somewhat skewed in favour of capacity building in the North.* All of these students are co-funded, which is presented as leverage. But in the end, attribution of accomplishment may be problematic.

The project consortium has been very active in organizing workshops. In some there has been direct involvement of SANREM, and all seems to have had relevance for the SANREM program. Overall, this may be the best indicator of the strong partnership that has been established in the region.

Management

The effectiveness of the coordination and oversight in this project is difficult to discern. What appears to be lacking is a clear concept of what the outcomes of this program should be. As the proposal speaks of options and alternatives without specifying what these will be, and leans heavily on participatory approaches to define these, the project obtains the character of being open-ended. It probably is early enough in the project to make corrections and streamline it, but *it is high time that clear outputs and outcomes are defined against which future assessments can be made.*

Strengths and Weaknesses

In summary, the strength of this project is at the same time its weakness. Because it is very participatory, the project design is rather open. The result is that the activities appear to be decided in a rather ad hoc fashion. For an outsider it is impossible to see how all activities fit together and make a coherent program. The reporting is not helpful in this regard and with few exceptions lacks quantitative information. Where this is available, the scientific quality is less than the best. What is lacking most, however, is the grand scheme of this project. In part this may be because the project operates at the interface of research and implementation. This gives it a trans-disciplinary nature, but this requires strong conceptual frameworks. There are not many good examples in the world on how to conduct trans-disciplinary projects. It is courageous to try it, but *such pioneering work requires clear concepts and strong leadership.*

Recommendations

Develop a conceptual framework on how the proposal will integrate its results, and define the outputs and outcome better than "options" and "alternatives." Develop a chart with clear milestones, based on Table 3 or something better, and start reporting on the basis of these activities rather than on the basis of objectives.

LTRA-3 Response to Interim LTRA Review

We have made several adjustments to the project in response to EEP observations, and we have individual responses where we feel clarification is needed. Our most general response is that the research strategies document comprehensively lays out our objectives, our conceptual framework, methods and research hypotheses. We thank the EEP for stimulating an improved presentation of these things. Specific questions are addressed as follows:

1. What is the overall research goal of this project?
   The SANREM LTRA Watershed-based Natural Resource Management in Small-scale Agriculture: Sloped Areas of the Andean Region is working to address an important problem—households and communities in environmentally fragile Andean Region areas need alternatives to strengthen economic vitality through more productive livelihoods while ensuring environmental sustainability and social development. To address this

problem, the research program's overall objective is to enable and support local capacity to plan policies and interventions to raise incomes, improve social conditions and protect and improve the environment in Guaranda, Ecuador and Tiraque, Bolivia.

2. What are the principle research hypotheses that will be answered?

   Please see the matrix of research activities in our research strategies document.

3. At the conclusion of the research, what will the principle development impacts be?

   These are: (i) more effective management of natural resources and sustainable use of natural resources in Chimbo, Ecuador and Tiraque, Bolivia; (ii) diversify economic activities through alternative natural resource-based livelihood strategies; and (iii) build social capital, enhance local governance and contribute to economic and social stability in resource-degraded, relatively remote rural areas.

4. What is the current conceptual framework for the research and how do the various components fit together and complement each other?

   Please see the matrix of research activities in our research strategies document.

5. Florida A&M does not seem to be involved in research activities conducted to date. If they were involved, please describe their involvement.

   Dr. Flowers main involvement is in the sub-project: "Biomonitoring using aquatic macroinvertebrates in the headwaters and mid-altitude drainage of the Río Chimbo." The objective of this project is to develop a protocol for monitoring the water quality in the Río Chimbo and its tributaries in two study areas. The research activity involves the following: Communities of freshwater invertebrates (mostly insects) are being sampled semi-quantitatively and community parameters will be compared with what is known about other aquatic communities in Ecuador from previous studies. These comparisons, along with physical characteristics of the watersheds evaluated by other members of the SANREM team, will give a general picture of the quality of the water in the study areas. Additional data both from the aquatic insects and other parameters, will refine this water quality assessment, and will also detect abrupt changes in water quality, if any occur in the duration of this project. Dr. Flowers is also involved in the adaptive watershed management activity.

6. Partners indicated that personal contact between partners is insufficient. Is this a legitimate observation and if so, how will it be addressed?
   It was, but we have taken steps to integrate work. We have weekly meetings at Virginia Tech between the socioeconomics and monitoring/modeling teams. Penn State researchers are being included through distance linkages. Construction of an LTRA web-page will also increase integration and enhanced leadership in Ecuador will further our integration. We also will have a team meeting in Cochabamba.

7. What is the status of the baseline survey work in Bolivia and when will it be completed?

   Field work has been completed, data have been entered and we are beginning the analysis.

8. Has an analysis of previous NRM projects in the region been developed as proposed?

   It was, but data collection and access to documents have been difficult and the effort has been put on the back burner. We did not have enough resources programmed to ensure a quality product and encountered so many differences in experiences that without a much more in-depth analysis we could not make useful generalizations.

9. What is the purpose(s) of the proposed watershed modeling activities and how will the outputs of this effort be used in the project?

   Please see the matrix of research activities in our research strategies document. The basic idea is that the watershed modeling ties together all our areas of research; we will use the models to examine how individual changes and responses add up to have an impact on the watershed. The watershed models will also help summarize and aggregate impacts of interventions and will provide useful inputs into the adaptive watershed management program.

10. This conceptual model needs explicit formulation at this point in the project on the basis of which the objectives and outputs of the research program are clearly identified with the necessary milestones.

    Please see the matrix of research activities in our research strategies document.

11. What is the justification for the statement that "The P content is claimed to be below critical level for all vegetation types."?

    There is a large scientific literature devoted to the interpretation of plant mineral analysis, and its importance for the diagnosis of the nutritional status of plants. For example, in his definitive volume Nutritional Disorders of Plants: Development, Visual and Analytical Diagnosis (Gustav Fischer Verlag, 1992) Bergmann states that "Only the quantities of nutrients actually assimilated by plants and their concentrations in actively growing tissue are of decisive importance for growth and development of plants." (page 336). Our tissue sampling included many diverse plant species, some in distinct stages of development, so we did not describe our interpretation of these results in detail in our interim progress report, or cite relevant references, but these data do in fact contribute to an assessment of mineral limitations in the watershed. In the specific case questioned, i.e. tissue P status, there is ample scientific basis for stating that the critical P threshold for a wide range of annual crops is approximately 0.3% (e.g. Bergmann 1992, cited above). Based on our previous research and on published literature, we anticipated that these soils would be prone to Mn toxicity and P deficiency as primary edaphic stresses. In both cases soil analyses are much less useful than plant analyses in diagnosing these stresses,

since mineral bioavailability, especially for Mn, is quite difficult to assess from soil sampling, especially in soils that have not received much research attention, such as these alpine Andisols. Critical values for tissue P concentration should not vary much among seasons but could vary substantially within a growing season- for this reason reference leaves were sampled. Aluminum toxicity is difficult to assess from leaf Al content, since Al toxicity can manifest primarily in root tissue, but in this case Al toxicity would be expected to manifest as reduced leaf content of Ca, Mg, K, and P, with which trivalent aluminum is antagonistic. As the EEP points out, these sorts of analyses are most useful when combined with other indications of nutrient availability, which is why our project includes soil sampling. These results are also best interpreted by people with relevant expertise. Our team is widely published in the field of plant mineral nutrition, including environmental, phenological, and genotypic variation in plant nutrient requirements. While we are aware of the challenges involved in interpreting plant tissue analyses, they are an indispensable tool in assessing plant tissue status, especially for P and Mn, and their use is entirely justified by the scientific literature.

12. Why is the soils focus on andesitic soils of the high Andes?

    The project focuses on soils of the Chimbo watershed, which range approximately from 2000 to 4000 masl. All of the studied soils are used by local communities. Many are Andisols derived primarily from volcanic ejecta. The project focuses on these soils since they are the dominant soils in the project area. They also happen to be relatively poorly researched so may provide novel information regarding global carbon storage.

13. Is the proposed soil sampling for assessment of the carbon storage capabilities of soils sufficient for statistical analysis and publication of results in refereed journal articles? Is sufficient data being collected through the soil erosion work (Cs and erosion plots) for statistical analysis and publication of results?

    Sample size is obviously an important issue, especially given the remoteness of the study site, the variability of the landscapes, and challenges to exporting soil samples. In 2006 we collected a total of 94 soil samples from 22 sites at three separate locations in the watershed (Alto Guanujo, 3600m; Guaranda, 2700m; and Chillanes, 2200m). In July 2007 we returned to the watershed to collect an additional 42 samples from 10 sites. In total, we have 3 or 4 replicates at 4 soil depths from each land use at each of three locations (Alto Guanujo, Guaranda, Chillanes). Further sampling may be required, but we have sufficient replication at this stage to detect statistically significant differences among study factors. For example, soil P levels were significantly higher in the Guaranda region compared to Alto Guanujo ($p=0.007$) and Chillanes ($p=0.001$). Significant differences were also observed in % soil organic matter (SOM) at 40 cm where tree plantations had significantly lower levels of SOM than annual crops ($p = 0.033$) or natural forests ($p=0.023$). These results are according to a one-way ANOVA and Tukey test on the square root of the data.

14. Is adequate soil carbon data being collected to identify carbon trading opportunities?

Since the soils of the Rio Chimbo watershed are Andisols, their carbon storage is among the highest of all soil types in the world. We hypothesized that unsustainable land use practices are leading to loss of this carbon. Our measurements are confirming this, with higher carbon levels observed in soils of pasture, paramo, and natural forest compared to those of annual crops. Measurements of the C content of regional soils, and its loss to erosion, are required to assess the potential contribution of soil conservation in the Andes to the global C budget, and therefore its relevance to C trading. Currently, US farmers are being paid from C trading schemes to employ soil conservation practices that increase C sequestration (http://www.oardc.ohio-state.edu/story.php?id=3472). The World Bank has established a Biocarbon Fund "…to demonstrate projects that sequester or conserve carbon in forest and agro-ecosystems." (http://carbonfinance.org/Router.cfm?Page=BioCF). The governments of Spain, Denmark, and The Netherlands have established funds for C trading credits for developing countries like Ecuador. Prospects for increased C trading and increased recognition of the value of soil in C sequestration are likely to increase in coming years.

15. What are the research hypotheses of the various erosion studies being conducted and how do the various erosion research activities complement each other?

    Our research is predicated on the fact that soil erosion is having a devastating impact on the productivity and sustainability of agriculture in both Ecuador and Bolivia. Land use is driving this erosion, and it is well known that land use practices that maximize soil cover enhance soil conservation. It is also a fact that Andisols have high C content, so we hypothesize that their erosion may represent a significant flux in global C budgets, which may afford possibilities for C trading credits to reward soil conservation. Please see our research strategies document for more information about how the various activities fit together.

16. What is the purpose of the cacao research and how is it related to the other research activities?

    The cacao research is part of the research into constraints to increased productivity and profitability among agriculture-based livelihoods. At the lower elevations of the Chimbo watershed in Ecuador, cacao is fairly common (in single stands and in association with Andean Fruits). Frosty Pod and Witches' Broom represent serious obstacles to increased production, particularly of high-quality Nacional cacao that predominates in the area. This research complements other agronomic research examining means of generating incomes while reducing or limiting soil erosion in the watershed. Information on costs and income implications of planting cacao will be used (as will the information from other products) in our household models.

17. What is the purpose of the strawberry research and how does it relate to the other research activities?

    Strawberry research is a part of our effort to identify and analyze livelihood alternatives. A critical part of our project is to identify alternatives for income generation on- and off-

farm and evaluate how these activities correspond to or fit into the household livelihood strategy. In Bolivia, strawberries were identified as a feasible and promising alternative and our research is aiming to evaluate the potential and provide information on best management techniques. Similarly, in Ecuador we are investigating alternatives for small-scale dairy processing, higher-valued Andean fruits and cacao (at lower elevations).

Final EEP Assessment of LTRA-3

It is gratifying to note that the EEP Interim LTRA Report has led to a comprehensive strategy document that addresses some of the issues raised in the document. Overall, the questions raised in the review have been systematically addressed. Some of the more technical responses are still wide open for scientific debate or missed the point being made, but the aim of the review was not to enter in such a debate but to stimulate critical thinking about the merits and demerits of various research approaches. There are 2 points to be raised:

The first point is the response to point 3. The answer is not surprising as that could be read in general terms in the reports on offer. The question is that these impacts will be derived from outputs that lead to outcomes. I guess the question should have been, what are the outcomes and how will they be documented. Impact may have such a delay that the current project may be long out of existence before they can be observed.

The second point that deserves some elaboration is the response to point 8. There was a Bridging fund activity dedicated to the transfer of information from the previous SANREM phases into SANREM III. The Bridging fund PIs complained about the poor collaboration that was given by the previous PIs in offering the necessary data and reports. The same is now done in this LTRA, suggesting that there is a systemic problem. If it is at all possible to exert influence on the previous phase MEs through USAID, it might be worth trying to remedy this. If not, USAID should learn a lesson from this and not close project or project phase until meta-databases and data are properly placed in the public domain.

Annual Report, October 2007-11-23

The annual report of 2007 is, as expected an incremental expansion on what was reported so far and subject to the EEP review. However, the report is a lot easier to read and is a lot more coherent in its presentation. This starts with the lengthy section on research strategy and development objectives, in which the conceptual framework is presented with its various research components. Through a number of diagrams the reader is guided through the logical steps by which the 4 principle objectives would have to be met. The Research Team thereby goes a long way in answering the request made in the EEP Interim Report, for which it should be congratulated.

The progress by objectives section provides details in some areas where the reports on offer so far had been scanty. Overall, it is clear that the watershed has been given greater prominence in the report as it plays a key role in the conceptual framework. Under Objective 1, the watershed boundary work seems well-done and the risk map for Tiraque is a good starting point. It also

seems logical that from this map now certain areas are identified for in-depth erosion studies. A similar map is now apparently available for the Ecuador Chimbo sub-watershed.

It is a pity that such a map was not available at the time that the erosion work in Ecuador was initiated. It would be nice to see where the selected sites in Ecuador fit on such a map. As it stands, the selection seems to have been largely guided by visual observation. The work on soils has been adequately addressed in the EEP report. The only observation one should make is that much of the watershed model discussion in the report refers to the issue of water quality as an indicator of sustainability. Under objective 1, one would have expected that sampling be done in the selected watersheds to establish this baseline and use it to monitor progress, once the measures under Objective 2 are adopted. Afterwards would be too late. We note that Heatwole has established a plan for this, but if that will provide the baseline it should better be reported under objective 1.

The activities under Objective 2 are now presented in a much more organized fashion. The scope of the activities is somewhat breathtaking and one continues to worry whether any of the experiments are getting the attention needed to allow recommendations. As an example, the experiments established to generate nutrient recommendations turn out to be minus-one trials. That would merely establish whether the crops need N, P, K and S or whether one of those can be left out. Not being an expert, one would wonder whether that is the burning question at hand. Most crops need all of the above and the question is, what is a balance diet for the (spectrum of) crops. This would require a lot more and different experimentation. The science of these activities was adequately commented on in the EEP Interim Report. Moreover, some mapping in the watersheds should be done to establish the recommendation domains.

Under Objective 3 the report now offers a balanced set of modelling activities that need to progress simultaneously to meet the goals set in the conceptual framework. The modelling activities (biophysical and economic) may be a bit out of phase, but not enough to worry about. Many other activities on-going under objective 3 are not reported on this year.

Under Objective 4 the team reports on its links with the various institutions. The Governments of Ecuador and Bolivia require land use plans for the various districts. SANREM could not have arrived at a better time. It seems to take advantage of this situation. The various training activities are impressive and should produce some well trained experts in the countries. The publication record is still a bit thin, reflecting the young age of the project. However, it is refreshing to see that the people from the region are writing papers. The project has some leveraged funding and is anticipating more. The project highlights seem somewhat one-sided.

Overall, this report is a lot more comprehensive and easier to follow, may be in part because certain activities are omitted (Objective 3). The conceptual framework is in place and if pursued consistently, it should help deliver the desired outputs and outcomes.

Work plan FY 2008

This plan starts out with the same conceptual framework. It is followed by a summary of the research portfolio with hypothesis and research methods spelled out in tabular form, structured by objective. The expected outputs for each research activity, the unit of investigation and the

responsible parties are spelled out in the operational work plan. The tables provide good overviews, but not enough detail to analyze. More detail is offered in the research methodology appendix to the work plan (for some odd reason much of it in Spanish). Some comments on this appendix follow:

Activity 1A and 1B: This is an on-going activity, largely in Ecuador (though a Bolivian partner is mentioned). The research team is planning on doing more of what it has done so far, but plans to conclude the overall synthesis of the collected nutrient status data of the watershed (in Ecuador) and publish the results. Until this synthesis is completed it is difficult for the EEP to pass further judgment on the quality of this research. In the end, the appearance of this work in a peer-reviewed journal will provide it with a seal of quality that it needs. The EEP would be interested in receiving the scholarly paper on "The effects of land use on soil carbon storage and erosion in the Watershed" as well as information about the journal that it will be submitted to as an appendix to next year's annual report.

Activity 1C: This is the synthesis of the baseline database, which is now complete for both countries. The analysis will link the livelihoods of the population within the 2 watersheds to the NR base and market-level data using cluster analysis, for later integration in the integrated watershed model. The degree of success will be measurable in the acceptance of the papers that are announced for 2 peer-reviewed publications, of which the EEP would welcome copies at the coming annual report submission.

Activity 1D: This is the first time that a clear set of activities is described for the bio-physical assessment of the watersheds. The differentiation among and within the watersheds in terms of soil erosion, water quality and quantity will be based on baseline information, amplified by data collected in activity 1A and 1B. For the water quality aspect, work is planned to monitor the Rio Chimbo (what about the second watershed?) based on water quality and its macro-invertebrates. By August 2008, 2 papers will be prepared on the environmental conditions of the watersheds. The water quality (bio-monitoring) group will conclude its work in October 2008 and promises an unspecified number of publications. These should all be made available to EEP with the targeted journal information.

Activity 1E: This is a corrective action to amplify the baseline data and get a better (qualitative) understanding of the role of women in the way and means by which household assets are managed. The survey still has to be conducted. Working papers will be produced.

Activity 2A: This is a description of some erosion work being done in some sub-watersheds with land management as a key parameter. The experiment runs for 3 years until Dec. 2009 and not much can be expected as output beforehand. The sites were carefully pre-selected and the design is classical.

Activity 2B: This describes the on-going minus-one trials on maize. This is the most rudimentary type of fertilizer trials possible and is generally done to explore the needs for certain nutrients. By themselves they provide little information. The justification for this work remains unclear. It is difficult to see how this work will be of much help in developing site-specific fertilizer recommendations. A description of the work on the Bolivian site is missing.

Activity 2C: Based on a self-evident hypothesis (improved management of production systems would NOT be considered improved if they did not improve the well-being of farmers). The description of what is done under this item is not specific and inadequate.

Activity 3A: This is not reported on, probably because the field work is done and the project is now doing analysis of data. However, in the tabular listing, field work in Bolivia is still announced.

Activity 3B: This is an analysis of micro-catchments in order to characterize them in Agroecological/ economic terms. The hypothesis is that this will help in designing more sustainable management systems for the differentiated zones. The work description is too general to be able to comment on. Apparently, data are being collected for SWAT modelling. Outputs are kept rather vague.

Activity 3C: For this research activity only a rudimentary outline is provided. Not adequate. The outputs are promising. A number of existing models will have been fully tested by April 2008 and a publication will be ready by September. The EEP is looking forward to this critical output.

Activity 4A: This activity describes the outreach activities that are undertaken using a participatory approach. This is a cross-cutting exercise that involves most of the scientists. This activity seems largely on target.

Overall, the method descriptions are far from complete and rather different in quality. The PI might have insisted on more uniform quality of reporting of the scientific methods. Particularly the activities under objective 3 are pledges rather than descriptions. The annual report for FY2007 offers a better and more balanced picture of what the project is accomplishing than the FY2008 work plan. The activities under objective 3 may be partly to blame as they are not reported on in the annual report. Many of these experiments are long-run with little on offer in terms of results. The EEP is somewhat concerned that this late in the program the activities under objective 3 are still only vaguely described.

LTRA-4: Adapting to Change in the Andes: Practices and Strategies to Address Climate and Market Risks in Vulnerable Agro-Ecosystems

Interim LTRA Review

Lead reviewer: R. Burnham
PI: Corinne Valdivia, University of Missouri-Columbia

Project Overview

The problem. Fragile ecosystems may be most vulnerable to climate change because the economies of the agricultural systems are tightly linked to local predictions of atmospheric conditions. Decreasing biodiversity of crop plants and soil degradation further deteriorate the elasticity of such a system.

So what? The household economies of many human communities in the high Andes are based on the cultivation of potatoes, oca, quinoa, isaño, and other subsistence crops, all of which are served by livestock for soil improvement. Small changes in climate can disable any one of the tenuous links in human livelihoods.

The solution. Reducing vulnerability of human and natural ecosystems can be achieved by improving crop choice and variety, improving soil quality by rotation and fallow period, and alerting farmers to options that reduce their vulnerability. Generating a common knowledge of the strategies to avoid risk is key to improving the livelihoods of these communities and to preserving natural ecosystems in which they reside.

Objectives

Building capacity and creating institutions that link local and new knowledge can enhance resilience. In addition, the team aims to facilitate access to information and technologies that allow families to build assets by negotiating and navigating markets. They are guided by five objectives:

1. **Dynamics.** Develop measures and indicators of ecosystem and livelihood wellbeing;
2. **Perceptions.** Evaluate farmer perceptions of soil conditions, production system changes, pests, diseases, and climate risks;
3. **New practices.** Produce practices and information that provide alternatives for adapting to change;
4. **Markets and networks.** Develop market access through strategies and institutions that contribute to resilience; and
5. **Strengthen capacity.** Increase the capacity for collaboration between communities and stakeholders.

Collaboration

U.S. universities:

- University of Missouri-Columbia, lead;

- Iowa State University;
- Kansas State University; and
- University of Connecticut.

International and developed-country organizations:

- Peru
  Universidad Nacional Agraria La Molina Instituto de la Pequeña Producción Sustentable
  Universidad Nacional del Altiplano – Social Sciences
- Bolivia
  Universidad Mayor San Andrés – Collage of Agriculture
  Universidad de la Cordillera – Social Sciences
  Fundación PROINPA – NGO Native crops and development
- International
  International Potato Center – natural resources, potatoes and pests and diseases

Strong partnerships were envisioned in both Bolivia and Peru, ideally in equal strength in each country, to facilitate comparison and linkages. In Bolivia, strong partnerships with community, university, and NGO participants are in place. In Peru, partnerships have been forged, but the associations are less developed with universities UNA and UNALM. Much of the research testing has occurred in Bolivia, which explains some of unequal pattern, with the large majority of the research in Peru being a result of exporting tested methods from Bolivia. Collaborations among researchers are in place across U.S. institutions, as well. The strong collaboration was evident with many of the participants from Bolivia and the United States in attendance at the SANREM CRSP Annual Meeting. The lead PI indicated that the Peru USAID mission was focused more on human education in Puno, Peru, and therefore less supportive of the basic research that could be carried out there, thus the development of the scientific aspects of the project has been shifted toward Bolivia. The intention is to implement projects with Peruvian partners using leveraged funds as available.

