



Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

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SANREM CRSP Semi-Annual Report

October 2007- March 2008

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Management Entity

The SANREM Management Entity (ME) was extremely busy and productive in the past six months. Besides hosting the External Evaluation Panel (EEP) and the Administrative Management Review (AMR) team, we initiated the Cross-Cutting Research Initiatives program, managed the Payments for Environmental Services (PES) Associate Award, updated our website design, co-sponsored and supported an international conference on water resources in Chile, and finalized plans for our annual meeting May 26-29 at University of the Philippines-Los Baños.

The major programmatic Management Entity activity over the past six months was the establishment of the Cross-Cutting Research Initiatives program. Using one-time catch-up and forward funding from USAID, the SANREM CRSP called for cross-cutting research proposals in the areas of soil quality, gender, watershed modeling, knowledge-to-action, and a special initiative in biotechnology. The Technical Committee reviewed the applications and recommended that subject to minor revisions the Management Entity support the following cross-cutting research initiatives:

- Assessing and Managing Soil Quality for Sustainable Agricultural Systems. Principal investigator (PI): Peter Motavalli, University of Missouri. This project involves LTRAs 2, 3, 4, and 5.
- Biotechnology: Soil Metagenomics to Construct Indicators of Soil Degradation. PI: Karen Garrett, Kansas State University. This project, which involves LTRAs 2, 3, and 