Accomplishments

Insufficient data were presented, either in writing or in presentation, for an exhaustive evaluation of the dynamics of the Andean systems. Some of the scientific results are incomplete, e.g., characterizations of soil attributes have been collected but are undergoing analysis. Other results, e.g., various data from household surveys, were summarized for investigators at meetings in February 2007 and reviewed in presentations at the annual meeting.

An impressive amount of work and information has been gained from the household surveys, which is the current strength of the research results, given that the biological and soil data are not complete. A creative approach to understanding the potato biodiversity was implemented, and the results were integrated into ongoing research. Also, trials of some approaches to amending soils and to using different varieties have been implemented, with some results already available for community evaluation.

The conflicting information gained from informants about the use and application of the local knowledge of climate variability should remind us all of the potential reluctance of communities to open up to researchers. It was not clear whether information gained from local knowledge

was critical to the future of the project, even though the topic is genuinely fascinating. It would be a positive step for the researchers to articulate more clearly exactly how the local knowledge will be integrated with climate modeling for return to the community. It is important that communities can be self-reliant when the project ends, rather than dependent on external sources to evaluate their needs.

Some small, significant steps have been made toward developing new practices (Objective 3), but thus far objectives 4 and 5 have not been fully developed. The team's surveys are based on local households from which the market is presumed to emanate. They also have access to data gathered at a larger scale, but the integration of the two data sets was not immediately clear. They have sufficient time to address these objectives as soon as more is known about the dynamics of the biological system and options for hedging vulnerability become evident to the researchers.

Quality of Science

Overall, the science content has the potential to be high. The results so far are more descriptive than hypothetical-deductive, although the data are not yet complete. Household surveys have been taken and quantified to get a descriptive picture of the dynamics of the agricultural systems. These were performed in several communities in at least two regions in Bolivia, and in Peru. Large amounts of information are available about the perceptions of climate change, the use of livestock and fallow for improving soil quality, and the range of cultivated crops. The application of these data to hypotheses or questions about the communities should be explicit; currently the data seem to be used to describe, rather than probe.

A large number of soil samples were taken (exact numbers were not specified for each area or in total), as were samples of organic amendments, largely livestock manure. These have not been analyzed yet, according to reports, although Peter Motavalli indicated in discussion that some had been analyzed. No analysis has been undertaken, and the projected time to completion was one year. The hypotheses, as stated in the response to EEP panel suggestions at the SANREM CRSP Annual Meeting, indicate that there should be differences in soil quality depending on farming treatment. "Th'ola" was identified as a high-quality indicator of soil quality but was not explained biologically, not even the scientific name, in the activity report, field reports, or the proposal.

There seems to be a great deal of support for increased use of applied fertilizers. Their cost and availability must be assessed within the context of increasing temperatures and decreased water availability (elements of climate change) and against or in conjunction with the options of reduced tillage, soil improving fallow rather than unintentional fallow (is th'ola the best cover for fallow?), IPM, and other technologies. Eventually the issue comes down to either increasing soil productivity, or import of more food, reducing animal numbers, and encouraging out-migration of people.

Biodiversity would appear to be one means of escaping an ever-spiraling cycle of increased dependency on a narrow range of crop varieties. The investigation into the crop varieties was creative but ultimately descriptive. It will produce a report published in Spanish and English journals, and serve to educate those in the immediate region of a demonstration garden. The

science surrounding biodiversity in general might be improved in common garden trials, allowing for a greater confidence in the superiority of certain varieties, and greater publicity for local farmers through the networks of Objective 4. Common gardens have been established, with variables being types of organic amendments, tilling types, etc., but different types of potatoes to be tested were not mentioned. Finally, it is expected that the research will expand beyond potatoes to other food crops. If it does not, this will be an extreme loss to the community basis this project has developed. Again, the ability of the community itself to respond to change and vulnerability in the future, when the SANREM project has ended, is critical to the concept of developing capacity.

Capacity Building

An impressive part of the research is the large number of people involved at every level. Many students have been trained, and their professors as well as large numbers of community or heads of communities are involved. The strength of this human interest bodes well for the implementation of the project if the researchers are well respected and cooperate interactively with the communities. This certainly seems to be the case. Also, involving university-level individuals may help stimulate knowledge of the proposed activities and solutions at higher governmental levels. This is particularly true in Peru, where the team may need more local support to complete its intentions.

Management

Management appears to be largely from the PI, Corinne Valdivia, but with trip reports also written by soils expert Peter Motavalli. As both investigators are from UM-Columbia, it is easy to see why they are most involved. It would be nice to see more, both in volume and substance, from Jere Gilles, who it appears was absent for a portion of the grant period. It would also be nice to see more from the graduate students and country participants who are involved in the project — their training is also important at the grant level, not only at the analysis level. It is understood that these reports are made to the PI but were not requested by SANREM for this review, so it is simply encouraged that they keep their level of participation as high as possible.

Strengths and Weaknesses

The science is progressing - more on biodiversity per se (especially natural systems?) would be nice. The integration of climate modeling with local predictors is creative and very interesting. As mentioned, this is a unique setting for evaluating climate change. Much should be made of this. Community involvement, integration, and linkage are well in place, especially within Bolivia. Step 1 of the three important steps is very well done. Participation is good.

Soil assessment appears to be simply constructed, yet results appear to be slow in coming forward. More integration with the other Peruvian and Bolivian SANREM projects (Jeff Alwang, for example) on water quality and soil management would be advisable. Repeat surveys may help to confirm impressions in selected areas; however, these are already a strong point of the research. Make more of the results known and frame them in a question-based manner. The unfortunate lack of support from Peruvian USAID mission has diminished the cross-country comparisons.

What is the potential for achieving future impacts, and what are those likely to be? The impacts are likely to be substantial for the communities in which the research has been most active and the areas close to experimental gardens. The information will disseminate relative to the degree of involvement of other communities. If the intent is a regional reduction in vulnerability, then the tentacles of information need to go as far as possible, involving members of other communities, not just leaders. Are there ways to get farmers to participate from more distant areas? Farmers are busy, and leaving the farm for long periods may be difficult. Is there built-in intention for increasing capacity beyond the area of interest? The researchers mentioned areas of even poorer communities — can the results of the research be communicated there?

Further, it is not entirely clear how these results will be scaled from local to regional to global. Plans for this scaling in the context of a conceptual model are recommended strongly for future impacts. Doing that — construction of the conceptual model —is important now, rather than after data collection is complete. This should include aspects of climate, ecology, changes in livelihood strategies, forage options, crop options, etc.

Recommendations

- Move beyond the descriptive nature of the data that has been gathered. Excellent depictions of the communities are provided, but impact can best be made when the data are applied to hypotheses. More in-depth analysis of these data may have been done but was not presented.
- Develop a conceptual model. Enter the types of new knowledge to be generated. Include information on how the knowledge will be translated to the local community, the regional community, and the global community, for example, soil knowledge, pest dynamics, planting decisions, market opportunities. These are all spatially referenced, both people (as sources) and the information. Participation of Conrad Heatwole of Virginia Tech may be useful here. Involve Gilles in a more concrete way; his role was not made clear.
- Create a concrete plan for participation in Peru. Can La Molina University be more involved? Make a plan for this, and try to invest time where it is best spent. If Peru cannot be a comparative site under the SANREM timeline, it would be best to diminish current efforts there.
- Expand to crops beyond potatoes (quinoa, oca, iñola). CIP has pretty well covered the potato, so it would be good to investigate other cash crops, as suggested in the proposal, even if their cash value is not as high as that of potatoes. CIP has involvement in a variety of crops and has expertise in landscape ecology (see next recommendation).
- A landscape approach to vegetation change would be an excellent addition. The entire community of plants may show a stronger response than individual crop species.
- Because of the strength of the climate work, expansion in this dimension is recommended. Climate applications are largely descriptions of recent change and are not extrapolated sufficiently to the biotic community, especially the spread of insects, pathogens, and other plant diseases, invasive species, etc.
- Climate analysis also seems to be relatively short term. Be certain to include climate variability from longer-term data sets to ensure that you are not tracking local and short-term changes. Be sure that temperature variables are applicable. (Is mean annual temperature a meaningful variable anywhere?)

- Make clearer the information that is being returned to the communities and how this is being done. Measures of degradation? Soil data? Forage options? IPM data to come? Alternate crop varieties?
- Clearer measures of soil degradation are needed. What is baseline, what is control, what properties will be evaluated? Soils data need to be completed. Better communication on the conceptual linkage of soil to the entire picture may be part of the solution
- Increase the self-criticism of the researchers. While it is understood how the report and presentations were conceived, I recommend a table or digest of the small improvements that could be made. It is hard for an advisory panel to help if we cannot evaluate issues.
- Plant extracts seem to be a sidelight that could be curtailed or approached with other funding.

LTRA-4 Response to Interim LTRA Review

The review was very helpful to us. We appreciated very much having the comments from the EEP for our annual meeting. These were very helpful, and in many ways brought us back to the big picture, our hypotheses and how our project is integrated. We have addressed some of the recommendations and suggestions in our work plans, and our annual report. We developed proposals to fund activities recommended by the EEP. We included landscape and landscape vegetation to answer how the drivers (climate and markets) impact on the land use and vegetation. We included for Ancoraimes research on water balance to address questions of changing climate trends and medium term change. We are collaborating on the SANREM cross-cutting watershed modeling activity, and through this project also accessing imagery for the landscape change research in two other regions (Umala and Puno), to compare across Altiplano ecosystems the role of drivers in landscape vegetation linking imagery, ground truthing and perception maps of the community groups. We also collaborated in the development of cross-cutting proposals for soil quality indicators using both traditional and metagenomic techniques, gender, and knowledge to action.

Some clarifications to the EEP report not included in our annual report or work plans follow:

1. Please update your collaborators list

   Peru

   Universidad Nacional Agraria La Molina Instituto de la Pequeña Producción Sustentable

   Universidad Nacional del Altiplano – Social Sciences

   Bolivia

   Universidad Mayor San Andrés – Collage of Agriculture

   Universidad de la Cordillera – Social Sciences

   Fundación PROINPA – NGO Native crops and development

   International

   International Potato Center – natural resources, potatoes and pests and diseases

   Stakeholders

   UNDP Bolivia Climate Change Adaptation Small Donations Program

   Programa Nacional de Cambio Climático Bolivia (National Program on Climate Change)

CIDES – Social Sciences Graduate Program UMSA
SENAMHI Bolivia (Agency for climate and weather predictions)
USAID Title II Bolivia
CIRNMA Puno NGO research and development
PRONAMACHS government agency on watersheds
CIPCA NGO working on governance in communities and municipalities Bolivia

2. Project Objective Clarification: Perceptions. Evaluate farmer perceptions of soil conditions, production system changes, pests, diseases, and climate risks (Objective 2)

   This contains two different themes. On the one hand it elicits perceptions, through the local knowledge of problems in climate, soils, and biodiversity, which is the basis to bridge local knowledge systems and new knowledge through participatory methodologies. It provides the framework for communicating and assessing new knowledge. The reason we are looking at perception is on the one hand to understand risk, and on the other to understand the knowledge that frames decisions regarding climate, markets, soils, biodiversity, and dynamics of pests.

3. Project Objective Clarification: Strengthen Capacity for collaboration between communities and stakeholders.

   The stakeholders include the researchers and students conducting field research with farmers are included in the stakeholders, along with others working on themes of climate change, markets, livelihoods and adaptation in Altiplano ecosystems.

4. In Bolivia, strong partnerships with community, university, and NGO participants are in place. In Peru, partnerships have been forged, but the associations are less developed (with universities UNA and UNALM). Much of the research testing has occurred in Bolivia, which explains some of unequal pattern, with the large majority of the research in Peru being a result of exporting tested methods from Bolivia.

   Perhaps it should be explained that the Peru component was originally mainly focused on capacity building. However, as we worked to integrate the teams last year, it became clear that the addition of the Peru sites would enrich the comparative approach based on the livelihoods framework— in soils, pests, biodiversity, markets, advocacy coalitions, policy and cross-theme issues. The EEP mentions that community involvement, integration, and linkage are well in place in Bolivia. But, there is strong evidence that this is true in Peru as well. The various trainings and internships suggest that there is excellent community involvement and integration from Santa María. Delays in involving a second community Apopata, was due to the time spent in seeking participation of another community that ultimately declined to collaborate.

   Peru's participation also conceived as a capacity building through the MS program at UNALM. Comments of further integration are timely and very useful in our annual meeting. Peru's process of linking local and new knowledge in order to create a shared "space" for innovation to occur is inter-learning, where both farmers and researchers

learn from each other, starting with a problem that farmers identify. An example of this is the sharing of knowledge on alfalfa in Santa María with technicians in order to identify interventions that improve management. In year three approaches and experiences are shared among communities in the three regions, as well as among researchers and students. Advocacy coalition, a skill and strength in Peru, is one example.

5. It was not clear whether information gained from local knowledge was critical to the future of the project, even though the topic is genuinely fascinating. It would be a positive step for the researchers to more clearly articulate exactly how the local knowledge will be integrated with climate modeling for return to the community.

   The research on local climate indicators, how farmers use these, and their perceptions are essential to building from this knowledge system to incorporate new knowledge from the research on climate. We use participatory approaches that stimulate interactions in order to build this link. Some areas of commonality are how farmers work with the concept of probabilities, linking knowledge about change short term variability and long term change. A finding is the observations of winds as part of the local knowledge indicators that coincide with the climatology research, where both knowledge systems have similar findings about the direction, and implications for precipitation. This approach is used in climate, soils, biodiversity, dynamics of pests and markets, and captured under objective 5.

6. Some small and significant steps have been made toward developing new practices (objective 3), but thus far objectives 4 and 5 have not been fully developed.

   Objective 5 has been developed, and refers to the inter-learning, knowledge sharing approaches, and research on participation. The focus of this objective is on capabilities and capacities that lead to building the bridge of these knowledge systems, and the ability to act on this new knowledge.

7. Overall the science content has the potential to be high. The results so far are more descriptive than hypothetic-deductive, although the data are not yet complete. … <u>The application of these data to hypotheses or questions about the communities should be explicit, currently the data seem to be used to describe, rather than probe.</u>

   The project has hypotheses, which were reviewed at our project meeting, and are framing our analysis.

8. A large number of soil samples were taken (exact number not specified per area or in total), as were samples of organic amendments (largely livestock manure). These have not been analyzed yet, according to reports, although Peter Motavalli indicated in discussion that some had been analyzed. <u>No analysis has been undertaken and the projected time to completion was one year.</u>

No analysis…. Soils research comments below (Response 16) outline research activities being implemented and addressed on fertilizer application. Details of the research are also included in the annual report.

9. Common gardens have been established, with variables being types of organic amendments, tilling types, etc., but different types of potatoes to be tested were not mentioned. Finally, it is expected (by this reviewer) that the research will expand beyond potatoes to other food crops. If it does not, this will be an extreme loss to the community basis this project has developed.

   The community garden experiments only consider one potato crop and multiple amendments. The biodiversity gardens, consider the varieties and their testing by farmers. We include landscape vegetation research.

10. Unfortunate lack of cooperation from Peruvian USAID mission has diminished the cross-country comparisons.

    Lack of interest from Peru's USAID mission was disappointing. We have managed to visit them twice to inform on project activities.

11. Moving beyond the descriptive nature of the data that has been gathered will improve the project. Excellent depictions of the communities are provided, but impact can best be made when the data are applied to hypotheses. More in depth analysis of these data may have been done but was not presented.

    Analysis of the data is currently under way in the many themes.

12. Involvement of Gilles in a more concrete way, his role was not made clear.

    Unfortunately our travel reports do not reflect all the works investigators are engaged in. They also don't reveal details of the project. These are short, and when more than one person travels, only one writes the report.

13. Climate related comments: "Climate analysis also seems to be very relatively short term, be certain to include climate variabilities from longer-term data sets to ensure that you are not tracking local and short-term changes. Be sure that temperature variables are applicable (is mean annual temperature a meaningful variable anywhere?)."

    It's important that the EEP members know we are working with 40 year station records, 50 year global reanalysis data, 100 year gridded temperature and precipitation data, and 25 year satellite estimates of precipitation. Some of the results presented were comparisons limited by the 25year satellite data record, but we are always concerned with distinguishing between variability in the system and long term trends. We did not discuss annual mean temperature at all in our presentation. What was presented included trends in maximum and minimum temperature (from station data) and the climatological monthly annual cycle for evaluation of the climate models.

14. It was not clear whether information gained from local knowledge was critical to the future of the project, even though the topic is genuinely fascinating. It would be a positive step for the researchers to more clearly articulate exactly how the local knowledge will be integrated with climate modeling for return to the community. It is important that communities be self-reliant when the project ends, rather than dependent on external sources to evaluate their needs.

    Information gained on local knowledge indicators is key to building a bridge between local and new knowledge. The tendency for some respondents to attribute everything to climate change is similar to other studies conducted by the PIs, and suggested the need to continue to document cultural capital so that communities can better differentiate what they can change, and what are external forces.

    The goal of validating local forecast indicators is to develop a local capacity for generating useful forecasts using data from local and extra-local systems. Properly validated indicators can potentially help meteorologists as well as there are not enough weather stations to permit accurate local forecasts.

    Local knowledge forecasts are instrumental in understanding how farmers approach probabilities, and can feed into the socialization of climatology and climate forecast products in the future. Understanding this, as well as how information is shared will be tested to identify nodes of information. The survey of local households allows us to identify the access to markets that each household has. When farmers have risky markets we expect diversification of the household portfolio.

15. Th'ola was identified as a high quality indicator of soil quality but was not explained biologically (not even the scientific name) in the Activity Report, Field Reports, or the Proposal.

    Two kinds of th'ola: Parastrephia Lepidophylla and Baccharis Incarum (See Soils comments). Tho'la was not identified as a high quality indicator of soil quality, but was cited as an important component of sustainable agriculture in the low rainfall region of the Altiplano since the tho'la provides multiple uses including serving as a forage, as a fuel source and as a restorer of soil fertility. Historic losses of the area with tho'la and other vegetation will be determined in this project over the next year using satellite and aerial imagery. In addition, as part of activity #3, the contribution of tho'la to soil fertility and soil organic matter during the fallow period is being examined.

16. Some of the scientific results are incomplete (e.g., characterizations of soil attributes have been collected but are undergoing analysis with no results produced). … <u>No analysis has been undertaken and the projected time to completion was one year.</u>

    Soil sampling: Soil sampling started in September 2006 related to four activities:
    1. *<u>Soil classification and soil quality assessment</u>: Surface soil samples (0-20 cm) and pit samples by horizon of agricultural fields representing the major soil types in each*

community that were identified by community members. The surface samples are currently being analyzed and their analysis should be completed in three months. The pit samples will take 6 months to complete because they are initially being analyzed in Bolivia as part of an undergraduate thesis project. The completed information from these analyses will be discussed and shared with the communities.

2. *<u>Characterization of organic soil amendment resources in the communities:</u> In September, 2006, samples of the organic soil amendments (i.e., primarily animal manure) and native vegetation (th'ola) were taken from multiple sites in each community. The analysis of these samples has been completed.*
3. *<u>Characterization of soil degradation due to changes in fallow periods:</u> Soil samples were collected in September, 2006 in the Umala communities and their physical and routine chemical properties have already been analyzed. A more intensive fractionation of soil organic C and N and measurement of potential N mineralization and respiration will take a year to complete. Collection and analysis of soil samples in Ancoraimes on this theme will be conducted starting in September, 2007 as part of an undergraduate thesis project. Soil samples were also taken from directly below th'ola and between the th'ola plants in fallow of different lengths of time and the analysis of these samples have not been completed.*
4. *<u>Alternative practices to improve soil fertility and soil organic matter to buffer against climate change:</u> For this effort, soil samples were taken from each replicate of the treatments at the beginning, middle and end of the first year of field trials. These samples will take 3 months to analyze.*

17. There seems to be a great deal of support for applied fertilizers, which will potentially be difficult to maintain in the face of climate change. Can other options be explored in more detail? No till options, soil improving fallow rather than unintentional fallow (is th'ola the best cover for fallow?), IPM, etc.

    The project presented several possible strategies to the EEP related to increasing soil organic matter as a buffer against climate change, including the ones mentioned in these comments (i.e., improved soil fertility, use of green manures, improved crop residue management, improved fallow management, and use of conservation tillage). Due to the restraint of available funding and the time not all the options could be studied. Based on the baseline survey and participatory workshops, problems with soil fertility were one of the highest priority issues related to soils and so this expressed need helped to direct the focus on use of organic and inorganic soil amendments. The soil scientist in this project is trying to leverage additional funding to conduct research on identification of multipurpose plants that could be part of an improved fallow system in the north and central Altiplano.

18. Soil analysis appears to be simply constructed and yet results appear to be slow in coming forward

    Soil analysis has been completed in many instances, but more extensive biologically-based analysis (e.g., potential N mineralization, respiration) takes more time to complete. Not sure what the EEP refers to when it states that the "soil analysis appears to be

simply constructed" since there are multiple chemical and physical fractions being analyzed. We are trying to first complete some routine analysis of soil fertility indicators (e.g., pH, soil organic matter, extractable P, exchangeable Ca and Mg, neutralizable acidity, CEC) so that we can return his information to the community. Our more extensive characterization will take longer to complete.

19. Clearer measures of soil degradation are needed – what is baseline, what is control, what properties will be evaluated? Soils data need to be completed. Better communication on the conceptual linkage of soil to the entire picture may be part of the solution

    There are several potential measures of soil degradation depending on the problem and we have chosen to focus on assessing soil degradation by determining changes in soil organic C and N and soil physical properties (e.g. bulk density). This focus may not have been clear to the EEP. The EEP does bring up a valid concern related to determining the baseline or control since long-term data sets related to changes in soil properties over time are not available for the communities we are studying. We have chosen to compare a chronosequence of fields in which fields have been in cropping or fallow for variable amounts of time. This sampling strategy does pre-suppose that fields have the same initial condition prior to cropping. We are endeavoring to process the soil samples as quickly as possible, but we are also committed to training students and professionals, and strengthening the analytical capabilities of the new soils laboratory at UMSA in Bolivia and this process makes the analyses take longer.

20. Management appears to be largely from the PI, Corinne Valdivia from UM Columbia, but with trip reports also written by soils expert Peter Motavalli. As both investigators are from UM Columbia, it is easy to see why they are most involved. It would be nice to see more (both in volume and substance) from Gilles, who it appears was absent for a portion of the grant period. It would also be nice to see more from the graduate students and country participants who are involved in the project – their training is also important at the grant-level, not only at the analysis level.

    Valdivia is the PI, and also leads research and capacity building on livelihoods, adaptation, and market integration. Dr Gilles is Co PI and has primary responsibility in the following areas– local knowledge systems and perceptions of risk and climate, analysis of access to information and support for network analysis. He has support responsibilities in the design and implementation of surveys and in the risk assessment areas. Dr. Motavalli is co PI in Soils, Dr. Garrett in Pests Diseases and Biodiversity and Dr. Seth in climate. They all have corresponding co-investigators at host country institutions. The project is organized by themes and skills that integrate sciences, and span the three regions with collaborating scientists who are lead investigations in collaboration with US counterparts.

21. Increase the self-criticism of the researchers. While I understand how the report and presentations were conceived, we recommend a table or digest of the small improvements that could be made. It is hard for an advisory panel to help if we cannot evaluate issues.

Not sure what the comment means on self criticism by developing a table or digest of small improvements.

Final EEP Assessment of LTRA-4

Summary: The project responses cleared up a number of questions and information left out of the annual reports. The EEP appreciates the detail that was presented in the reply. There seems to still be gaps in the information (see questions 2, 7 and 20 for example). For the future it is suggested that the researchers continue to pay attention to detail in reporting, linking each part of the project in a clear manner. Hypothesis testing, data analysis and writing in the coming year will help in understanding the outcomes for sections of the project. It is also suggested that project problems be written so the EEP can not only understand the issues but perhaps help in solving. It is also suggested that the PIs continue to try and interest the USAID mission in Peru. To sum the individual comments below, this next year will be one of data analysis, synthesis and writing to show the interrelationships and impacts of the subprojects to the overall problem and to the local populations.

The text that follows shows first each comment made in the EEP review followed by the EEP response in italics to the LTRA 4 project responses.

1. Expanded Collaborators List.

   This is fine – collaborators are newly listed. Does not specify how these were brought on or why left out earlier.

2. Project Objective Clarification: Perceptions. Evaluate farmer perceptions of soil conditions, production system changes, pests, diseases, and climate risks (Objective 2)

   This is the exact same paragraph as was included in the response I sent to SANREM EEP on January 1, 2008. So here is the reply I made again. "As I read the response, it starts out to say there are two different themes but then describes one and then refers to the word perception as singular. So I am not certain what was being clarified, but certainly the "perception" was clarified but perhaps not as it had been fully intended?" The EEP asks that this be made clearer.

3. Project Objective Clarification: Strengthen Capacity for collaboration between communities and stakeholders.

   This has been made clearer.

4. In Bolivia, strong partnerships with community, university, and NGO participants are in place. In Peru, partnerships have been forged, but the associations are less developed (with universities UNA and UNALM). Much of the research testing has occurred in Bolivia, which explains some of unequal pattern, with the large majority of the research in Peru being a result of exporting tested methods from Bolivia.

The researchers clarify that there is a great deal of work underway in Peru, which may not have been entirely evident in the original proposal and presentation.

5. It was not clear whether information gained from local knowledge was critical to the future of the project, even though the topic is genuinely fascinating. It would be a positive step for the researchers to more clearly articulate exactly how the local knowledge will be integrated with climate modeling for return to the community.

   Again, this is interesting added knowledge. No problem with this clarification.

6. Some small and significant steps have been made toward developing new practices (objective 3), but thus far objectives 4 and 5 have not been fully developed.

   Objective 5 development covered, again as a clarification-fine.

7. Overall the science content has the potential to be high. The results so far are more descriptive than hypothetic-deductive, although the data are not yet complete. … The application of these data to hypotheses or questions about the communities should be explicit, currently the data seem to be used to describe, rather than probe.

   This was also the reply in the "clarifications" document, so I am not sure I see this as a response. It is a comment and apparently they are trying to articulate the hypotheses more clearly.

8. A large number of soil samples were taken (exact number not specified per area or in total), as were samples of organic amendments (largely livestock manure). These have not been analyzed yet, according to reports, although Peter Motavalli indicated in discussion that some had been analyzed. No analysis has been undertaken and the projected time to completion was one year.

   I read these over from the documents earlier and have incorporated some comments below on this, but largely this is fine – why not included earlier is a question that is simply one that encourages SANREM to try to articulate more clearly to the PIs what would be useful for EEP review. No science covered in the reports means we will see no science…

9. Common gardens have been established, with variables being types of organic amendments, tilling types, etc., but different types of potatoes to be tested were not mentioned. Finally, it is expected (by this reviewer) that the research will expand beyond potatoes to other food crops. If it does not, this will be an extreme loss to the community basis this project has developed.

   Again comments were included in the earlier document and I have again included them below on this issue of what is diversity.

10. Unfortunate lack of cooperation from Peruvian USAID mission has diminished the cross-country comparisons.

    This is a step forward from the clarification document earlier this year in which they simply said the interaction was disappointing. Perhaps there might be stronger encouragement from SANREM ME to be persistent in mission interactions? I have no idea how to solve this problem or whether this is the only LTRA with this issue.

11. Moving beyond the descriptive nature of the data that has been gathered will improve the project. Excellent depictions of the communities are provided, but impact can best be made when the data are applied to hypotheses. More in depth analysis of these data may have been done but was not presented.

    This is not much of a reply – I can't comment on this.

12. Involvement of Gilles in a more concrete way, his role was not made clear.

    I think the lack of involvement was seen also in the Bolivia meetings but in any case, it is hoped that Gilles can be as involved as possible to provide expertise. Travel reports – this has probably been worked into the EEP Final report as a recommendation to the ME: travel reports could be more detailed without loss of perspective – perhaps more direction can be given to PIs from the ME on this.

13. Climate related comments: "Climate analysis also seems to be very relatively short term, be certain to include climate variabilities from longer-term data sets to ensure that you are not tracking local and short term changes. Be sure that temperature variables are applicable (is mean annual temperature a meaningful variable anywhere?)."

    Detail provided here on the depth and breadth of climate data that was not available earlier. These simple numbers were good to add. ME should be alerted to this type of detail being useful to the EEP in evaluation – the science is hard to evaluate without more detail and instructions from the ME should include the detail needed by the EEP.

14. It was not clear whether information gained from local knowledge was critical to the future of the project, even though the topic is genuinely fascinating. It would be a positive step for the researchers to more clearly articulate exactly how the local knowledge will be integrated with climate modeling for return to the community. It is important that communities be self-reliant when the project ends, rather than dependent on external sources to evaluate their needs.

    More detail was added here but exactly where it was intended to amplify has been lost by this reading. Again see prior comments on ME specifying what science is to be communicated by PIs during meetings, trip reports, etc. would help a scientific evaluation by the EEP.

15. Th'ola was identified as a high quality indicator of soil quality but was not explained biologically (not even the scientific name) in the Activity Report, Field Reports, or the Proposal.

    As a biologist this comment is a little frustrating. I understand the expertise of the PI is not biology, so I would not make a big issue of this, but the clarification only deepens my concern over the biological principles of this project and how they are articulated. I know this might not be the goal of some members of the project but this is my only concern over the project: is the biology really linked to the social issues? Tho'la is not a single biological entity (comment from C. Valdivia) and the multiple uses to which it is put (comment by P. Motavalli) may very well pertain to different species and yet there is no effort to do anything but to treat it as a single "vegetation type" which is not terribly useful.

16. Some of the scientific results are incomplete (e.g., characterizations of soil attributes have been collected but are undergoing analysis with no results produced). … No analysis has been undertaken and the projected time to completion was one year.

    The researchers are a bit behind on this point but make clearer the state of the analyses.

17. There seems to be a great deal of support for applied fertilizers, which will potentially be difficult to maintain in the face of climate change. Can other options be explored in more detail? No till options, soil improving fallow rather than unintentional fallow (is th'ola the best cover for fallow?), IPM, etc.

    It would also seem that if there were problems applying some treatments of soil fertility because of lack of funding, this really should be stated as a problem at the juncture in the report where that is possible. Again, my inclination is to ask the ME to make this kind of information (how to report problems) much more obvious to the PIs because it appeared we had this problem in almost all projects: there were problems but no one wanted to acknowledge this directly. How can we (EEP) help if we have to identify the problems by reading between the lines?

18. Soil analysis appears to be simply constructed and yet results appear to be slow in coming forward

    We were not made aware of the depth of the soil analysis. Perhaps a diagram or simple narrative of the types of analysis being carried out would be useful to other members of the project as well?

19. Clearer measures of soil degradation are needed – what is baseline, what is control, what properties will be evaluated? Soils data need to be completed. Better communication on the conceptual linkage of soil to the entire picture may be part of the solution

Clarification helps – again, a simple diagram might have been included – but detail was not specifically requested by the ME so it was apparently hard to include more and keep within the guidelines?

20. Management appears to be largely from the PI, Corinne Valdivia from UM Columbia, but with trip reports also written by soils expert Peter Motavalli. As both investigators are from UM Columbia, it is easy to see why they are most involved. It would be nice to see more (both in volume and substance) from Gilles, who it appears was absent for a portion of the grant period. It would also be nice to see more from the graduate students and country participants who are involved in the project – their training is also important at the grant-level, not only at the analysis level.

    Note that this breakdown of the personnel did not address the comment that Gilles does not seem to be involved. I did not meet Gilles (that I recall – but I might forget…) in Peru on my site visit, so that feeling was not dispelled. I did meet Dr. Garrett and Dr. Seth.

21. Increase the self-criticism of the researchers. While I understand how the report and presentations were conceived, we recommend a table or digest of the small improvements that could be made. It is hard for an advisory panel to help if we cannot evaluate issues.

    This refers to the point that "everything is going along well" according to most of the reports but the project clearly has some hurdles and does not articulate them well. Hurdles can be overcome and some tend to divert. It is not a problem to acknowledge this, in fact it might help future projects if these were cleanly though through. We are not trying to make an issue with this project on this point specifically, but the tendency is to down play the problems and only mention he achievements, but the EEP looked carefully enough to see a few issues that might have been better brought forward.

LTRA-5: Agro-forestry and Sustainable Vegetable Production in Southeast Asian Watersheds

Interim EEP LTRA Review

Lead Reviewer: R. Harwood and Ron Cantrell
PI: Manuel Reyes, NC A&T University

Project Overview

The stated overall goal of this research is "to convert degrading SEA watersheds into vibrant, sustainable basins enhancing the quality of life of their inhabitants." There are six stated objectives, each linked to SANREM objectives. The overall project and its research are organized around these objectives, each having assigned partner responsibilities and with progress reports having that objective-based structure. These are:

Technology: addressing identified production-focused constraints, including:
- Agro-forestry systems;
- Drip irrigation;
- No till
- Integrated pest management (IPM); and
- Germplasm.

Markets: using market chain research to solve constraints and target opportunities;
Policy: identifying policy options to promote vegetable agro-forestry and reward environmental services;
Environmental and socio-economic impacts: assessing short- and long-term impacts;
Gender: providing mechanisms to improve the well-being of women; and
Scaling-up: building host country capacity for watershed-level scaling.

Using the first letter of each stated objective, above, the project has adopted the acronym TMPEGS for identification and reference. These overall objectives are consistent with those of the original proposal, with all being implemented. The project is organized according to the six objectives, with a team leader for each. Work plans and reporting are done by objectives across sites. The specifics of objectives then fall within those sub-teams. There is a need to make periodic adjustments to the lower-level objectives as research progresses, especially as country-specific implementation requires adjustment.

Collaboration

International and developed-country partners:
- World Agro-forestry Center (ICRAF)
- World Vegetable Center (AVRDC)
- Ronald Morse, consultant
- University of California-Berkeley
- Texas A&M University

Virginia Tech
Central Queensland University

Host country partners:
Vietnam — Nong Lam University
Indonesia — Bogor Agricultural University
Philippines — De La Salle University, University of the Philippines at Los Baños, UP Open University, and Don Bosco Technical College.

Private sector:
Mars Inc., Vietnam.

The partnership is extremely large and complex, and has been assembled through very intensive efforts by Project Director Manuel Reyes of the lead institution. Federal dollar sharing is approximately 13% to the lead institution, 38% to international and developed countries, and 48% to host-country institutions. Mobilization and coordination are heavily dependent on the personal relationships between Dr. Reyes and the more than two dozen scientists in the project. Relationships seem to be working quite well. Team-building was started with the initial highly participatory planning session for proposal development during project conceptualization. Team members suggest similar follow-up meetings, but the widely scattered team and high cost of bringing everyone together makes it impractical. All partners are participating, and all seem to be meeting their input schedules.

The Mars partnership is linked with research coordination but is not receiving SANREM financing. The Mars site is experiencing serious problems, prompting a need to reassess the role of that site, to be addressed below.

There is a perceived need for team interaction for planning and review among the three country locations that might be accomplished best in a cost-effective manner through periodic electronic conferencing. This appears to be urgent, particularly given pending budget cuts and the special needs for spreading capacity for analysis and synthesis.

Accomplishments

Site selection and establishment. Each of the sites indicated in the proposal has been activated. Some "extended" testing is being undertaken beyond original site boundaries. The extended testing is required for development of larger data sets or to access particular conditions helpful to broader sampling or analysis. In that sense, a "site" represents a geographical focal point or platform for an extended research effort, depending on the needs of a particular objective. The Philippine and Indonesian sites have a long history of intensive research and development, so there is a solid base of institutional relationships on which to build. The Vietnam site has a less intensive background of work.

Review of former research. There is evidence for significant review of former research only for one or two of the six project objectives. This review may have occurred, but it is not documented. For those sites in the Philippines and Indonesia there is extensive literature, including watershed characterization and a good deal of systems characterization, but there is

little evidence that it has been assembled and made available to the entire research team. The Indonesian site area was subject to one of the very best analyses of agro-forestry system types available in the literature.

Research objectives. The objectives are being addressed in each country site and at differing levels, depending on site-specific needs. In the Philippines and Indonesia, research toward each of the six objectives is ongoing, with progress on schedule. Some of the analyses of surveys were delayed by slowness of budget distribution in 2006. Plots are scheduled for establishment according to the 2007 work plan. Training has been done in each of the primary technological and research areas.

It is highly important that a workable no-till planter be available within 2007, since the hand-powered machine could not be made to work. This is putting the no-till work behind schedule. South Asian scientists have worked intensively with equipment manufacturers to develop such machines for the Gangetic plan areas. Hopefully the developers in this project are aware of that work, being done with IRRI and CYMMYT collaboration in the rice-wheat consortium.

In Vietnam, early survey results indicate that significant changes in research objectives are needed. The most serious concern is the appropriateness of having vegetable-based agro-forestry systems in the research plan. The site area is within a forestry-dominant area as designated by government policy. Cacao is a priority crop for the area. Second, the area would have to compete with an intensive vegetable production area within the same market region. There is suggestion that a mixed-perennial system would be more appropriate. In such a system, no-till planters have no role, for the systems do not require tillage after establishment. IPM is decidedly different. Another consideration is the scientific strengths of the partnership at Nong Lam University and their potential (or lack thereof) in the horticulture area.

Gender roles are decidedly different from those in other countries. Policy studies and their applicability are markedly different under Vietnamese governance. Payment for environmental services (PES) is under study by the Nong Lam researches in another project, and the study watershed is a highly important one to Vietnam. The mixed forestry system could still represent a data point on the agro-forestry meta-analysis. The hydrological work in support of PES is still important. Given the desired long-term relationship between Nong Lam and NCA&T, the revision should be done within that framework.

With the extreme conditions of the Vietnam Mars Inc. site caused by bulldozer land clearing and contour grading, it is hard to see how most of the research objectives can be meaningfully accomplished. Such soil disruption requires, on the often-fragile tropical soils, an extended period of uniform soil improvement through cover crops and erosion control, fertilization, and preferably limited tillage. Even if a stand of cacao can be established, crop growth is likely to be poor with extremes in uniformity. The water reservoirs will obviously need redesign. The Mars role in the partnership should be assessed to determine which, if any, of the objectives they might contribute to while their long-term site improvement is ongoing. It seems unlikely that the location can contribute meaningful research to SANREM. One possible solution would be for Mars to pursue its own development objectives and serve as an outreach/demonstration site during scaling-up.

Training sessions and conferences have been very well designed and implemented, with good attendance. This is a result of the high priority given to those activities in the project. For the most part, training sessions have been done well in advance of implementation of that part of the research. Most of the specific research outputs so far are using early subjective assessment of the data. Formal analysis of the data has not yet been completed. An Indonesian technical bulletin has been published.

Quality of Science

The selection of research topics and treatments through collaborative design seems to have been excellent. There is a gap in process following that selection.

There is a major need for greater formality of process in design of the research trials. When the work plans are produced, it is essential that the objectives and "materials and methods" be spelled out for each trial in much the same manner as would be done for a journal publication. These details may be in the minds of researchers at some level, but the teams have not gone through the process of carefully articulating them, and they cannot be reviewed for statistical soundness or other quality factors either by the team leaders or the project PI. This seems to be a project-wide deficiency. As an example, the drip irrigation work seems to have excellent potential for impact, but it does not appear to have any kind of research structure that would make the results of a quality for refereed journal publication. The reported results so far are mostly anecdotal.

In Indonesia and the Philippines there is a solid historical research base on the two sites, with Philippine and Indonesian partners and ICRAF having been heavily involved for years. AVRDC staff know the areas and technologies well. The no-till, vegetable germplasm, IPM, and Soil and Water Assessment (SWAT) scientific inputs seem to have been an excellent choice. These seem to be high-impact areas addressing key concerns. The no-till work will take considerable "selling" to farmers. The SWAT model would seem an appropriate choice for documentation, analysis, and scaling, but the objectives for its use should be carefully thought through and clearly understood by all partners. Is this model a useful and relevant one for Nong Lam colleagues to spend time learning? Do they have a long-term interest in it? How much time and effort will it take to accumulate the data needed for its running and validation in Vietnam? With modest time and capacity for research amid their teaching and other responsibilities care must be taken to focus on project and site research priorities. The backstopping from SANREM's Cross-Cutting Watershed Modeling and Assessment Activity is highly important to the quality of this research, should it be extended to Vietnam.

There is no indication, as noted above, of having a comprehensive list of available scientific materials from the sites available to all researchers. This is particularly needed for site characterization analyses such as soils, climate, demographics, economics, and markets.

A significant need for overall agro-forestry/mixed forestry analysis is apparent and not being clearly addressed in the objectives. It is stated in the latest quarterly report that "integration of trees on vegetable farms is only feasible if the complementary effects are greater than the competitive effects and that the cumulative value of tree products is greater than the cumulative

value of the yield loss in the crop displacement area." The relationship is more complex than that. Surely ICRAF has done significant research on where trees can and cannot be integrated into cash crop systems across gradients of markets, farm size, labor cost and availability, edaphic factors, and policy environments. There appear to be few available guidelines that fit, judging from serious errors in targeting in Vietnam and the apparent surprises in Lantapan, where rapid economic and market development is prompting farmers to remove trees in favor of intensive, full-sun vegetables. Guidelines for integrated tree system appropriateness are clearly needed and require analysis across gradients of the key system drivers. LTR-5 by itself may not reach conclusion on this but could make a significant contribution.

Field implementation. Each of the sites is implementing on schedule and according to current work plans. Surveys are on schedule. Plot layouts for the field trials are currently being done with the assistance of AVRDC. The Vietnam site is moving ahead with assumption of changed objectives.

Ongoing and intended analysis. There are considerable analytical and reporting expertise and capacity in the partnership of the Philippine and Indonesian sites. Not only are there long site histories, but the partners have a long history in reporting and publishing. The Vietnam site has less research history. It is unknown how much data might be available from pre-1955 work. Some survey and analysis are available from power grid and construction background surveys. The university is growing in its analytical capacity. SANREM team partners should pay particular attention to the needs in their areas of specialty and work with their Vietnamese counterparts as co-or junior authors on research output to develop that experience and to link findings to research at other sites. The Systems analyses, GIS-related work, and SWAT analyses could well be areas of analytical cooperation.

The planned analyses from survey work seem appropriate. However, there is no indication as to the expected level of scientific soundness of the outputs, just what results are anticipated, or where they might be suited for publication. To set targets for desired rigor, publication targets should be established before the analysis goes further. For every activity there is a need to be specific concerning planned outputs. The expected dates of delivery should be used as benchmarks to track progress.

There is significant question as to the relevance to the near-equatorial tropics of the vegetable-tree interaction physiology studies being done at AVRDC. The relevance of conclusions reached at the more northern latitude with differing climate and species mix will have to receive significant justification.

Capacity Building

The list of completed and planned workshops and training sessions is impressive. Training for the gender studies and SWAT model work has been moved to earlier in this second year. Reports indicate that attendance and workshop quality have been high. There are no graduate degrees funded, but there is considerable graduate thesis work included in the studies, much funded from project monies.

With such a large amount of technical assistance coming into the project in the specific research areas, there is question of the capacity of local institutions to effectively absorb and use it all. This goes back to the need for partners to have continued input into the analytical phases as well as in design and early implementation.

Management

Are coordination and oversight effective? The high-energy, personal linkages among the NCA&T project director and the partners are critical, and they seem to be working well. The participatory mode of project development and operational management has built considerable goodwill and energy. It is highly important that cost-effective ways to continue linkages among the three national programs be established. What facilities are available for teleconferences? Does ICRAF have such capacity?

Is the project cost-effective? On the surface, it appears that there is a large amount of technical assistance being supplied at a very reasonable cost. ICRAF, in particular, is providing a huge amount of service at modest cost. The Philippine universities as well as the lead institution are operating at very reasonable cost. As for pipeline, the complex institutional arrangements seem to have come online rather quickly. Now that they are in place and operating more smoothly, pipeline flow should be more regular. The early disruptions, with host country institutions spending from their own budgets, seem to have abated.

While project staff have excellent relationships, the actual science being conducted under each objective is hard to follow at the project director level and above. This is partly a result of the dispersed team, with leadership spread around the globe. The greatest problem is the lack of formal research plans, as mentioned above. The project director will have to put a process in place for his close monitoring of activities, to include output specifications and benchmarks along with the detailed plans. The overall SANREM monitoring procedures by themselves are not sufficient for management at the project level. The project director must be highly knowledgeable about the specifics of the research and its design and quality.

Strengths and Weaknesses

Summaries of the strengths and weaknesses of each activity have been covered earlier. The significant strengths originate from the strong partnership, the holistic nature of the approach, and the focus on key scientific areas of intervention. The project has an excellent integration of technology (knowledge), market chain analysis, economic and social analysis of family well-being, assembly of a database and SWAT analysis for environmental service estimation, and a planned macro-analysis suitable for scaling.

It is surprising that the team did not have the information and knowledge to better assess the potential fit of mixed and agro-forestry systems into the socio-economic environment, causing disruptive and false starts at some locations. This underlines the need for such research for future development work.

As the Vietnam site objectives are revised, the mixed forestry systems that that team is moving toward are very much the kind that CIFOR has studied in its socio-ecological research (the work

of C. Colfer and associates). If relevant, the Nong Lam partner hopefully would have access to resources to seek that input, particularly if further no-till work is to be done at that site.

A significant difficulty is presented by the extreme scientific complexity of the systems under study and by the many dimensions of research being undertaken. The division of that work by objectives within which research can be focused has been well done and appears workable.

Future Impacts

What is the potential for achieving future impacts, and what are those likely to be? The project has capacity to provide significant understanding of the role and potential for mixed agro-forestry and mixed forestry systems. These can serve to guide both policy and development activities toward intensively managed mixed systems of high ecological productivity and sustainability. Their economic and social stability remains to be seen.

A brief comment on "readability" of the reports: The progress reports, apparently to achieve brevity, have taken acronym development and use to the point that, without careful translation (and possibly even with it), the message is difficult to follow.

Recommendations

Several suggestions were made above, the most important being:

- Revise the objectives for the Vietnam site, and change its position in the project framework.
- Carefully limit "mission creep" into more areas of scientific or other interest. The project is already highly complex. Additional dimensions would surely detract rather than add to focus and quality.
- On this issue, for instance, the team should very carefully assess how far it takes the ecosystem services characterization toward PES. There is an inclination, particularly in Vietnam, to move toward an assessment of PES. This was not a part of the original objectives and should be carefully thought through.
- Carefully assess the amount and type of scientific assistance and input as the project moves toward the analysis and interpretation stages. The complexities of that analysis challenge the best scientific minds and capacities. Keep partners involved!
- Be sure that the outcomes are positioned (nested) within appropriate matrices of GIS-based ecosystems and socio-economic-geopolitical drivers so that site data and analyses constitute true public goods that have reasonably broad interpretation and relevance. Some of the partners have significant experience with this. ICRAF, in fact, has an economist, Frank Place, based in Nairobi, who is expert in this area. When he comes to Bogor on his next trip, the project should do its best to entice his interest and enlist his help.

LTRA-5 Response to Interim LTRA Review

1. Have you conducted and/or updated an agro-forestry/vegetable production literature review for each of your sites?

Yes. These literature reviews will be updated and consolidated in 2008.
Additional response from Jun Mercado, ICRAF, Mindanao partner: "For Lantapan, Philippine site, I conducted literature review related to VAF systems particularly on tree-vegetable interaction as part of my PhD dissertation. The studies were focusing on prune hedgerow using leguminous trees e.g. L. leucocephala, G. sepium, etc. The work of Tod Nissen and David Midmore was more on tree crop interaction under taungya agro-forestry system, which means growing of vegetables before tree canopy closure. Our research goal is to grow both trees and vegetables continuously with minimal negative interaction. Economic benefits will derive from both trees and vegetables."

2. What is the status of the no-till planter work? See Paul Catalan's response below. Is the no-till work back on schedule? Yes

   Paul Catalan the principal investigator provided the following response (October 10, 2007): "Regarding the EEP report: Since we won't have to develop a manually driven no-till drill and with the increased knowledge and experience that I now have with farming and no-till; we can come up with a simplified, working prototype/s of no-till drill with seeder late November or early December. The initial prototype design will be similar to the one used in Brazil, India, and Paraguay. We will send the prototype/s early December to the stakeholders in Mindanao. And yes, thanks to your emails, I was able to keep track of some of the no-till developments in India, Pakistan, Brazil, Paraguay and Bangladesh. Regarding the CIMMYT scientist: I emailed Dr. Peter Hobbs, who worked with CIMMYT and Dr. Rolf Derpsch. I am still waiting for their response. I still have to send an email to Dr. Raj Gupta, who went back to ICAR this January 2007. I am still looking for other scientists and maybe equipment manufacturers from the internet who I can talk to.

   Regarding the progress of the implement, we have already tested the drill rig with an inverted T-opener. With an average down force of around 150 lbs, it can operate using around 40 kg – 60 kg pulling force which I think a carabao (water buffalo) can provide. We are simplifying the design and we will be able to test it when I come back from Australia November 1, 2007. We already have found a motor that we can use. We will purchase the motor and study how it can drive the no-till drill in November also. The motor can be used to drive any other implement that we may develop such as a small residue roller and the like. Four of my students who will have more time to do research & development activities next semester will be working for me to develop no tillage equipment. So I am very confident that we can catch up with lost time this year. Also, I am seriously considering the mechanization of agricultural process combined with the use of alternative energy sources like solar power, biofuels, etc., as a possible subject matter for my dissertation when I enroll for my PhD at DLSU next year. Maybe I can ask for your help in identifying possible topics."

3. How have you changed the Vietnam research objectives to respond to the early survey work and problems at the site?

   The primary focus of the Vietnam research shifted from vegetable agro-forestry to the potential of growing cacao with cashew trees through: (a) screening varieties of cacao for compatibility with cashew trees, and (b) evaluating the benefits of drip irrigation to cacao

planted between cashew trees. The secondary objective is investigating the potential for indigenous vegetable production under cashew canopy. Results of baseline study showed that indigenous vegetables have potential for home consumption, soil erosion control, and some pest control. Potential indigenous vegetable crops suitable for production under cashews have been identified and growth trials are underway.

4. How are you responding to the problems at the Mars site?

   Before the EEP review, a vegetable screening study was planed at the Mars site. The study involved a variety of vegetables with various levels of shade. However, the Mars partners did not have enough staff or water to maintain the study plots and the study failed. SANREM did not fund establishment or maintenance of this work as it was funded directly by Mars. SANREM was funding erosion and yield studies at the site. This work has been transferred to the Nong Lam University research farm where our Nong Lam researchers have direct control over the trials.

5. Your interim report and other review material did not document your experimental designs and methods. Please describe the research design and methods for all your experiments.

   The research strategy and detailed research designs and methods were incorporated in the FY2008 work plan.

6. a) Is the SWAT model a useful and relevant one for Nong Lam colleagues to spend time learning?

   The SWAT model is very useful and relevant for Nong Lam University colleagues. Watershed modeling capabilities are generally lacking in Vietnam and modeling capacity is needed to assess the environmental impacts of the SANREM practices and other Vietnam land use management scenarios on Vietnamese water resources. We will provide training and experience to enable our Vietnamese partners to undertake watershed management studies on their own in the future.

   b) Do they have a long-term interest in it?

   The Nong Lam University scientist leading the watershed modeling research is the chairperson of the new Nong Lam University Geomatics program (Dr. Nguyen Kim Loi). Among the three countries participating in this research, Nong Lam University is the only one with a license for ARC-GIS software, which is needed for SWAT. Dr. Nguyen Kim indicates that water resources management and modeling capacity is a priority are for the geomatics program and the university.

c) How much time and effort will it take to accumulate the data needed to run and validate SWAT in Vietnam?

   The Nong Lam University team is in the process of collecting climatic, hydrologic, and water quality data for SWAT model calibration and limited validation. They are being advised by

Texas A&M (Dr. Srinivasan) and Virginia Tech (Dr. Conrad Heatwole). Through Dr. Heatwole's help, satellite imagery for the Vietnam study watersheds has been purchased and the team, under Dr. Heatwole's direction, is currently analyzing the imagery. Dr. Heatwole will also visit and assist Vietnam in developing its watershed analysis and monitoring capacities, using funding from the new cross-cutting watershed management activity.

7. Support from SANREM's Cross-Cutting Watershed Modeling and Assessment Activity is highly important to the quality of this research, should it be extended to Vietnam?

   The cross-cutting watershed modeling and assessment activity has been extended to Vietnam. The SANREM study site in Vietnam has major problems with soil erosion from cashew plantations. Soil under the cashew trees is kept bare and during the rainy season soil erosion is substantial. TMPEGS is researching alternative methods for improving soil cover under cashews. Hydrologic impact assessments of these methods at the watershed scale will be evaluated using the SWAT model.

8. a) How are you sharing scientific materials collected and generated by all your research partners among sites?

   Scientific materials are shared in three ways:
   1) *Secure website: http://ncat6.blackboard.com/webapps/login/.*
   2) *TMPEGS website – http://tmpegs.org/*
   3) *constant flow of emails between partners team*
   4) *regional partner meeting and teleconferences*

   b) There is no indication of a comprehensive list of available scientific materials from the sites available to all researchers. This is particularly needed for site characterization analyses such as soils, climate, demographics, economics, and markets.

   Baseline, market, gender, and other baseline and intermediate studies have been provided to researchers via email and through the web sites referred to above. However, this approach is not systematic. To improve on it the plan is to develop a systematic way of sharing this information. In TMPEGS website, each work plan element will have a progress report section. Progress reports, pictures, and activities related to a work plan element will be uploaded to that section.

9. Will your research ultimately result in guidelines for integrated tree system appropriateness that can be applied across your study sites? What parameters will be considered in the guidelines?

   Guidelines will be developed. Parameters will include: net complementarity index, yield, soil erosion reduction, benefit/cost ratio, acceptability of practice to community, and others. The guidelines will specify relationships between light intensity and vegetable yield from different vegetable-tree systems and provide recommendations on appropriate indigenous, medicinal and commercial vegetables that can be produced with trees. Issues concerning yield of commercial and indigenous vegetables in a tree system, appropriate cacao varieties

that can be grown with cashew, drip irrigation system design parameters, and the use of perennial peanut (arachis pintoi) as cover crop will be addressed.

Additional response from Jun Mercado, ICRAF, Mindanao partner: "Our research result will lead to the development of guidelines for integrated tree systems. These parameters include tree line spacing, canopy structure, silvicultural management particularly on pruning and thinning, and tree functional characteristics such as N_2 fixation, rooting pattern, phosphatase activity, mychorrizal association, etc and tree root architecture. We also conducted vegetable-tree matching looking at leafy, fruit and root vegetables. Our hypothesis is that fruits and root vegetables are more appropriate than leafy vegetable under VAF systems."

10. How are you nurturing your Vietnam partners and assisting them in the development of research skills and tools (data analysis, modeling, GIS, etc.)?

    First, the set-up for reporting provides for Vietnamese partner interaction with scientists from the US, Indonesia, and the Philippines involved in a given objective. Each objective has a coordinator. There are 'T', 'M', 'P', 'E', 'G' and 'S' coordinators. Each coordinator is communicating with the team she/he is leading. The interaction of members from each objective fosters development of research skills of Vietnamese partners and also all TMPEGS scientists. Vietnamese partners directly email partners from other countries to seek advice and help. Second, soil quality, no-till, SWAT model, and Bearh's Environmental Leadership training is provided to key scientists in Vietnam. Third, Vietnamese researchers has been visited by Dr. Robin Marsh (UC Berkeley) twice, Dr. David Midmore (Central Queensland University), once and Dr. Manuel Reyes (NC A&T) three times. In 2008, Dr. Marsh will take a 6-month sabbatical in Vietnam and work directly with the Vietnamese partners. Vietnamese researchers will also be visited by scientists from AVRDC and ICRAF.

11. What are the publication targets for the various aspects of your research (surveys, field studies, etc.)? Are your methods and experimental procedures rigorous enough for standards of these publications?

    Targets are international, regional, and local journals; extension bulletins; and magazines and newspapers. TMPEGS intend to periodically review methodologies to insure that research methodologies employ sound scientific methods and that they are appropriate for intended journals. Leadership provided by senior scientists from the US and other partner countries will continuously assess research progress and methodologies to enhance the scientific quality of our research and insure publication in appropriate journals and other publications.

12. What is the relevance of the near-equatorial tropics of the vegetable-tree interaction physiology studies being done at AVRDC? The relevance of conclusions reached at the more northern latitude with differing climate and species mix will have to receive significant justification.

Most of AVRDC work is actually occurring at the tropical field sites of our host country partners. AVRDC is providing seeds and scientific advice to all our host country partners. They had not previously conducted vegetable-agro-forestry research in Taiwan and requested support for limited research at their Taiwan center. The support SANREM provided for the Taiwan experiments was necessary to gain their participation and expertise for the tropical field sites. Their Taiwan work may also be applicable in some high altitude areas of the tropics. Some vegetables studied at the Taiwan site are the same as at tropical sites.

13. Can you improve communications among the three sites?

    Yes, changes to improve communication include: a) host country coordinators will participate in a regular annual face to face meeting. This began last June in Vietnam; b) led by the theme coordinator, scientists involved in a theme (objective) are communicating with each other via email; c) Reyes is leading a quarterly host country coordinators teleconference meeting via Skype; d) the TMPEGS website will have research 'work plan elements', with progress for each 'work plan element' updated every six months (related to reply in question (5); e) pictures from each 'work plan element' will be uploaded in another website (google-picasa) and linked to the TMPEGS website; f) publications and presentations will be compiled and made available either through the secure website or the public TMPEGS website; and g) regular email communication updates from the project director will be continued.

14. The project director must provide close monitoring of activities, to include output specifications and benchmarks along with the detailed plans. The overall SANREM monitoring procedures by themselves are not sufficient for management at the project level. The project director must be highly knowledgeable about the specifics of the research and its design and quality. How will project oversight be improved?

    The following will improve project oversight: First, response to question 13. Second, during the development of the 'work plan elements', project director has gained more knowledge on the specifics of each research. Third, completion of the research strategy was helpful in developing a holistic vision of the project. Fourth, project director has and will continue consistent communicating with theme coordinators. Fifth, annual and semi-annual reports will be done by each investigator and emailed to theme coordinators, country coordinators, and the project director and then discussed. Country coordinators will submit consolidated country reports to the project director, who will then provide them with feedback. Likewise theme coordinators will submit consolidated theme reports to project director and receive project director feedback.

15. Mission creep and movement into more areas of scientific or other interest is a concern. The project is already highly complex. Additional dimensions would surely detract rather than add to focus and quality.

    We had proposed expanding SANREM SWAT modeling activities Thailand. This activity has been abandoned as a SANREM activity. Also ecosystem services characterization and

payment for environmental services studies recommended for Vietnam and Philippines sites will not be pursued. The focus will be on the existing core elements of the research as described in the proposal or TMPEGS objectives.

16. a) Be sure that the outcomes are positioned (nested) within appropriate matrices of GIS-based ecosystems and socio-economic-geopolitical drivers so that site data and analyses constitute true public goods that have reasonably broad interpretation and relevance.

    Hydrologic impact assessment will be done using SWAT, a GIS based model. The socio-economic team will analyze the economic/environmental impacts of vegetable agro-forestry using outputs from SWAT and other economic parameters at the sites. Furthermore, the socio-economic team has developed a feedback monitoring protocol to regularly assess responses of 'small scale farmers both women and men' to research/outreach services provided by the TMPEGS.

    b) Some of the partners have significant experience with this. ICRAF, in fact, has an economist, Frank Place, based in Nairobi, who is expert in this area. When he comes to Bogor, the project should do its best to entice his interest and enlist his help.
    Enlisting the help of Dr. Frank Place is currently being explored.

Final EEP Assessment of LTRA-5

The research staff ofLTRA-5 responded to the questions and recommendations of the 2007 project review by the SANREM EEP in the following three ways: 1) written response prepared by the PI Manuel Reyes, 2) 2007 Annual Report, and 3) 2008 Work Plans. Using these three approaches, the project staff has done a very good job of providing information to clarify questions and to include the EEP recommendations into their 2008 work plans. It is significant to note that the research staff responded to the specific questions for LTRA-5 and also all of the generic questions applicable to their project provided by the EEP Review.

The EEP review included several significant recommendations. The following are the responses of the project staff:

1. It was recommended that there be a greater formality of process in the design of the research trials. The recommendation was accepted by the project staff and the 2007 Annual Report gives much more detail about results from the site surveys and the rational for selection of treatments and trial design. The 2008 Work Plans provide even greater details about the research questions, research hypothesis, description of trial locations, and trial methodology. These changes will strengthen the scientific rigor of these trials and facilitate communication among collaborators and non-project staff. One area that can be strengthen in the 2009 Work Plans would be a better description of trial design on farm fields and the role of the researchers and producers in the conduct of these trials. Of concern is the use of experiment station type small plot trials are being done on farmer fields. While some of these type trials give indication of what type of future trials are needed, trial designs on farmer fields most often require different size plots, number of replications, and locations to provide useful data for determining farmer

recommendations.

2. It was recommended that project staff avoid mission creep. This was accepted and the proposed expansion into Thailand and the ecosystem services characterization and payment for environmental services studies for Vietnam and Philippines have been abandoned as a SANREM activity.
3. It was recommended that effort be made to adequately characterize the various sites for soils, climate, demographics, economics, and markets. This need was accepted and will be presented in the outputs of the surveys in the near future.

The EEP Review raised some questions for clarification and most of these were answered in the written response prepared by PI Manuel Reyes. The following are examples of the questions raised and the responses provided:

1. The MARS partnership was experiencing some problems of getting started and this planned work has been transferred to the Nong Lam University research farm and will be conducted by the university researchers.
2. The availability of a no-till planter was of concern because of its importance to an important research objective at the Songco, Philippine site. Working prototypes of no-till drills from Brazil, India, and Paraguay will be used to develop a no-till drill that can be fabricated in the Philippines.
3. The question was raised about the usefulness and relevancy of the SWAT model for the Vietnam research sites. The Vietnam researchers are interested in using the models and plans are made to collaborate with SANREM scientists and consultants that can assist in the utilization of this model. Also, additional training will be provided to the Vietnamese collaborators in data analysis, GIS, and modeling.
4. The question was raised about the possible use of teleconferencing to improve communication among project researchers. The plans for improved communication include: 2 project websites, constant flow of emails, regional meetings, and teleconferences. All of these approaches will be used to share experiences and data in a more systematic fashion than in the past.
5. The question was raised about the applicability of the AVDRC research being conducted in their Taiwan center. It was explained that the majority of the SANREM supported research will be done at the tropical field sites of the host countries and a very limited amount of basic research was being supported at the Taiwan site.
6. The question was raised about whether a literature review had been conducted and/or updated on the agro-forestry/ vegetable production at each of the project sites. These literature reviews have been updated and will be consolidated in 2008.

In summary, the LTRA-5 project staff responded in a very positive way to the EEP recommendations, The EEP notes the progress made by the LTRA-5 research staff in developing a conceptual model for the project, but encourages the P.I. to continue to provide leadership in the process of developing the model so that the research objectives are properly nested within its ecosystem, human, and economic contexts.

A written response was provided to each question raised and the recommendations were incorporated into the 2008 Work Plans. The project staff prepared a very informative and complete 2007 Annual Report. The research staff of LTRA-5 was most appreciative of the time

and effort provided by the ME in helping them respond positively to the EEP Review.

Overall LTRA Program Review

Interim LTRA Review

Note: For this section, all EEP members participated in an intensive review of the entire LTRA portfolio to arrive at consensus on the most relevant points. Our comments and recommendations are generalities that apply to many, if not most of the activities and projects but may not apply in all cases to each project.

Objectives

The world is becoming increasingly interactive, with major increases in intensity between ecosystems, agriculture, and people, as is properly stated in the SANREM CRSP mandate. Competing demands for resources, especially for land and water among the three of these dimensions as economies grow and intensify, place severe strains at the interfaces, heavily influencing eventual increases in productivity. The LTRAs obviously do not cover all, or even a majority, of geographies and types of interfaces, but they are broadly representative of many very common situations. Structured at very modest cost, they appear very well construed university-backstopped programs which provide proof-of-concept on sustainably intensifying agriculture in developing countries. The projects have global reach, and use a holistic approach at the local level to research limiting factors within ecosystems or watersheds. They must be realistic in focus to achieve scientific rigor with available resources. The following observations apply:

- SANREM appears to have a unique role in setting a standard for an integrative approach to agricultural development. The LTRA projects have potential to point the way toward managing interfaces among the demands of innovative technologies, their resource needs, the market chains required, and their sociopolitical environment. The projects are facing inevitable pressure for component research to become insular, as seen in their reporting.
- The conceptual model for SANREM, summarized earlier in this report, illustrates its global mandate. The competitive process that originated the LTRAs very appropriately forced a multidimensional, cross-disciplinary and cross-institutional approach. It is obviously impossible for any project to include all possible dimensions. Each project thus must construct a conceptual model that should "nest" its research objectives within its ecosystem, human, and economic contexts. That model must embed objectives, hypotheses, and activities within an operational framework. The model requires more than one illustration to define these dimensions. By placing key drivers in selected domains into a research context, priorities become clear, and pressures for "mission creep" can be better managed. Project researchers appear to have these models in mind, but they are not always clearly illustrated, and most appear to require constant upgrading. Many project models do not yet include objectives and well-focused hypotheses.
- At this early stage of LTRA implementation, the projects and the ME must ask whether research objectives are sufficiently limited, focused, and clear to balance scientific quality with breadth of coverage. Good conceptual models and frameworks help make

those decisions more rational, particularly when budget cuts must be made. If objectives are to become more consolidated, the nesting within context for those objectives that remain becomes increasingly important.

- Specific objectives should, at this stage of project evolution, each be followed by statements of outputs and expected delivery dates, which then become milestones.
- The TOP framework suggests objectives to be spread across a spectrum from fundamental to applied research, with a continuum to scaling and outreach. The projects cover that spectrum. The balance appears reasonable, but the projects should reflect the primary strengths of their university partners. “Scaling” should focus on concepts, processes, and training for an integrative outreach while limiting the actual extension supported by limited SANREM funds and optimizing the impact of local partner resources.
- Limited SANREM budget, regardless of size, will always suggest, if not require, leveraging. That leveraging often brings a broadening of effort as partners implement their own agendas as part of SANREM. The management and reporting of activities must be structured to reflect core research objectives as well as supplemental and related work.

Accomplishments

- The teams for LTRAs have developed a very positive spirit and sense of purpose. There is openness and sharing among PIs. As far as the EEP can tell, there is good interaction with the USAID regional offices with significant consideration of donor country priorities.
- Research teams are to be complimented for their entrepreneurial spirit in obtaining funding to support both core and associated research for many of the projects. This leveraging is substantially increasing both the depth and scope of SANREM research.
- Capacity building is well underway, with many graduate students engaged and most projects heavily investing in training for project implementation.
- A good deal of survey data have come in and analyses are starting. Results so far are primarily from subjective assessment, with statistical results to follow.
- While there has been substantial progress, some areas in many of the projects seem slow to evolve and are not as could be expected at this stage of project development. Some of these will be dealt with below under specific recommendations:
- The systems approach is not yet strong enough. Many of the teams are counting on quantitative models to bring that integration. The strengthening of conceptual models and frameworks should help to direct integration approaches.
- Literature reviews are not highly evidenced, whether in summaries accomplished or, as evidenced in at least some cases, lack of familiarity with what has gone before, either in previous SANREM phases or from other institutions.
- After 14 months, it would be expected that hypotheses would be more completely formed and be undergoing revision toward greater specificity. Research methodology should be spelled out at the start of experimentation. The summary of this could be structured to read as a “materials and methods” section of the eventual expected publication. This would be especially useful for management tracking by the PIs and for peer review.
- Value chain concepts seem to be slow in evolution.

- Many of the in-country relationships seem to be adequate, but it is not possible to tell at this point if they are adequate for eventual policy formulation or for scaling and outreach.
- There is need for development of an outreach philosophy and strategy for the SANREM integrated systems according to the TOP framework. Given the strengths of the university partners, that strategy and the training for its implementation should form the core of scaling efforts, with modest actual farmer spread to show proof of concept and potential for impact. Widespread eventual development is the realm of in-country partner groups.

Quality of Science

Science quality was a key feature of the charge to the EEP and thus was considered across all aspects of each project. We have evaluated scientific aspects on the basis of feasibility of the approaches, hypotheses stated, data collected, analysis of data, clear articulation of results, and potential impact of results on applied and basic aspects of the field of study. These aspects of the evaluation should be included in instructions to the project leaders by the ME in subsequent report requests.

Hypotheses. Use of a hypothetic-deductive framework for asking questions was almost universally weak among projects. External and self-evaluation of progress cannot be carried out if the specific questions to be asked are not clear. It became evident that most projects were not structured to pose answerable questions or testable hypotheses. The lack of the hypothesis framework gave a descriptive flavor to the data and outcomes, rather than a problem-solving approach backed by evidence.

Recommendation: that all projects reevaluate what they are asking; how they will know when the answer has been collected, revealed, or proven; and how that can be articulated more effectively.

Materials and methods. These need to be defined and carefully laid out by project leaders. Methods are often unknown to the lead PI, even in generalities, which was seen as a weakness. These need to be more clearly accessible to project leaders.

Recommendation: that each project or sub-project write up materials and methods for each experiment or activity. These will serve as the basis for subsequent scientific publications and so are highly recommended at this time. Further, these are recommended to be internally reviewed among scientists on various subprojects to facilitate communication and self-exploration of the projects

Models. In general, the EEP perceived too heavy a reliance on quantitative models, e.g., watershed models, SWAT, econometric models, climate models, GIS, and not enough on conceptual models under which the ability to link different aspects of the project would be clearer. The idea of conceptual models has been addressed in other section of the EEP review; it is the specific link to scientific results emphasized here.

Recommendation: Instead of reliance on only the models, we suggest asking more direct questions about where nutrients or household resources are flowing, for example. One approach

might be a value chain starting at the marketer but extending backward to the field (potatoes, bees, trees, corn, cotton, etc.), and forward to the purchaser.

Participatory process. Most projects show a strong and significant input at all levels. We perceived input from the local level to the facilitating USAID missions to NGOs to ministry officials, local scientists, and their universities. These have all had varying degrees of input to the scientific goals. In this, SANREM has largely achieved its goal. Ownership of the scientific process is a positive aspect of this activity. This input, however, does have a down side of drifting the mission and/or downgrading the science, with a greater focus on short-term problems and solutions than on long-term goals.

Recommendation: A stronger attempt to formulate the large goals in terms of a conceptual model, which will help keep the focus on the scientific goals in addition to capitalizing on local input. Once these goals are framed so that all audiences can capture the scientific contributions, it will be easier to stay "on mark."

Funding match to science. In some cases the amount of funding allocated to certain subprojects has been insufficient to perform the best experiments. While funding may not be sufficient for more in-depth analysis in some cases, we argue that the best solution may not be an analysis that shortcuts the best science (in some cases, inexpensive projects headed only by graduate students).

Recommendation: Many projects have been successful in leveraging funds for new projects, and we encourage these expansions. However, more might be done with a small amount of leveraging to upgrade analysis of some of the biophysical science aspects, e.g., soil analyses.

Balance of outcomes. We perceived that science on socioeconomic aspects of projects receives a large amount of data at a relatively low cost, (e.g., Alwang, Valdivia). This positive aspect is seen across many projects. However, the similarly small amount of money does not appear to go as far toward biophysical scientific goals unless it is leveraged with other funds (cacao, Alwang; biodiversity surveys, Travis). We would like to see the best science possible being carried out within these projects, and this may take additional linkages (e.g., soil genome work in the Alwang project).

Recommendation: While this is not the case for all projects, we would like to see the biophysical science designed to gain more for its financial input.

Innovation. We applaud the innovation brought to these projects from previous research efforts. We encourage those projects in which innovation can be strengthened with more self-evaluation to institute such (or informal *external* evaluation). This aspect of innovation was found to be a mixed bag, even within individual projects.

Service versus core science. It is recognized that only a certain kind of person will undertake a CRSP project. That person is committed and interested in communicating to the general scientific audience as well as contributing to human welfare. These investigators balance

science-driven projects with human need and adventitious trials. With these externalities, a certain aspect of the science can be diluted or downgraded.

Recommendation: It may be necessary to identify individual subprojects as direct service activities versus core science activities. An upfront identification of which is service and which is science may clarify these mixed agendas. We suggest applying the recommended conceptual model here to visualize approaches and activities.

Improve science quality in host countries. One of the obligations of the SANREM CRSP is to engage our collaborators in cutting-edge science. Greater efforts can be made in many countries to bring the science to a higher level and to involve local students and scientists more intensely in that effort — we recommend going beyond teaching seminars. Trouble-shooting might be more carefully articulated in this respect to get input from local scientists but also to engage in the scientific approach to solving problems. Bringing more interactive cutting-edge science to the host countries is critical (soil genome mapping in the Valdivia project, for example). The Valdivia and Alwang projects may wish to collaborate on the soil genome work.

Literature reviews, background. We found substantial gaps in knowledge about previous research in many projects. Some of these gaps led to investigators walking a well-worn path when innovation could have been made; other instances of gaps seemed to contribute to continued data taking when trouble-shooting should have been going on. In this respect, certain community response values dictated research much more than literature and background information, which may have contributed to the well-worn path (e.g., Valdivia, Alwang).

Recommendation: Literature reviews should be performed and results communicated to participants at regular meetings. Open a discussion of biophysical versus social approaches.

Self-reflection and evaluation. We noted persistent claims that objectives and timetables were being met, and results were being produced. However, on careful interpretation and closer questioning, we discovered that these claims were not always entirely fulfilled. In some cases, problems were acknowledged, but the in-depth questions about why the problem was occurring were not being posed. In other cases, the real connection between a subproject and any of the stated project goals was not clear.

Recommendation: Institute more effective means of self-evaluation, which might be implemented through more active scientific management by the PI. This is not to deny the application of resources to ancillary projects but to make those projects more integrated into the whole (cacao, Alwang; global modeling, Valdivia).

Scientific publications. Quite simply, we perceived that there were not enough publications on the way. Without the hypotheses more clearly stated (see above), it was hard for the EEP to visualize individual publications to come. Though the projects are only one-third to completion, there should be clear indications of which papers will address which topics, and how (and where!) they might be published.

Collaboration

SANREM projects demonstrate good effort to build collaborative relationships among faculty and staff of U.S. universities, researchers in USAID-assisted countries, members of local communities, NGOs, and the private sector. Responsibilities for project activities are well distributed among these collaborators. A strength of the SANREM CRSP is that it has brought these collaborators together and that they show commitment, or "buy-in," to the program

A further strength of SANREM is that it facilitates collaboration across boundaries of nationality, culture, scientific discipline, profession (e.g., public, nonprofit, for-profit, academic sectors), and levels of operation from the field, farm, and forest to the highest tiers of formal institutions. In many cases this is the first time for such disparate parts of the larger agricultural, natural resource, and environmental community to get to know one another.

At the same time, better communication is needed within projects so that people in all parts of each project know about the work of others and how it all fits together. In some cases, particularly remote participants in the project are flying blind without good guidance or perspective on the entire project. In some cases the responsibilities of project staff may not be reasonably assigned.

This phase of SANREM is doing a good job of acquainting the staff of each of the five main projects with one another and their respective objectives. But here also, more and better inter project communication is needed. SANREM project leaders need not only to communicate with participants at the community level and to staff throughout their projects, but also to listen. Each project presents participatory activity, but in some cases it appeared that these local participants simply may have been present or given tasks. There was limited evidence that in-country partners are being listened to.

It is important not only that there be a clear conceptual framework of the work of each project, but also that this framework be understood by all participants in the project. Even for those projects that successfully articulate a conceptual model of their work in project documents, it is not clear that they have imparted this model to in-country participants, or that in-country researchers have participated in its development. A key responsibility in SANREM collaboration is to formulate and thoroughly communicate common conceptual models to project participants and external groups.

It is observed that some researchers may be into their hobbies, unrelated to their respective projects. Regardless of scientific merit, effort that does not contribute to the project in a collaborative way with other researchers, or within the context of the conceptual model, detracts from the project.

Capacity Building

There is not a clear concept across SANREM of what constitutes capacity building. The meaning of the phrase in SANREM needs to be reviewed, defined, and promoted, with consideration of SANREM's responsibility to teach interdisciplinary, problem-solving, and holistic thinking. The

participatory approach should be discussed in this context, and how participation is linked to capacity building.

SANREM researchers are purposely engaged in the interdisciplinary conduct of science. One essential objective is to build the capacity for interdisciplinary science and to leave behind, in each country where SANREM is engaged, the science capacity to carry on the work that was begun under the project. A test of the success of each project will be whether it has left behind the capacity required to continually solve emerging problems like those approached by the respective SANREM projects.

There is a likely learning curve in working across disciplines for PIs as well as the other team members. Common sampling frames among all researchers in each project are the essential feature of interdisciplinary research. SANREM researchers still need to work at it. A SANREM project cannot be judged successful until effective interdisciplinary research is conducted among U.S. researchers and imparted as a practice among host country partners.

The selection of students for academic training and their venues of training need to be reviewed to assure the strong likelihood of contributing to the scientific capacity of the SANREM project in host countries. Academic training within the United States, within the regions of research, and within the host country — as well as the nationalities of the students — all need to be considered.

Farmers, forest users, and community members need to be trained in non-degree programs. Holistic thinking and problem-solving need to be emphasized among these research participants so that they may continue the work of SANREM in their communities and for their own benefit. A major contribution of this project should be on-the-ground capacity building among farmers and forest users.

The participatory approach is not complete until the conceptual models for SANREM research have been imparted to community participants. Farmers and forest users must be empowered through their participation to understand how they may identify the problems before them; and to assert their rights and abilities to solve them.

Management

The SANREM CRSP focuses on knowledge: its discovery, organization, and dissemination. The program is organized through a novel landscape systems approach initiated by the ME and a team of system coordinators.

Strengths, Weaknesses

Reporting to USAID seems to be fine, and the ME is fulfilling its obligations. It is useful for PIs to get together at meetings and to communicate with each other periodically. The ME encourages individual projects to communicate. This is very commendable!

The ME has fostered dynamic interaction among the projects and between the projects and the ME; it has created a community whereby individuals within and among projects can easily communicate. The participatory nature of the ME has created an environment for sharing ideas. This is a positive feature of the management style.

The SANREM CRSP is fostering interdisciplinary training, which rightly connects to the goals but also fosters a new and more complex way of thinking of interdisciplinary science. This is particularly important for non-U.S. training, and the EEP commends the ME for nurturing this new way of doing science.

The structure of reporting could be improved so that the EEP can do its evaluations more efficiently (see the Objectives section, above). The ME seems to be managing projects to show impacts rather than science. There is too much emphasis on productivity indicators that are the goals of USAID. The ME should encourage more comprehensive reporting. There needs to be emphasis on research outputs and milestones, as well as activity indicators (impacts). Specifically, the management of science quality needs milestones and defined outputs based on scientific and participatory experiments and interactions.

Recommendations

The EEP team is very impressed by the new knowledge generated, the excellent graduate training, and scientific staff commitment to engage in multidisciplinary research. We believe that the SANREM program is a suitable instrument to capitalize on the strong disciplinary knowledge base and development research expertise at American universities in addressing complex issues of developing country contexts through an inter- and trans-disciplinary approach. As we place more stress on the environment due to rapid change, there are often unintended consequences for these linked people-agricultural-environmental systems. The inter- and trans-disciplinary approach to research exemplified by SANREM is the most viable way to approach the complexity that is the real world.

The recommendations below focus on issues that emerged from the evaluation, with emphasis on elements that could be improved based on our insights obtained from the existing programs. These are aimed at further strengthening the SANREM program as a whole. We believe that investment in future SANREM programs should be augmented, and that future programs will benefit from the following recommendations. We recommend:

- The continued development of instruments to extract cross-cutting public good from the research projects. Those should include knowledge related to soils, water, biodiversity and ecosystem services, governance, institutions, and gender.
- The development of a mechanism for learning from sister SANREM program experiences, including an analytical paper (series) on what worked and what did not, and how local institutions were recruited and integrated into the SANREM program.
- Each project should continually reassess its activities in the research-extension continuum within TOP and clearly identify the range of research activities where U.S. universities have their greatest contribution to make. This should result in a planned balance between fundamental and applied research, and in the articulation of a philosophy and strategies for scaling and outreach of integrated systems and their technologies.

- More preparatory work should be done to establish an agreed upon integrated framework of objectives leading to hypotheses, with output and deliverable due dates becoming project milestones. Clearly identified knowledge gaps could then be filled where possible from associated research. A set of deliverables corresponding to the SANREM core funding should be identified, as well as additional desired deliverables subject to more funding through the many leveraging channels.
- The relationship between PIs and their respective researchers needs attention. The ME may need to make clear to all researchers that projects need leadership and "followership." Despite differences in disciplines or seniority between PIs and their colleagues, the PI needs to lead the research. PIs and researchers need to agree on what outputs are needed, and when. Milestones for each researcher's work need to be set and met. PIs are not simply facilitators, they must exert leadership. The ME needs to support PIs in their leadership roles.
- As mentioned in the Collaborations section, above, better communication is needed so that people in all parts of each project know about the work of others and how it all fits together. Also, more and better inter-project communication is needed.
- One essential objective is to build the capacity to conduct interdisciplinary science and, as mentioned above, to leave behind the capacity to carry on work begun under SANREM projects. The selection of students for academic training and their venues of training need to be reviewed to assure the strong likelihood of contributing to the scientific capacity of SANREM host countries. Graduate education should be done by exposure to cutting-edge science.
- Considering the complexity of this type of research program — serving the interfaces of agriculture, people, and the environment — the EEP recommends to extend the program beyond the five years' research of the first phase, particularly for those projects where the promotion of sustainable institutional change and policy modifications on the basis of the research have a realistic chance of being realized.
- There may be merit in reorganizing the reporting on these projects. The reporting under categories of objectives seems not to be sufficient. As the projects develop a conceptual framework they might report in a more functional fashion using these frameworks. Specifically, the conceptual model of the project should comprise the objectives, hypotheses, activities, research protocol, and capacity building. It might be useful to report using the model components as a framework.
- Because SANREM is a flagship program of USAID, the EEP recommends that funding for SANREM be maintained at realistic levels. If any cuts in funding should be made, the Technical Committee should ensure that this not be done at the expense of core activities and scientific rigor. The EEP recognizes the value of leveraging SANREM funding but also registers that leveraging can contribute to mission drift.
- The SANREM Knowledge Base is well documented and conveniently accessible. The ME and researchers need to encourage the use of the knowledge base by as many means as possible. The ME in cooperation with researchers should issue news releases regarding research findings as appropriate, useful and especially to draw attention to the expanding SANREM Knowledge Base.

ME Response to Interim LTRA Review

Overall, the Management Entity (ME) found that the Interim External Evaluation Panel (EEP) review of the SANREM Long-Term Research award (LTRA) Program was excellent. The review was shared with the ME team, SANREM CRSP Technical Committee (TC), and all the individual LTRA research teams. The EEP identified strengths and weaknesses of the overall program and individual activities have been used by the ME, TC, and partners to improve the quality of SANREM research. The individual SANREM LTRA PIs have responded positively to the EEPs comments and suggestions. Each has made revisions in their research activities in light of the suggestions and/or new ideas generated in response to team discussions stimulated by the EEP suggestions. Each LTRA has developed written responses to the EEP suggestions to document their responses to the EEP review.

The ME agrees that the ME requested structure for the LTRA progress reports did not provide adequate information for the EEP to evaluate the quality of the LTRA science. The emphasis on reporting on actual or potential development impacts overshadowed research methods and intermediate results. LTRA reporting requirements were changed for the annual report to more clearly demonstrate research progress toward development impacts.

ME responses to EEP comments (in abbreviated form) are provided below in italics.

1. The projects are facing inevitable pressure for component research to become insular, as seen in their reporting.

   The ME agrees with this observation and has been working with the LTRAs to minimize mission creep and to focus attention and resources on the core research objectives and integration of research findings.

2. The conceptual model for SANREM, summarized earlier in this report, illustrates its global mandate. The competitive process that originated the LTRAs very appropriately forced a multidimensional, cross-disciplinary and cross-institutional approach. It is obviously impossible for any project to include all possible dimensions. Each project thus must construct a conceptual model that should "nest" its research objectives within its ecosystem, human, and economic contexts. That model must embed objectives, hypotheses, and activities within an operational framework. The model requires more than one illustration to define these dimensions. By placing key drivers in selected domains into a research context, priorities become clear, and pressures for "mission creep" can be better managed. Project researchers appear to have these models in mind, but they are not always clearly illustrated, and most appear to require constant upgrading. Many project models do not yet include objectives and well-focused hypotheses.

   The ME has worked with the LTRA PIs to better define and document their research strategies, conceptual models, scientific designs, research and experimental methods.

The research strategies are now included in the LTRA's FY2008 work plans and annual reports.

3. At this early stage of LTRA implementation, the projects and the ME must ask whether research objectives are sufficiently limited, focused, and clear to balance scientific quality with breadth of coverage. Good conceptual models and frameworks help make those decisions more rational, particularly when budget cuts must be made. If objectives are to become more consolidated, the nesting within context for those objectives that remain becomes increasingly important.

   The ME agrees. The development of the Research Strategy and Development Objectives section (Form 20) for the Annual Work Plan and the annual Reports has been very useful in this regard. However, we are particularly concerned about one LTRA, which is having a difficult time articulating its research objectives and progress towards meeting those objectives, even after responding to the Interim EEP Review. We will work closely with all the LTRAs during the coming year encourage them to focus on their research objectives.

4. Specific objectives should, at this stage of project evolution, each be followed by statements of outputs and expected delivery dates, which then become milestones.

   The FY2008 work plans required the LTRAs to specify outputs and delivery dates by objective. Some LTRAs have met this requirement better than others and we will assist those needing additional assistance to develop good milestones and milestone dates.

5. The TOP framework suggests objectives to be spread across a spectrum from fundamental to applied research, with a continuum to scaling and outreach. The projects cover that spectrum. The balance appears reasonable, but the projects should reflect the primary strengths of their university partners. "Scaling" should focus on concepts, processes, and training for an integrative outreach while limiting the actual extension supported by limited SANREM funds and optimizing the impact of local partner resources.

   Agreed. SANREM research can only point the way forward. Projects should not be conducting extensive dissemination activities. Having said that, it should be noted that the participatory nature of the SANREM model and TOP Framework consider "dissemination" as an integral component of the upfront research and design process. In our review of the FY2007 annual reports we have paid particular attention to this and have or will provide feedback to LTRA PIs concerning the necessity to focus on the research and research capacity building aspects of their activities rather than secondary development activities. However, we recognize that the relevance and ultimate impact of our concept, process and training efforts depend upon the tracking and success of the secondary development activities and consequently some leveraging of our funding to support this area must occur. This will be discussed during future TC teleconferences.

6. Limited SANREM budget, regardless of size, will always suggest, if not require, leveraging. That leveraging often brings a broadening of effort as partners implement their own agendas as part of SANREM. The management and reporting of activities must be structured to reflect core research objectives as well as supplemental and related work.

   As described previously, reporting requirements have been modified so that reports focus on research progress and methods in addition to development impacts.

Accomplishments

7. The systems approach is not yet strong enough. Many of the teams are counting on quantitative models to bring that integration. The strengthening of conceptual models and frameworks should help to direct integration approaches.

   The development of the required research strategies and conceptual model frameworks will promote a stronger systems approach in the LTRAs. When we visit the research sites this year, this will be one of the evaluation items. The necessity of the systems approach will also be a topic for TC teleconferences. Finalizing and engaging the PIs in the review of the SANREM systems book will also facilitate discussion of the systems approach.

8. Literature reviews are not highly evidenced, whether in summaries accomplished or, as evidenced in at least some cases, lack of familiarity with what has gone before, either in previous SANREM phases or from other institutions.

   We acknowledge this, but with our reporting structure it is not apparent, although the original proposals had considerable literature review. The secondary research implied by literature reviews is often undervalued. We will work with PIs to strengthen this component.

9. After 14 months, it would be expected that hypotheses would be more completely formed and be undergoing revision toward greater specificity. Research methodology should be spelled out at the start of experimentation. The summary of this could be structured to read as a "materials and methods" section of the eventual expected publication. This would be especially useful for management tracking by the PIs and for peer review.

   New research strategy and work plan guidelines require PIs to document research objectives, related hypotheses, and experimental methods used to test hypotheses. For the most part, the FY2007 work plans document hypotheses and research methodologies well. Given the multi-disciplinary nature of these tasks experimental methodologies are not always appropriate for all research objectives. Nevertheless, we have been working with PIs to formulate more rigorous methodologies to tighten the scientific approach presented in the Research Strategy and Development Objectives sections.

10. Value chain concepts seem to be slow in evolution.
    Not sure what this comment refers to, but value chain work was generally proposed during the final two years of the research plan. Value chain work, where appropriate, is a major emphasis this year.

11. There is need for development of an outreach philosophy and strategy for the SANREM integrated systems according to the TOP framework. Given the strengths of the university partners, that strategy and the training for its implementation should form the core of scaling efforts, with modest actual farmer spread to show proof of concept and potential for impact. Widespread eventual development is the realm of in-country partner groups.

    We agree that widespread dissemination is beyond SANREM's means and mission, but are not fully clear about the EEP's concern here since the participatory process is SANREM's primary outreach philosophy and strategy. Scaling-up and/or out is also subject to research investigation in its own right. Using funds for FY2008 that were unexpectedly received from USAID, we are implementing a cross-cutting activity entitled "Knowledge to Action", which will examine a variety of forms of participatory knowledge generation and its subsequent translation into interventions and practices that improve environmental decision making and deliver benefits to communities. Four of the five LTRAs are involved in this cross-cutting activity. See the "Linking Knowledge and Action: Meeting NRM challenges in SANREM" cross-cutting research proposal.

Quality of Science

Science quality was a key feature of the charge to the EEP and thus was considered across all aspects of each project. We have evaluated scientific aspects on the basis of feasibility of the approaches, hypotheses stated, data collected, analysis of data, clear articulation of results, and potential impact of results on applied and basic aspects of the field of study. These aspects of the evaluation should be included in instructions to the project leaders by the ME in subsequent report requests.

12. Hypotheses. Use of a hypothetic-deductive framework for asking questions was almost universally weak among projects. External and self-evaluation of progress cannot be carried out if the specific questions to be asked are not clear. It became evident that most projects were not structured to pose answerable questions or testable hypotheses. The lack of the hypothesis framework gave a descriptive flavor to the data and outcomes, rather than a problem-solving approach backed by evidence. *Recommendation:* that all projects reevaluate what they are asking; how they will know when the answer has been collected, revealed, or proven; and how that can be articulated more effectively.

    Critical research questions, rigorous methods, and hypotheses are now documented in each LTRA's research strategy as recommended by the EEP. See the FY2008 Work Plan. The work plan has also which has been distributed to the TC for review and will be discussed at the next TC teleconference(s).The process of drafting these research strategies was seen as extremely valuable (although time consuming at a critical moment of the year) by most PIs.

13. Materials and methods. These need to be defined and carefully laid out by project leaders. Methods are often unknown to the lead PI, even in generalities, which was seen as a weakness. These need to be more clearly accessible to project leaders. *Recommendation:*

that each project or sub-project write up materials and methods for each experiment or activity. These will serve as the basis for subsequent scientific publications and so are highly recommended at this time. Further, these are recommended to be internally reviewed among scientists on various subprojects to facilitate communication and self-exploration of the projects

Materials and methods are now documented in each LTRA's research strategy and FY2008 work plan as recommended by the EEP. Of course not all sciences structure their research methodologies with reference to "materials and methods". Often sample and survey design issues predominate. Furthermore, we have been confronting the issue of how to do systems science (particularly for complex adaptive systems) apply single hypotheses when our primary interest is in documenting interaction effects under variations states/conditions. These research strategies have been distributed to the TC for review and will be discussed at the next TC teleconference(s).

14. Models. In general, the EEP perceived too heavy a reliance on quantitative models, e.g., watershed models, SWAT, econometric models, climate models, GIS, and not enough on conceptual models under which the ability to link different aspects of the project would be clearer. The idea of conceptual models has been addressed in other section of the EEP review; it is the specific link to scientific results emphasized here. *Recommendation:* Instead of reliance on only the models, we suggest asking more direct questions about where nutrients or household resources are flowing, for example. One approach might be a value chain starting at the marketer but extending backward to the field (potatoes, bees, trees, corn, cotton, etc.), and forward to the purchaser.

    Conceptual models are now documented in each LTRA's research strategy and FY2008 work plan as recommended by the EEP. They have been distributed to the TC for review and will be discussed at the next TC teleconference(s). Some conceptual models need refining.

15. Participatory process. Most projects show a strong and significant input at all levels. We perceived input from the local level to the facilitating USAID missions to NGOs to ministry officials, local scientists, and their universities. These have all had varying degrees of input to the scientific goals. In this, SANREM has largely achieved its goal. Ownership of the scientific process is a positive aspect of this activity. This input, however, does have a down side of drifting the mission and/or downgrading the science, with a greater focus on short-term problems and solutions than on long-term goals. *Recommendation:* a stronger attempt to formulate the large goals in terms of a conceptual model, which will help keep the focus on the scientific goals in addition to capitalizing on local input. Once these goals are framed so that all audiences can capture the scientific contributions, it will be easier to stay "on mark."

    Conceptual models are now documented in each LTRA's research strategy and FY2008 work plan as recommended by the EEP. They have been distributed to the TC for review and will be discussed at the next TC teleconference(s). Some conceptual models need refining.

16. Funding match to science. In some cases the amount of funding allocated to certain subprojects has been insufficient to perform the best experiments. While funding may not be sufficient for more in-depth analysis in some cases, we argue that the best solution may not be an analysis that shortcuts the best science (in some cases, inexpensive projects headed only by graduate students). *Recommendation:* Many projects have been successful in leveraging funds for new projects, and we encourage these expansions. However, more might be done with a small amount of leveraging to upgrade analysis of some of the biophysical science aspects, e.g., soil analyses.

    This is a valid observation. We have encouraged the PIs to focus on the research and research capacity building and have provided supplemental funds for 10 additional host country graduate students (studying at host country institutions) to expand SANREM research. LTRA PIs developed research proposals for each student that build on on-going SANREM research objectives that needed additional effort. Supplemental funding for cross-cutting soil quality, biotechnology (soil metagenomics) watershed management, gender, and knowledge to action research also provides additional resources to expand collaborative biophysical and other research activities across projects.

17. Balance of outcomes. We perceived that science on socioeconomic aspects of projects receives a large amount of data at a relatively low cost, (e.g., Alwang, Valdivia). This positive aspect is seen across many projects. However, the similarly small amount of money does not appear to go as far toward biophysical scientific goals unless it is leveraged with other funds (cacao, Alwang; biodiversity surveys, Travis). We would like to see the best science possible being carried out within these projects, and this may take additional linkages, (e.g., soil genome work in the Alwang project). *Recommendation:* While this is not the case for all projects, we would like to see the biophysical science designed to gain more for its financial input.

    Newly initiated cross-cutting research on soil quality, soil metagenomics, and watershed management is encouraging cross-project integration and comparative research across projects and providing funds for additional biophysical science research.

18. Service versus core science. It is recognized that only a certain kind of person will undertake a CRSP project. That person is committed and interested in communicating to the general scientific audience as well as contributing to human welfare. These investigators balance science-driven projects with human need and adventitious trials. With these externalities, a certain aspect of the science can be diluted or downgraded. *Recommendation:* It may be necessary to identify individual subprojects as direct service activities versus core science activities. An upfront identification of which is service and which is science may clarify these mixed agendas. We suggest applying the recommended conceptual model here to visualize approaches and activities.
    Agreed. We have been working with PIs to identify, and more consciously manage, relevant service activities. Service versus core science is an issue in several of the activities but particularly in LTRA-2 An Agricultural Markets Model for Biodiversity Conservation where SANREM funds were to be used primarily to assess the benefits and

costs of the COMACO conservation/development model and some funds were to be used to develop new COMACO enterprises/products (development objectives). In this particular project, it is difficult to determine whether the emphasis is on research or COMACO development and the ME is working with the PI to better articulate what the SANREM research is and what the COMACO development activities are.

19. Improve science quality in host countries. One of the obligations of the SANREM CRSP is to engage our collaborators in cutting-edge science. Greater efforts can be made in many countries to bring the science to a higher level and to involve local students and scientists more intensely in that effort — we recommend going beyond teaching seminars. Trouble-shooting might be more carefully articulated in this respect to get input from local scientists but also to engage in the scientific approach to solving problems. Bringing more interactive cutting-edge science to the host countries is critical (soil genome mapping in the Valdivia project, for example. The Valdivia and Alwang projects may wish to collaborate on this).

    Agreed. New host country graduate student support and cross-cutting research initiatives were developed partially in response to this suggestion. All of the host country graduate student support and the majority of the cross-cutting research initiatives funding is going to host country institutions. These activities will engage host country scientists across projects and countries and contribute to building host country research capabilities.

20. Literature reviews, background. We found substantial gaps in knowledge about previous research in many projects. Some of these gaps led to investigators walking a well-worn path when innovation could have been made; other instances of gaps seemed to contribute to continued data taking when trouble-shooting should have been going on. In this respect, certain community response values dictated research much more than literature and background information, which may have contributed to the well-worn path (e.g. Valdivia, Alwang). *Recommendation:* Literature reviews should be performed and results communicated to participants at regular meetings. Open a discussion of biophysical versus social approaches.

    We agree with the importance of literature reviews and there use in defining the research problems and approaches. PI's are aware of this recommendation. The ME will assess this during this year's LTRA assessment activities/trips. In particular, the ME will review individual LTRA web sites to assess the extent of literature reviews and intra-activity information exchange.

21. Self-reflection and evaluation. We noted persistent claims that objectives and timetables were being met, and results were being produced. However, on careful interpretation and closer questioning, we discovered that these claims were not always entirely fulfilled. In some cases, problems were acknowledged, but the in-depth questions about why the problem was occurring were not being posed. In other cases, the real connection between a subproject and any of the stated project goals was not clear. *Recommendation:* Institute more effective means of self-evaluation, which might be implemented through more

active scientific management by the PI. This is not to deny the application of resources to ancillary projects but to make those projects more integrated into the whole (cacao, Alwang; global modeling, Valdivia).

This continues to be a problem as evidenced by the "Obstacles encountered and corrective responses taken" sections of this year's annual reports. The ME is providing PIs feedback to insure that PI assessments are realistic and to encourage them to address obstacles encountered.

22. Scientific publications. Quite simply, we perceived that there were not enough publications on the way. *Recommendation:* Without the hypotheses more clearly stated (see above), it was hard for the EEP to visualize individual publications to come. Though the project is only halfway to completion, there should be clear indications of which papers will address which topics, and how (and where!) they might be published.

    PIs were asked to identify potential publications for different research efforts. This will be included in individual LTRA research strategies.

Collaboration

SANREM projects demonstrate good effort to build collaborative relationships among faculty and staff of U.S. universities, researchers in USAID-assisted countries, members of local communities, NGOs, and the private sector. Responsibilities for project activities are well distributed among these collaborators. A strength of the SANREM CRSP is that it has brought these collaborators together and that they show commitment, or "buy-in," to the program

A further strength of SANREM is that it facilitates collaboration across boundaries of nationality, culture, scientific discipline, profession (e.g., public, nonprofit, for-profit, academic sectors), and levels of operation from the field, farm, and forest to the highest tiers of formal institutions. In many cases this is the first time for such disparate parts of the larger agricultural, natural resource, and environmental community to get to know one another.

23. Better communication is needed within projects so that people in all parts of each project know about the work of others and how it all fits together. In some cases, particularly remote participants in the project are flying blind without good guidance or perspective on the entire project. In some cases the responsibilities of project staff may not be reasonably assigned.

    The development of the research strategies and experimental designs helped bring teams closer together. In projects where this appeared to be a problem, particularly the SE Asia project, the PIs seem to be making efforts to improve communications and have included improved communications (regional meetings and teleconferences in their work plans)..

24. This phase of SANREM is doing a good job of acquainting the staff of each of the five main projects with one another and their respective objectives. But here also, more and better inter-project communication is needed. SANREM project leaders need not only to

communicate with participants at the community level and to staff throughout their projects, but also to listen. Each project presents participatory activity, but in some cases it appeared that these local participants simply may have been present or given tasks. There was limited evidence that in-country partners are being listened to.

We do not know the extent to which this is a problem. The TC host country representative recently requested permission from the TC to communicate directly with all host country partners so that she could better represent their issues and concerns at TC meetings. This suggestion was not viewed favorably by all PIs, some of whom wanted all communications to their partners to pass through them so as to not confuse their partners. The ME feels that if we have a TC host country representative, they should represent all the host country partners and if so, they need to be able to communicate with the partners This issue will be raised with the Board and at the next TC meeting. The ME will try to assess the extent and quality of intra-activity communications and partner involvement during individual LTRA assessments during site visits.

25. It is important not only that there be a clear conceptual framework of the work of each project, but also that this framework be understood by all participants in the project. Even for those projects that successfully articulate a conceptual model of their work in project documents, it is not clear that they have imparted this model to in-country participants, or that in-country researchers have participated in its development. A key responsibility in SANREM collaboration is to formulate and thoroughly communicate common conceptual models to project participants and external groups.

    The ME and TC will encourage PIs to continue refining their conceptual research models in collaboration with their host country partners. The ME will assess in individual LTRA assessments during site visits.

26. It is observed that some researchers may be into their hobbies, unrelated to their respective projects. Regardless of scientific merit, effort that does not contribute to the project in a collaborative way with other researchers, or within the context of the conceptual model, detracts from the project.

    There are several activities that the ME has followed up on with the PIs. Specifically these include the AVRDC work in Taiwan, the cacao work in Ecuador and some of the Zambia development activities, which do not seem to have follow-up research components. PIs are being asked to justify why SANREM funding should go to these activities and the activities place in the research model and/or consider terminating the activities.

<u>Capacity Building</u>

27. There is not a clear concept across SANREM of what constitutes capacity building. The meaning of the phrase in SANREM needs to be reviewed, defined, and promoted, with consideration of SANREM's responsibility to teach interdisciplinary, problem-solving,

and holistic thinking. The participatory approach should be discussed in this context, and how participation is linked to capacity building.

The ME had not considered this to be an issue or problem. We recognize that capacity building involves more than listing the number of training activities conducted and that we probably need a more systematic way of defining, enhancing, and reporting host country research capacity building activities, particularly activities that engage host country partners in research design and analysis and as a consequence strengthen their research capabilities.

28. SANREM researchers are purposely engaged in the interdisciplinary conduct of science. One essential objective is to build the capacity for interdisciplinary science and to leave behind, in each country where SANREM is engaged, the science capacity to carry on the work that was begun under the project. A test of the success of each project will be whether it has left behind the capacity required to continually solve emerging problems like those approached by the respective SANREM projects.

    Agreed, we are working toward this objective.

29. There is a likely learning curve in working across disciplines for PIs as well as the other team members. Common sampling frames among all researchers in each project are the essential feature of interdisciplinary research. SANREM researchers still need to work at it. A SANREM project cannot be judged successful until effective interdisciplinary research is conducted among U.S. researchers and imparted as a practice among host country partners.

    Agreed. We are striving to promote these interdisciplinary data sets and research methodologies.

30. The selection of students for academic training and their venues of training need to be reviewed to assure the strong likelihood of contributing to the scientific capacity of the SANREM project in host countries. Academic training within the United States, within the regions of research, and within the host country — as well as the nationalities of the students — all need to be considered.

    Academic training of host country graduate students and scientists in the US is a high priority but because of the expense, increased emphasis is being placed on supporting and integrating host country graduate students into SANREM research activities in the host countries. We can fund 5 to 10 host country graduate students in country for the cost of educating one foreign national in the US. The new host country graduate student support and cross-cutting research initiatives were developed partially to engage more host country students in SANREM research activities. These students should all have US and host country advisors and it is hoped that the US advisors will be actively engaged in their research and educational programs.

31. Farmers, forest users, and community members need to be trained in non-degree programs. Holistic thinking and problem-solving need to be emphasized among these research participants so that they may continue the work of SANREM in their communities and for their own benefit. A major contribution of this project should be on-the-ground capacity building among farmers and forest users.

    We believe that this is being accomplished through the participatory research methodologies being employed by all the LTRAs and these activities are documented via non-degree training reports each year. See the FY2007 annual report for non-degree training activities in FY2007.

32. The participatory approach is not complete until the conceptual models for SANREM research have been imparted to community participants. Farmers and forest users must be empowered through their participation to understand how they may identify the problems before them; and to assert their rights and abilities to solve them.

    See response to item 25.

Strengths, Weaknesses

33. The structure of reporting could be improved so that the EEP can do its evaluations more efficiently (see the Objectives section, above). The ME seems to be managing projects to show impacts rather than science. There is too much emphasis on productivity indicators that are the goals of USAID. The ME should encourage more comprehensive reporting. There needs to be emphasis on research outputs and milestones, as well as activity indicators (impacts). Specifically, the management of science quality needs milestones and defined outputs based on scientific and participatory experiments and interactions.

    These suggestions are being addressed via the new SANREM annual reporting and work plan requirements. Semi-annual reporting requirements will be modified similarly. For example, in the semi-annual reports, PI will be asked to describe updates/changes in their experimental methods and hypotheses as well as report on significant research accomplishments.

Recommendations

34. The continued development of instruments to extract cross-cutting public good from the research projects. Those should include knowledge related to soils, water, biodiversity and ecosystem services, governance, institutions, and gender.

    As mentioned previously, we have initiated new cross-cutting activities with approximately $500,000 in funding in soil quality, water, gender, and knowledge to action. We have additional cross-cutting activities in the areas of biodiversity and ecosystem services, governance, and institutional capacity building that are being funded with internal LTRA funds.

35. The development of a mechanism for learning from sister SANREM program experiences, including an analytical paper (series) on what worked and what did not, and how local institutions were recruited and integrated into the SANREM program.

    The SANREM web site has working papers and research brief areas (http://www.oired.vt.edu/sanremcrsp/menu_information/working_papers.php and http://www.oired.vt.edu/sanremcrsp/menu_information/researchbriefs.php) on its web site where experiences and research findings are disseminated. Working papers and research briefs are also highlighted in the quarterly SANREM newsletter so partners will be aware of new publications.

36. Each project should continually reassess its activities in the research-extension continuum within TOP and clearly identify the range of research activities where U.S. universities have their greatest contribution to make. This should result in a planned balance between fundamental and applied research, and in the articulation of a philosophy and strategies for scaling and outreach of integrated systems and their technologies.

    We agree. The newly created Knowledge to Action cross-cutting activity will hopefully better articulate SANREM philosophy and strategies for this.

37. More preparatory work should be done to establish an agreed upon integrated framework of objectives leading to hypotheses, with output and deliverable due dates becoming project milestones. Clearly identified knowledge gaps could then be filled where possible from associated research. A set of deliverables corresponding to the SANREM core funding should be identified, as well as additional desired deliverables subject to more funding through the many leveraging channels.

    We believe that we are addressing this via our new reporting and work plan requirements. We are also planning a strategic planning exercise later in the year with SANREM partners and other invited participants to identify knowledge gaps/research priorities that will be addressed during phase IV of SANREM (assuming we are renewed) via SANREM competitive grants program.

38. The relationship between PIs and their respective researchers needs attention. The ME may need to make clear to all researchers that projects need leadership and "followership." Despite differences in disciplines or seniority between PIs and their colleagues, the PI needs to lead the research. PIs and researchers need to agree on what outputs are needed, and when. Milestones for each researcher's work need to be set and met. PIs are not simply facilitators, they must exert leadership. The ME needs to support PIs in their leadership roles.

    We believe that as a result of the EEP Interim Report and ME feedback, some PIs are aware that they were not providing adequate leadership and oversight over some program elements. The ME will continue to work with these PIs to encourage them to be aware of and provide leadership over all of their funded activities. In some cases, the ME will assist the PIs in providing leadership as needed.

39. As mentioned in the Collaborations section, above, better communication is needed so that people in all parts of each project know about the work of others and how it all fits together. Also, more and better inter-project communication is needed.

    LTRAs that were viewed as having problems in this area have proposed corrective actions to improve communications between co-PIs and partners, particularly the SE Asia project. The ME will assess these efforts and improvements in our site visits this year.

40. One essential objective is to build the capacity to conduct interdisciplinary science and, as mentioned above, to leave behind the capacity to carry on work begun under SANREM projects. The selection of students for academic training and their venues of training need to be reviewed to assure the strong likelihood of contributing to the scientific capacity of SANREM host countries. Graduate education should be done by exposure to cutting-edge science.

    The ME agrees and is encouraging LTRAs to maintain host country research capacity building as a priority. Additional funds have been allocated for host country graduate student support and involvement in SANREM research activities.

41. Considering the complexity of this type of research program — serving the interfaces of agriculture, people, and the environment — the EEP recommends to extend the program beyond the five years' research of the first phase, particularly for those projects where the promotion of sustainable institutional change and policy modifications on the basis of the research have a realistic chance of being realized.

    The ME certainly agrees with this and believes that some projects need to be extended to realize their potential research impacts. If we are renewed, we plan to identify research priorities by the end of this fiscal year and release new RFAs for phase IV funding early in FY2009 so that the new research program is in place at the start of phase IV. Existing projects will be encouraged to compete for phase IV funding.

42. There may be merit in reorganizing the reporting on these projects. The reporting under categories of objectives seems not to be sufficient. As the projects develop a conceptual framework they might report in a more functional fashion using these frameworks. Specifically, the conceptual model of the project should comprise the objectives, hypotheses, activities, research protocol, and capacity building. It might be useful to report using the model components as a framework.

    We have modified our reporting requirements (see changes in FY2007 annual report) and we will continue to do so as needed to allow improved program review and dissemination of program results and impacts.

Final EEP Assessment of LTRA Program

The EEP is very impressed with the very careful attention that the ME made to the suggestions and recommendation for the overall LTRA Program. They very systematically addressed all of the questions raised. It was also obvious from the 2007 Annual Report and the 2008 Work Plans that considerable effort was made by the ME to communicate with the P.I.'s of the individual LTRA's concerning these recommendations. The three very important areas where this was most evident were: 1) better definition and documentation of their research strategies, conceptual models, scientific designs, research and experimental methods, 2) better specification of outputs and delivery dates by objective, and 3) inclusion of critical research questions, rigorous methods, and hypothesis are documented. It is obvious that members of the ME have developed a very supportive and collegial relation with the LTRA research staff that permits this type of needed communication.

Other SANREM CRSP Activities

Bridging Grants Program

The Bridging Grants program was designed to capture some of the low-hanging but late-ripening fruits from the SANREM II program. According to the original proposal, such bridging grants were to:

- be follow-on transfer activities, policy, or impact studies
- that add value to previous accomplishment of the CRSP

A call went out to former PIs and Co-PIs to develop short (5 page) proposals for up to 18 months and $100,000, with rather clear indications of the desired areas of inquiry and selection criteria. Proposals were to be submitted by late November 2004 approximate inception for January 1, 2005. Twelve proposals were received and these were reviewed by the Technical Committee. Based on the recommendations of the Technical Committee, the following four were awarded funding:

1. Analysis required for payment of watershed environmental services (Ohio State University) – 18 months, $ 97,634
   D. Southgate, T. Haab and F. Rodriguez

   This was a concise and very clear proposal building on some environmental economics work that had been undertaken in the later part of SANREM II in Ecuador. The PIs proposed to look at the willingness to pay (WTP) of downstream water consumers and willingness to accept (WTA) by the watershed users as two components of contingent valuation (CV). The idea would be that farmers would reduce the intensity of land use in the upper watershed against payments and thus protect water quality. The watershed and small water-user town were identified *a priori*. The project involved 4 activities:
   - Survey in town for WTP analysis (one paper)
   - Survey in watershed for WTA analysis (one paper)
   - Biophysical assessment of the watershed
   - Design of legal alternative payment schemes by local lawyers

   The proposal is convincing, the implementation less so. Of the four activities, the final report only covers the WTA survey. The inability to conduct the WTP survey in the Ecuadorian watershed environmental services project was discussed with the Management Entity. At that point in the project (approximately 6 months after project inception), it was not possible to redesign the project in an alternative setting. It was agreed that since the survey could not be conducted it was not of great value to proceed with the biophysical assessment of the watershed (which supposedly required half of the requested funds). Consequently, the objectives of the project shifted and the costs were reallocated to conducting the workshop. The legal alternative payment subcontract was changed to an assessment of laws and regulations, bearing on PES, possibly because the schemes that were to be designed would have required the completion of the biophysical

assessment. The portion of the proposal that was implemented seems to have been done competently, but the study missed its mark considerably. The study produced one peer reviewed paper (WTA) and conducted a well attended workshop. However, it remains unclear what value was added to SANREM II.

2. Sustainable land use and biodiversity conservation in the Andes: Scaling-up SANREM-Andes research (University of Georgia)
   R. Rhoades, V. Nazarea – 18 months, 100,000 US$

   This proposal covered a lot of ground with three objectives in LUC, Biodiversity and the Knowledge base area. The proposal is not easy to follow and would seem over-ambitious at first glance. However, as an outsider, one cannot assess the degree to which the proposed activities were ongoing. At any rate, all promised products seem rather useful, particularly the complete documentation of the work done in this project in Phase II using Toolbook.

   The final report is brief, and claims that all the objectives were met. CDs, books, book chapters and papers, videos and workshops were delivered. Only part of this is truly documented, but the plausibility is high, based on some of the narrative offered. The formal training component fell short of its mark (only one student was supported). In all, it appears that this project gave good value for money.

3. Metadata development for the SANREM Knowledge Base (SKB)
   C. Heatwole, E. Yagow, B. Benham and M. Merrill. – 18 months, 85,000 US$

   This is a straightforward project that makes a lot of sense. The development of a meta-database with good entry slots and quality information on what is in the database is the best way to store data for future use and reference. The PIs make a strong team, but make it clear from the onset that they depend on the Management Entity (ME) to be successful. Rather than designing from scratch, the project used an existing framework to develop their unique template. The work is a clear bridging activity, divided in 3 objectives:
   - Develop a stable metadata template
   - Catalogue digital and print resources of previous SANREM projects
   - Develop a manual for users

   In the final report (2 pages) it is claimed that all the objectives were met and that, after some corrections, a stable template was developed. Outputs from previous projects were catalogued (400 entries), a manual was prepared. This all seems on target. All materials that could be accessed were included in the SKB. Unfortunately, models and datasets were never made available to the ME or to the SKB team by the SANREM CRSP Phase II ME. In fact, most of the resources that were available were obtained from the SANREM CRSP II website before it was brought down or in paper form from the ME of Phase II. However, it is disappointing to see that all the material catalogued is printed material and no models or datasets, as was expected from the proposal. Also the fact that only 6 dissertations are covered appears short of full coverage of SANREM 1 and 2. The charm of a meta-database would be that it offers insights into the primary data that were

collected in projects and their possible accessibility to outsiders. It is unclear whether SKB can now fulfill this function, and if not, its value is limited. Also, it is unclear whether the promised output of "process documentation" in developing the meta-database was ever produced. It might have shed light on what it can and cannot do. The proposal mentioned a graduate student, but a student per se was not hired, instead these resources were used to support graduate and undergraduate students working on the project. Interestingly, this project seems to have had no contact with the two other bridging projects that both claim to have prepared their data for transfer to SANREM III (Project 2 and 4). Without further information it is hard to judge the success of a well conceived bridging project.

4. Globalization, agricultural growth and the environment: consolidation and continuity of SANREM research in Southeast Asia.
   I. Coxhead and G. Shively. 18 months, 100,000 US$

   This is a piece-meal proposal that aims to do some policy work on the coffee crisis of Vietnam, do some LU work in a watershed in Vietnam and get some of the work done in the Philippines out in a book. The only real bridging work is the development of a meta-database for submission to SANREM III. The key argument in the proposal is the need for some extra field work for the tailoring of a national-scale economy-environment predictive model that will help policymakers in deciding on land use. Some students from Vietnam (one from India) would be involved and trained in the process.

   The final report places emphasis on a completely new activity related to aquaculture. The field work that was undertaken as river basin work may have been meant to be on this topic all along, but it was well hidden in the proposal. As such, it is unclear how it bridged SANREM II and III. Also, some work was done on cross-country comparison of small-holder coffee production that was not clearly identified in the proposal. The promised output of a national-scale economy-environment predictive model appears to have been built as a prototype and validated, but to get to use it for the policy analysis, another bridging fund would have been necessary. Another output, a book on some of the research findings from the Philippines was not published yet at the end of the contract period, but was moving along, and was scheduled for end 2006. The book is nearly finished and the authors expect it to be published in 2008. The meta-database was indeed produced. Two Vietnamese students were in residence. Some papers appeared in books and in proceedings. The anticipated policy working papers and policy briefs were not in the publication list. However, the aquaculture work was effectively used to obtain a new research grant from the Ford Foundation. In all, the PIs were productive, but not very effective in delivering the promised products.

   Overall, the interpretation of the concept of bridging funding may have been quite different for different PIs. Since we have no access to the unsuccessful proposals, it is difficult to make founded judgments. However, from reading the successful grant reports, there remains a question of whether some the bridging funds were rewarded to those projects that had failed to meet their objectives in Phase II. This cannot be assessed without going into the original Phase II proposals. Given the rather limited funding of

each project, the expectations should probably not have been too high. The very brief final reports may be part of the reason that the overall impression is one of medium quality work. It is questionable whether this format of bridging is worth repeating in this form. Particularly the project components requiring collection of new primary data seem to have missed their target. If this exercise were to be repeated it might be better to use a targeted commissioning process rather than a competitive bidding process to capture some of outcomes that were emergent.

Planning Grants Program

The SANREM CRSP was designed to support Sustainable Agriculture (SA) and Natural Resource Management (NRM) through collaborative research between US universities, NGO partners, developing country institutions, and USAID missions. The objectives of the SANREM CRSP are to:

1. Increase scientific knowledge and technical innovations in SA and NRM;
2. Improve knowledge management, education and communication leading to behavioral changes in adaptation and adoption of new SA and NRM technologies and practices;
3. Reform and strengthen SA and NRM governance, policies, and local institutions; and,
4. Promote the functioning of sustainable resource-based enterprises in national, regional, and global markets.

The SANREM CRSP planning award RFAs were issued on July 1, 2005 and the applications were due Feb. 23, 2005. The goals of these awards were:

1. To develop multidisciplinary, multidimensional applications by providing funding for travel and other support needed to address development objectives in a participatory manner.
2. To provide funds to institutions and teams that had not been engaged previously in international development research.
3. To ensure consultation with USAID missions.

From the SANREM website: The SANREM CRSP received 74 Planning Award Applications from 37 U.S. universities to address critical sustainable agriculture and natural resource management issues. Eighteen Planning Awards from 11 lead U.S. universities were selected for funding by the SANREM CRSP Planning Award External Review Panel. The Planning Awards involved activities in 27 developing countries and culminated in the development of Long-Term Research Award applications. Five LTRAs were subsequently funded from Jan. 1, 2006, to Sept. 30, 2009. Four of the five received a Planning Award.

Planning Award Program Evaluation Criteria and Evaluation:

1. **Did the planning awards process result in high-quality LTRA applications?**
   Clearly, the planning awards did place the awardees in an advantageous position relative to others as 4 of the 5 long-term awards were obtained by those who also received planning awards. The advantage may in part be due to the fact that the format for the planning grant is basically the same as that as for the long-term grants except for in a few notable ways. It is shorter, and does not include the TOP framework. Further, the planning grant application

clearly states that the application must include a "partnering plan" which asks what US institutions, host country organizations, IARCs, NGOs, etc will the project link to. This latter requirement of the planning grant may have placed those applications in a slightly more favorable position relative to the other long-term applications because they would have specifically addressed this partnering component. Several of the LTRA proposals the EEP reviewed did not have the partnership component well developed. This occurred in spite of the fact that in the evaluation criteria "participatory partnership" was a criterion for success.

2. **Was the application process sufficiently flexible to obtain creative and viable project proposals?**
   The 18 planning proposals which were submitted covered all of the priority inquiry areas (technology integration; governance; economic policy and enterprise development; social and institutional capacity building; biodiversity conservation and environmental services; systems linkages; globalization, vulnerability and risk) either as a primary goal or within succeeding goals. However, the last two were perhaps addressed least often. Further, the planning grants covered the regions of Africa, Central and South America, the Caribbean, East, Southeast and Central Asia, and Eastern Europe with the overwhelming number of sites in Africa and South America. Thus, it seems from the breath of themes and from the breath of sites, that the application process was flexible enough to engage a variety of topics that all fit within the systems framework.

   It would have been useful to have each proposal explicitly state in the abstract (or perhaps in the key words) which of the priority areas are to be addressed.

4. **Did the highly detailed RFA result in projects with the diversity of project components requested?**
   Whereas the various components (that is, the priority inquiry areas) were addressed in the planning grants, the components were not always placed in a systems approach even though the RFA explicitly states that "the research problem statement must be formulated within the context of one or more of the highest level sub-systems (e.g., ecosystem, governance/policy and watershed). Further, the required linkage of the research problem to the field or farm/enterprise was not made explicit in several cases.

   Perhaps a way to make sure a systems approach is in fact used is to place its importance in the Scientific Merit of the Evaluation Criteria.

   Having said this, there was much diversity in the awarded projects.

5. **Could the process be more efficiently organized to achieve the targeted multiplicity of project objectives? Should the objectives be more narrowly focused?**
   As SANREM has increased complexity into the formulation of what it means to have SA and NRM, it has taken a systems approach. This is highly commended and the systems framework is in fact one of the only ways to introduce the requisite complexity into problem solving. The conceptual model of the systems approach and the priority inquiry areas do provide the needed breath of components to understand SA and NRM in a holistic way. Therefore the objectives should remain broad so that each team of researchers can place its

problem and attendant hypotheses or questions to be answered by the research, within the broad context of a systems framework. This is always a bit messy but absolutely needed to solve complex problems. Whereas the list of components of the application is clear, it seems that some groups chose not to adhere to the application guidelines, but many did.

The process seems sound and the objectives adequately broad.

6. **Did the Planning Awards process facilitate improved communications and involvement by USAID missions in the development of the LTRA applications?**
   One measure of this criterion is that in the evaluation of LTRA proposals, those who did not communicate with USAID were not given high marks. Further, each funded LTRA proposal discussed how their research linked to Mission objectives in their relative countries. In two proposals (LTRA 1 and 5) there were explicit statements about meeting with USAID Mission people in their countries.

7. **Did the Planning Awards process help research teams or PIs with limited international development research experience develop competitive LTRA applications?**
   It appears that all LTRA funded projects benefited from prior experience in international research. As has been stated in the supporting documents, it is not everyone that the CRSP attracts as it requires someone interested in science, working with local USAID missions, ICARs and NGOs and applying the science to improve the livelihoods of people. This requires a special type of person. Thus it is not surprising that novices are not attracted to this type of competition.

8. **What were the strengths and weaknesses of the Planning Awards Program?**
   Perhaps the most important strength of the program is that it gives applicants time to put together a holistic proposal for the long-term grants. Since the application pieces are essentially the same, it provides a template and time to assemble the team and partners for a long term research endeavor. The only question here may be, is 7 weeks long enough to write an excellent proposal? More lead time might be considered. Given the current proposal structure, this process seems to have been successful. However, the EEP suggests that in the future the selection process needs to be reviewed and in this process determine what would be the most efficient use of these funds to strengthen the quality and coherence of the overall program.

Knowledge Dissemination Activities

SANREM has a comprehensive Knowledge and Information System (KIS) to disseminate sustainable agriculture (SA) and natural resource management (NRM) knowledge generated from both SANREM activities and other SA and NRM activities. The KIS is effective in making this information accessible to researchers and policy makers. The presentation of the knowledge base through various websites is comprehensive, attractive and well-communicated. The summary of these sources is repeated below, as taken from SANREM materials.

1. SANREM website and associated knowledge and information system resources are available at: http://www.oired.vt.edu/sanremcrsp/
2. SANREM Knowledge Base (SKB) cataloging all SANREM CRSP products and other key SA and NRM information resources (http://www.oired.vt.edu/sanremcrsp/menu_information/knowledgebase.php)
3. SANREM CRSP publications: books, newsletters, reports, research briefs, and working papers http://www.oired.vt.edu/sanremcrsp/menu_information/publications.php
4. Draft SANREM Landscape Systems book (https://secure.hosting.vt.edu/www.oired.vt.edu/sanremcrsp/team_PI/system-book.php

The goal of the SANREM Knowledge and Information System to make sustainable agriculture and natural resources management information products and technologies available to current and potential stakeholders through "website and its knowledge resources, an electronic newsletter, the SANREM CRSP listserv, and print resources" is being met. The system meets most criteria suggested for its evaluation.

Trial searches of material related to SANREM topics generally turned up useful resources relevant the topic in question. In region-specific searches, Latin America was less-well covered, Asia in-between, and Africa best covered. There was extreme variability, as would be expected, on country-specific searches. Water questions show twice as many references as soil. Atmospheric sciences were surprisingly well covered. As a matter of curiosity, a search of "environment" yielded 785 references; Agriculture, 392; Natural Resources Management, 237; and Sustainability, 177. One concludes that a serious research on a SANREM topic would be well-served by starting with the SKB.

The SANREM Landscape Systems book is well-focused, organized and apparently nearly complete. It is a comprehensive reference that gives guidance on the need and methods for understanding and responding to the continually changing qualities and relationships of natural resources and the means of human livelihood.

Any weakness of the system, lies in the question of whether "the developed knowledge is being accessed and used." The SANREM Knowledge Base (SKB) is there for users to find and utilize. It is not a pro-active system that seeks potential users. It may be useful for SANREM management to initiate a system of periodic press releases, reporting new and interesting findings, occasionally responding to news of current interest, e.g. the award of the Noble Peace Prize for work on global climate change.

It is particularly remarkable that USAID RFPs, make no mention of SANREM as a recommended resource for bidders on USAID projects related to sustainable agriculture and natural resources. For example, the Afghanistan Agriculture and Water Technology Transfer RFP, which heavily emphasizes the development of land and water policy, does not mention SANREM as a resource. Perhaps it is too early, but maybe it should be a goal for SANREM to be cited in relevant USAID RFPs.

It is strongly suggested that consideration be given to proactive steps to attract users to SANREM resources, in order to increase the return on the investment that USAID and SANREM staff are making in the SKB.

Cross-Cutting Activities

When the SANREM CRSP EEP selected the LTRAs recommended for funding in November 2005, they noted common themes in many of the activities and recommended developing these themes as cross-cutting activities. The themes recommended by the EEP and supported by the ME included:

- Landscape Systems Approach
- Biodiversity Conservation and ecosystem services
- Governance and Policy
- Water Management
- Soil Quality
- Watershed Management
- Gender

At the April 2006 Annual Meeting of SANREM, the ME proposed to the LTRA PIs, that SANREM initiate cross project activities for each of the above themes and recommended specific PIs to lead each theme. While the PIs agreed that the cross-cutting themes were important, they were not supportive of initiating any new activities when the LTRAs were just beginning and particularly without additional funding. The one cross-cutting theme that they did support involved watershed modeling and assessment and they recommended that the ME find funding for a pilot activity in this area. To test the concept, the ME supplied Conrad Heatwole, a water resources engineer at Virginia Tech, with a small amount of money to do a pilot study and prepare a proposal for TC consideration. For the pilot study, Dr. Heatwole worked with LTRA-2 An Agricultural Markets Model for Biodiversity Conservation (Zambia) to assess the use of remote sensing and watershed modeling in evaluating the effects of proposed alternative land management systems on water quality and water resources at the watershed scale. He did the pilot work in Zambia and then prepared a report and proposal for the TC, which recommended funding with uncommitted competitive grants funds. Dr. Heatwole was provided $70,000 to coordinate the cross-cutting watershed modeling and assessment activity.

In September 2007, SANREM learned that it would be fully funded in FY2008 plus additional funds were provided to make up for cuts during years 1 to 3. As a consequence of these additional core funds from USAID/EGAT, the SANREM TC initiated five cross-cutting research activities in the areas described below. Most of the research activities of these projects are additions to the original LTRA proposals and are applicable to a majority of the LTRAs.

Watershed Modeling and Assessment

The goal of this activity is to enhance the impact of the SANREM CRSP Long-Term Research (LTR) activities by providing technical support and a cross-cutting focus in watershed modeling and assessment. Two decision-making tools for planning, managing, and assessing impacts of

SA/NRM at field and watershed scales will be used: high-resolution (sub-meter) multispectral satellite imagery, and biophysical models of watershed hydrology and water quality. The intent is to assist and support current LTRA personnel in achieving and enhancing their project objectives, while benefiting from and examining cross-cutting issues. The objectives of the project are:

1. Support natural resource management at a watershed and policy analysis scale by documenting landscape condition, quantifying natural resources, and defining land cover and land use change using geospatial imagery and analysis.
2. Assess impacts of land use practices and climate change on agricultural sustainability and natural resource management at a watershed scale.
3. Design and implement low-cost community-based watershed monitoring program.

Assessing and Managing Soil Quality

Current SANREM CRSP long-term research activities address multiple agricultural and natural resource issues under diverse environmental, climatic and socioeconomic conditions. A common theme among many of the projects is characterization of soil degradation that results from both natural and human-induced factors, and assessment of changes in soil quality due to the introduction of improved soil management practices.

The intent of this proposal is to enhance and strengthen ongoing soil science-related project activities and initiate new cross-cutting research that utilizes the unique opportunity of the SANREM CRSP to examine common soil quality issues across a wide range of climates, cropping systems and socio-economic conditions. The proposed project will also integrate its activities with other proposed SANREM cross-cutting and biotechnology projects, including the projects on soil metagenomics, watershed modeling and assessment, and gender issues. The objectives of this project are:

1. Assess community perceptions and indicators of soil quality, including differences in perceptions of soil quality due to gender, environment and socio-economic factors.
2. Conduct a literature review of soil quality assessment techniques and identify practical but scientifically sound techniques that would be appropriate to evaluate soil quality across SANREM activities.
3. Determine the efficacy of spectroscopic-based (i.e. near-infrared, mid-infrared, and visible range) analytical methods to evaluate soil organic matter fractions and soil quality in degraded and non-degraded soils in a wide range of environments represented by the SANREM CRSP projects.
4. To collaborate in the evaluation of soil metagenomic methods as an indicator of soil degradation.

Biotechnology: Soil Metagenomics

One of the most exciting outcomes of the biotechnology revolution in genomics is our ability to characterize soil microbial communities with much greater coverage. The research group at Kansas State University has developed techniques to add molecular tags and simultaneously

process many tagged replicate soil samples. This allows them to compare soil microbial communities in carefully-designed replicated experiments.

SANREM provides a unique social science context for studying human impacts on soil degradation. In the recent SANREM review, the EEP recommended inclusion of soil metagenomics approaches in the SANREM portfolio. Ultimately more complete profiles of soil communities will also contribute to the development of methods to foster disease-suppressive soils and soil communities that optimize for other microbes contributing to plant health and productivity, such as mycorrhizal fungi and rhizobia. The objectives of this project are:

1. Characterize soil microbial communities from soils representing a range of levels of degradation.
2. Identify microbial taxa that are indicators for levels of degradation, especially those that may indicate the process of degradation has begun but is still reversible.
3. Link soil community structure to both the general soil biophysical context and the social science context in order to understand human impacts and drivers of human decision-making for soil management.

Linking Knowledge and Action

The potential for research to provide short and long term improvements in environmental sustainability and rural welfare are widely recognized. Yet there is a huge imbalance between the generation of knowledge and its subsequent translation into interventions and practices that improve environmental decision making and deliver benefits to communities.

While the uptake of research findings can occur through a range of formal and informal processes, effective implementation requires the use of systematic and strategic approaches. Knowledge-action systems, developed at national and international levels, are organized to harness science and technology in support of diverse social goals. They include the set of relationships, actors, institutions, and organizations that set priorities, mobilize funds, do the R&D, review publications/promotions, facilitate practical application and reinvention, and provide evaluative feedback on performance. Importantly, they evolve through time as a result of multiple and only partially integrated interventions.

The diverse resource management problems, resource settings, and variety of strategies used by individual SANREM CRSP research projects provide a rich set of cases to explore the relationships between knowledge generation and policy practice. Each of the projects was designed with the intention of linking knowledge to action through use of the SANREM Targeting Outcomes of Programs (TOP) Framework to develop the original research proposals. This participatory process provides a solid foundation for exploring the conditions under which research knowledge can influence the practice and behavior of policy makers, practitioners and resource users, and for formulating strategies to use, disseminate and implement research findings. Results from this cross-cutting initiative will also provide useful inputs into the evaluation of SANREM project's overall impacts as we will have collected information that can allow us to assess the degree to which observed changes are attributable to the projects.

Gender

SANREM CRSP promotes stakeholder empowerment and improved livelihoods through knowledge - based sustainable agriculture and natural resource management systems. The SANREM CRSP landscape systems approach demonstrates how linkages between gender, biophysical, technology, governance, economic, social, environmental, and globalization factors can be used to achieve sustainable development. Access to both natural resources and markets is gendered, and gender mediates the distribution of benefits between individuals and within households in given communities. Studies show that women's control of economic resources impacts on their bargaining position, and on investments in human capital through schooling and food investments. At the same time, research that ignores women's priorities, contributions, and spaces results in incomplete and faulty research results.

As markets emerge and change, producers are grouping together to improve their access to resources and support sustainable livelihoods. This project aims to compare how gendered networks and coalitions affect the ability of groups to access and control natural resources and to access appropriate markets and capture value for their agricultural and forest products. It will allow us to better understand how farmers and foresters manage resources and link to markets, what types of network characteristics contribute to securing sustainable livelihoods, and under what conditions these characteristics are most effective. It will significantly contribute to SANREM CRSP's ability to move knowledge to action and bring to light opportunities to benefit women during the current and future phase of the CRSP. Dissemination of findings through publications and policy briefs will aim to influence government policies and NGO partner programs to promote gender equity in sustainable development and livelihoods. A cross-cutting approach in different social and geographic contexts provides opportunities for collaborative and comparative efforts that build on existing research in four LTRAs.

Research questions (*to be refined after further discussion among LTRAs)*

1. How is access to markets for sustainable agriculture or natural resource products gendered?
    a) What products do women sell? Men sell? Are these products they produce or purchase from others to sell?
    b) Do men and women obtain different prices for the same products? If so, why?
    c) Which market activities are carried out by women? By men?
    d) Are there niches in the market under the control of women? Of men?
    e) How do other factors (class, ethnicity) interact with gender in determining these niches and outcomes in bargaining?
2. How are surpluses captured through marketing of local agricultural products and natural resources? By who? Where? Does this differ for men and women?
4. How are the financial gains from market participation (through effective networks) translated into tangible social gains within the household and how does the process of resource allocation differ between men and women as well as among women in different contexts?
5. Are there male-dominated or female-dominated networks or coalitions that influence access to markets, and returns/benefits?
6. How do women negotiate obstacles to market access?

7. How do coalitions/networks arise? How are they sustained? How do they benefit people?
8. Where is their source of power? How do they add value and permit groups to extract surpluses?
9. Identify and compare men and women's spaces (physical areas) in the production and processing of products destined for market. Map these in the value chain.
    a. Where are the markets (both formal and informal)?
    b. How are these linked to the market? (Map links to gendered spaces in the market.)
10. What factors affect women's choices of crops grown/natural resources managed or practices they adopt?

EEP Assessment of Newly Initiated SANREM CRSP Cross-Cutting Activities

The newly initiated SANREM CRSP cross-cutting activities are very much in line with the recommendations made by the EEP in 2005 for SANREM cross-cutting research themes. These activities have just begun and thus no progress can be reported, however it is the opinion of the EEP that these recently initiated activities will greatly enhance the quality of the LTRA research program and provides an excellent mechanism for linking the various LTRA's together. These cross-cutting activities will enhance the sharing of ideas and data among the various projects. While the importance of gender was expressed in all of the projects, the sharing of ideas and experiences was limited to communications at SANREM meetings. The inclusion of a Gender Coordinator by the ME in the original SANREM CRSP proposal and providing funding for gender cross-cutting activities will greatly strengthen this important aspect in all of the LTRA's.

EEP Assessment of Original SANREM CRSP Cross-Cutting Themes

Governance

All five LTRAs deal with governance issues. Their common thread is the development and application of knowledge to improve policies and policy performance. Methodologically, these research programs are addressing these issues in a case study format. LTRA-1, LTRA-3, and LTRA-4 are very explicit about conducting a 'natural experiment' comparing policy formation and impact analyses across countries.

One of the primary findings of this work is that local communities both desire and benefit from increased involvement in the management of their resources. The projects are demonstrating that local engagement (i.e., active roles in local decision making) is creating greater commitment to improvement management practices and local institutions. The relationship between local and national policies is a particularly common theme as well

Biodiversity

Biodiversity research is primarily conducted by LTRA-2, with governance aspects being studied in LTRA-1. LTRA-1 has found that local communities in Uganda are supportive of biodiversity conservation, but they need to be given active decision making roles in the design and implementation buffer zone protection schemes. A biodiversity assessment (bird counts) has been conducted by LTRA-3 with the intent to assist in the management of remnant forests and building wildlife corridors at their Ecuadorian site. LTRA-4 has been concerned with the biodiversity of vegetative species, in particular indigenous potato and forage crops, and is

making the link (as is LTRA-2) between biodiversity conservation and successful livelihood strategies.

The SANREM CRSP also supported USAID biodiversity activities in Madagascar through the provision of technical assistance to the Mission and its partners seeking to restore wildlife corridors (for lemurs) in the illegally logged Didi forest preserve. SANREM also implemented an Associate Award from USAID/EGAT to develop training materials and to conduct a training program for USAID personnel on payments for environmental services programs. These two activities are described in more detail in the following SANREM CRSP Management Entity activities section of the annual report.

Linking knowledge to action

Linking knowledge to action and then facilitating host country actions based on sound science are key components of the SANREM approach to NRM. Common to all projects are various forms of user group training (seminars, workshops, etc.). All LTRAs use participatory approaches to meaningfully engage users and their institutions in the research programs. These have been quite useful in problem identification and diagnosis leading to new product development (LTRA-2) and improved technologies (LTRA-3 and LTRA-4). Participatory approaches build a bridge between the knowledge systems of scientists and users that has practical application for farmer and policy maker decisions. The least vulnerable (among the poor) seem more likely to participate than the more vulnerable (LTRA-4).

LTRA-1 and LTRA-4 target not only direct users for the development and transfer of knowledge, they also focus on policy-makers to help improve the context for improved institutions and practices at the regional and national levels through national advisory committees, regional and national policy roundtables, and advocacy coalition building. Inherent in the research design of LTRA-1, LTRA-3, and LTRA-4 is a focus on linking participatory processes and the value of the products produced through those processes. This is also a focus for a FY2008 cross-cutting research project involving researchers from LTRA-1, LTRA-3, LTRA-4, and LTRA-5).

Water resources

There are two primary focuses on water resources management: improving water use effectiveness and efficiency (LTRA-3, LTRA-4, and LTRA-5) and watershed management for mitigating the environmental impacts of land disturbing activities (LTRA-2, LTRA-3, LTRA-4, and LTRA-5). In addition, watershed management will be the focus of a new FY2008 to 2009 cross-cutting research project in watershed modeling involving all but LTRA-1. Priority issues include assessing and mitigating the impacts of (1) land disturbing activities on stream/river (LTRA-3) and LTRA-4), and wetland and ecosystems (LTRA-2); climate change (LTRA-4), deforestation (LTRA-2), and vegetable/agro-forestry systems (LTRA-5). Lessons learned and knowledge generated is being used to inform policy making, particularly in LTRA-2 and LTRA-3. These research projects are all using GIS and remote sensing (satellite imagery) to supplement ground-based monitoring in the development and use of watershed models in support of land use management decision making. In addition, LTRA-3 and LTRA-4 are using participatory techniques to enhance the value of the findings. Host country capacity building in the use of watershed models for water resources management is a major emphasis of LTRA-5.

Drip irrigation is being used to improve water distribution, use efficiency, and the quality of vegetable crops (LTRA-5). A particular focus is minimizing competition for water between vegetables and trees in the vegetable agro-forestry systems. LTRA-3 is investigating institutional arrangements to allocate irrigation water in both Ecuador and Bolivia, reviewing enabling legislation, and interviewing irrigation association members.

Soil quality

LTRA-2, LTRA-3, LTRA-4, and LTRA-5 are researching field level soil management practices that increase soil fertility and enhance soil quality through increased carbon sequestration in soils. In both Latin America and South East Asia, researchers are testing a range of techniques to reduce soil erosion: perennial peanuts, cacao, and vetiver as cover crops (LTRA-5); grass strips (LTRA-3); farmer-recommended cover crops, drainage systems, and terraces (LTRA-4); and agro-forestry (LTRA-5). At the Zambia site (LTRA-2), erosion and declining soil quality are major problems in Zambia (LTRA-2), the focus has been more on conservation farming techniques to enhance soil fertility using manure, water catchment basins, and mulch. This research is testing these techniques across a wide range of agro-eco zones characteristic of southern Africa. LTRA-4 researchers have determined that local techniques for soil quality management are effective and are integrating local practices with relevant scientific improvements and developing appropriate technology methods for rapid soil quality assessment to improve soil management in the high Andes.

In the Andes, LTRA-3 and LTRA-4 are grappling with the effect of human management and climate on soil organic matter. LTRA-4 is focusing on soil management and cropping systems interventions to reduce risks associated with climate change, specifically reduced precipitation and changing frost free periods. LTRA-3 is also concerned with explaining the anomaly of higher soil carbon levels at lower elevations in order to better understand the characteristics of appropriate sustainability practices.

Linking farmers to markets

Linking farmers to markets is an important cross-cutting theme in four LTRAs. Using a case study methodology, value chain analyses have been central to the LTRA-3, LTRA-4, and LTRA-5 research strategies. Analyses have centered on both current crops and the potential for the reintroduction of indigenous potatoes (LTRA-4) and vegetables (LTRA-5) that are no longer commonly produced. Transportation studies have been a particular emphasis of LTRA-3 and LTRA-5. Combined, these analyses show that successful entry into new and higher value chain markets requires better market information, lower transportation costs and improved post harvest. While market analyses have identified new options, these do not appear to be within reach of the most vulnerable farmers (LTRA-4). LTRA-4 is innovating with an advocacy coalition approach to market integration involving building networks and coalitions along the value chain. Gender differences in market participation have been found within indigenous Andean populations (LTRA-3). Market women have been found to be a dynamic force in the Philippines (LTRA-5). These findings and a strong interest in gender issues among researchers have lead to a cross-cutting research project on gender and market access.

Two LTRAs have explored the potential for value added products. Product development and testing has been emphasized by LTRA-2 (soy extracts) and LTRA-3 (cheese). LTRA-3 is also initiating a study to determine the impact of cell phone technology on the provision of up-to-date market information to address the lack of competitiveness in Ecuadorian markets.

Cross-Cutting Research Activities Summary

The EEP is pleased with the efforts of the ME to initiate the cross-cutting themes and to facilitate the development of the four cross cutting research proposals. We think that these efforts will greatly enhance the development of common themes across projects and lead to the development of a conceptual model for the LTRA Research Program. These cross cutting activities provide a most useful tool for tying all of the 5 LTRAs together. We urge the ME to continue to stress the importance of these cross cutting activities to project research staff to enhance the overall success of the SANREM Program.

Other ME Activities

The SANREM CRSP also provides support for Associate Awards, and technical assistance. Support for publication of a review of eco-agriculture was an early biodiversity effort. Current additional activities in these two areas include: (1) Payments for Environmental Services (PES) Associate Award from USAID/EGAT to provide a training manual and workshop on PES for USAID personnel, and (2) a technical assistance activity for the USAID Mission in Madagascar to address restoration of an illegal timber operation in a protected area. The following is a brief description of the book and these two recent service activities for USAID:

Payments for Environmental Services Associate Award

In October 2006, the SANREM CRSP received an Associate Award entitled “Global Assessment of Best Practices in Payments for Ecosystem Services (PES) Programs” to support USAID program efforts in the area of payments for ecosystems services. Additional funding was provided to the BASIS CRSP and this activity was a cooperative activity between the SANREM and BASIS CRSPs. The objectives of the award were to:

1. Modify the SANREM Knowledge Base (SKB), so that it is more suitable for cataloging and locating PES resources.
2. Conduct a literature review of payments for ecosystem services programs in developing countries and enter information on the programs into the SKB.
3. Incorporate information resources on PES into the SKB.
4. Review PES activities in Latin America and the Caribbean, Africa, and Asia, and develop papers on PES activities and approaches in each region.
5. Develop regional case studies to demonstrate approaches to PES in the different regions.
6. Participate in the RUPES Global Event on Payments/Rewards for Environmental Services in Lombok, Indonesia, January 22-23, 2007 and present papers on regional approaches to PES.
7. Assist the BASIS CRSP in the development of a “USAID PES Sourcebook” to be used in training USAID personnel in the principles of PES.

8. Publish and maintain the PES Sourcebook through the SANREM CRSP website.
9. With the BASIS CRSP, conduct a one-day PES Policy Seminar in the Washington, DC for USAID personnel in October 2007.
10. Convert the PES Policy Seminar materials and videos of the presentations to a web-based distance learning tool.
11. Disseminate the regional syntheses papers through publication in a journal.

The SKB was modified as planned and information resources on 160 PES projects and 150 text resources were entered into the SKB. These resources are available through the SKB at http://www.oired.vt.edu/sanremcrsp/menu_information/SKB.php. A User's Guide for the PES portion of the SKB was developed and is available at: http://www.oired.vt.edu/sanremcrsp/documents/PES.Sourcebook.Oct.2007/PESKnowledgebaseQuery.pdf.

The regional synthesis papers are available on the SANREM CRSP PES webpage at: http://www.oired.vt.edu/sanremcrsp/menu_information/working_papers.php (Working Papers No. 06-07, 06-08, and 09-07). John Kerr and Rohit Jindal of the Department of Community, Agriculture, Recreation, and Resource Studies at Michigan State University also participated in the review of the regional synthesis papers.

The PES Sourcebook was developed by John Kerr and Rohit Jindal with assistance from Theo Dillaha of Virginia Tech. It is available at: http://www.oired.vt.edu/sanremcrsp/menu_research/PES.Sourcebook.Contents.php.

Technical Assistance to the USAID Madagascar Mission

In November 2004, Madagascar President Marc Ravolomanana discovered a logging road built by the Malaysian-owned Latitude Timber Co. This road construction and associated timber exploitation were in the Forests of Veriantsy and of Sahananto in the classified forest of Ambohilero, Fokontany Amboarabe, C/R de Didy. During the eight months of exploitation, Latitude Timber used heavy machinery to widen limited existing logging roads from less than 3 m to greater than10m in places, to construct kilometers of new road, and to harvest timber by clear-cutting along the roads.

At the request of USAID Madagascar in 2005, SANREM researchers conducted an initial assessment of the illegal timber operation and developed recommendations for restoration of the forest. In early 2007, USAID Madagascar requested follow-up technical assistance and in May 2007, SANREM sent a team of three scientists (Sarah Karpanty and Theo Dillaha of Virginia Tech and Charles Welch of Duke University) to revisit the site, assess reforestation efforts, and to update the restoration plan. Specific objectives of the project were:

- To assess passive restoration since the last site visit in July.
- To assess the health of planted and nursery tree seedlings and to develop recommendations for planting the remaining seedlings to best provide habitat and movement corridors for key wildlife species.
- To evaluate the successes and limitations of restoration activities by MIARO and Avotr'Ala, and to recommend additional practices as needed.

- To assess the socioeconomic impact of the road on Bemainty and Antsevabe, the two villages at opposite ends of the logging road.

The main project conclusions included:

- The forest is recovering through natural regeneration.
- The secondary and primary forest tree seedlings remaining in the nurseries on site should be planted under the canopies of existing or transplanted pioneer species to enhance their survival.
- Invasive species do not currently appear to be a problem. If non-native invasive species appear, they should be immediately eradicated to preserve the integrity of the forest system.
- Erosion, gullying, landslides, and bridge washouts have rendered the logging roads impassable to vehicles. This is an excellent development, which works against further exploitation of the area. The road should not be repaired or maintained.
- There do not seem to be major downstream water-quality impacts at this time due to the road construction because of the natural buffering by the forest.
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Book on Adaptive Management of Sustainable Agriculture and Natural Resource Management Systems

Small holders around the world are confronted by the linked problems of poverty and environmental degradation. In order to address these multiple and complex factors, SANREM CRSP Landscape System and Technology Transfer Coordinators are developing a guidebook for development practitioners. This book introduces an evolving adaptive management approach to SA and NRM systems. The goal of the book is to provide development practitioners with the knowledge, understanding, and tools to improve the innovative capacity of stakeholders. A sub-goal is to encourage policy maker and donor support for local innovation and adaptive management. The book will be published in 2008.

Part I of the book provides an overview of complex adaptive systems and the principles for adaptive management in the context of landscape systems. Part II of the book is composed of six landscape system chapters and a chapter on stakeholder empowerment/capacity building.

Concrete examples will be used to illustrate systemic properties and principles of sustainable management, decision making criteria, and links for scaling up, out, and down. Identification of practical innovation principles will assist practitioners in project implementation and in scaling up and out of successful technological and institutional innovations. They will also help donors and project developers design successful and sustainable agricultural and NRM projects and programs that empower stakeholder innovation.

Part III of the book presents a set of case studies, which demonstrate the application of landscape system adaptive management principles. Material for these chapters is currently being researched to provide holistic, multi-system and multi-scale presentations.

EEP Assessment of Other ME Activities

The EEP is in full agreement with the ME in participating in these additional activities. The associate awards provide a service to USAID in the area of natural resource management and raises the profile of the SANREM CRSP. The EEP has noted in earlier parts of this review about the importance of the use of the research and findings of the SANREM CRSP. These additional ME activities provide evidence of the need and use of the knowledge generated by the SANREM CRSP.

Summary and Recommendations

The EEP team is very impressed by the new knowledge generated, the excellent graduate training, and scientific staff commitment to engage in multidisciplinary research. We believe that the SANREM program is a suitable instrument to capitalize on the strong disciplinary knowledge base and development research expertise at American universities in addressing complex issues of developing country contexts through an inter- and trans-disciplinary approach. As we place more stress on the environment due to rapid change, there are often unintended consequences for these linked people-agricultural-environmental systems. The inter- and trans-disciplinary approach to research exemplified by SANREM is the most viable way to address the complexity that is the real world.

Following the interchange with the LTRAs on the Interim Report, the EEP commends the research teams for the constructive way in which they responded to the numerous suggestions made in the report. Particularly promising are the efforts made in developing the conceptual models for the projects to guide the further process of analyzing the data collected so far and the priority setting for additional data collection. The EEP encourages the LTRAs to continue to develop these conceptual models in the remaining time of the projects. These should help in generating general concepts that emerge from the research. These should also be helpful also to ensure that the projects maintain high standards of scientific quality, which should be a hallmark for US University driven projects. The EEP is also encouraged by the increasingly prominent role that the LTRA partners in the host countries are playing in the planning and execution of the projects. The EEP sees this as an essential component of capacity building at the institutional level.

As a means of capitalizing fully on the investments made in the LTRA projects, the EEP suggests that, towards the end of this SANREM phase, each of the projects are asked to identify and extract general concepts that are outcomes of their research work. Using these generalizations as a basis for discussion, it is suggested that the ME organize a final synthesis meeting with the principal investigators of the LTRAs in order to identify the common principles (models and metrics) that SANREM III has developed or can develop to add to the international discourse on Natural Resource conservation and use

Recommendations for SANREM

The specific recommendations below focus on issues that emerged from the evaluation, with emphasis on elements that could be improved based on our insights obtained from the existing programs. These are aimed at further strengthening the SANREM program as a whole. We believe that investment in future SANREM programs should be augmented, and that future programs will benefit from the following recommendations. We recommend:

- The continued development of instruments to extract cross-cutting public good from the research projects. Those should include knowledge related to soils, water, biodiversity and ecosystem services, governance, institutions, and gender.

- The development of a mechanism for learning across SANREM LTRA project experiences, including analytical papers on what worked and what did not, and how local institutions were recruited and integrated into the SANREM program.

- Each project should continually reassess its activities in the research-extension continuum within TOP and clearly identify the range of research activities where U.S. universities have their greatest contribution to make. This should result in a planned balance between fundamental and applied research, and in the articulation of a philosophy and strategies for scaling and outreach of integrated systems and their technologies.

- More preparatory work should be done to establish an agreed upon integrated framework of objectives leading to hypotheses, with output and deliverable due dates becoming project milestones. Clearly identified knowledge gaps could then be filled where possible from associated research. A set of deliverables corresponding to the SANREM core funding should be identified, as well as additional desired deliverables subject to more funding through the many leveraging channels.

- The relationship between PIs and their respective researchers needs attention. The ME may need to make clear to all researchers that despite differences in disciplines or seniority between PIs and their colleagues, the PI needs to lead the research. PIs and researchers need to agree on what outputs are needed, and when. Milestones for each researcher's work need to be set and met. PIs are not simply facilitators, they must exert leadership. The ME needs to support PIs in their leadership roles.

- As mentioned in the Collaborations section, above, better communication is needed so that people in all parts of each project know about the work of others and how it all fits together. Also, more and better inter-project communication is needed.

- One essential objective is to build the capacity to conduct interdisciplinary science and, as mentioned above, to leave behind the capacity to carry on work begun under SANREM projects. The selection of students for academic training and their venues of training need to be reviewed to assure the strong likelihood of contributing to the scientific capacity of SANREM host countries. Graduate education should be done by exposure to cutting-edge science.

- Considering the complexity of this type of research program — serving the interfaces of agriculture, people, and the environment — the EEP recommends to extend the program beyond the five years' research of the first phase, particularly for those projects where the promotion of sustainable institutional change and policy modifications on the basis of the research have a realistic chance of being realized.

- There may be merit in reorganizing the reporting on these projects. The reporting under categories of objectives seems not to be sufficient. As the projects develop a conceptual framework they might report in a more functional fashion using these frameworks. Specifically, the conceptual model of the project should comprise the objectives,

hypotheses, activities, research protocol, and capacity building. It might be useful to report using the model components as a framework. Reporting should be more detailed.

- Because SANREM is a flagship program of USAID, the EEP recommends that funding for SANREM be maintained at contractual levels. If any cuts in funding should be made, the Technical Committee should ensure that this not be done at the expense of core activities and scientific rigor. The EEP recognizes the value of leveraging SANREM funding but also registers that leveraging can contribute to mission drift.

- The SANREM Knowledge and Information System is well documented and conveniently accessible. The ME and researchers need to encourage the use of the knowledge base by as many means as possible. The ME in cooperation with researchers should issue news releases regarding research findings as appropriate, useful and especially to draw attention to the expanding SANREM Knowledge and Information System components.

- In country collaborators need to be full partners. The EEP wishes to see the partners to assume full participation in the SANREM science, its design and implementation.

Recommendations for USAID and the Donor Community

The SANREM program should be seen in the context of an increasing public awareness of the vulnerability of the worlds Natural Resource base, brought to the fore by the Millennium Ecosystem Assessment. The investments made by the donor community in the development of Sustainable Agricultural Systems should not only be of benefit to the stakeholders in the partner countries, but should equally add to the body of knowledge that will guide policy makers in managing the conservation and use of the worlds heritage in natural resources. The body of work that is currently being undertaken by SANREM CRSP researchers has the potential to make an important contribution in this regard with important new discoveries based on quality science about the interrelationships of natural resources, technology and human livelihoods. The external review panel identified several overarching areas for continual emphasis and improvement in the ongoing SANREM work.

Our review of this ongoing research also indicates to us the pressing need for the donor community to respond more vigorously and effectively to the necessity for research on sustainable agriculture and natural resources management. The research and findings are badly needed throughout the world, to help people emerge from poverty and conflict, and to prevent communities and nations from falling into poverty and conflict. Some of the needs are the following: More long-term research with long term objectives; greater emphasis on long-term impacts; increased funding to support the quality of science; and more integration of previous findings into new initiatives.

- The effects of human activity on natural resources evolve slowly, but can spell life or death to people and other communities. Our research must be planned and supported for the long term in order to understand life processes, and protect society from disaster.

- Much investment is made for the purpose of short term impacts. Planning and investing for quick impacts often requires shortcutting diligence in understanding the probable effects of investments, and diminishing accountability for actions that prove wasteful and destructive. Investment for short term impact needs to be balanced by greater investment for long term impact.

- Evaluations of research on the environment and human activity, in SANREM and elsewhere, abound with cases of too little invested for understanding complex and seriously consequential problems. It is our judgment that funding for research like that in SANREM is many orders of magnitude less than the costs of the consequences for not understanding and solving the environmental problems that we face.

- The SANREM Knowledge and Information System is well documented and conveniently accessible. It will be useful for the donor community to always encourage through their funding activity, the utilization of present knowledge in new initiatives. It is remarkable that funding initiatives by donors does not sufficiently build upon parallel or previous work funded or known by the donor, which could make new investment more productive. Better integration of knowledge is needed at the donor level.

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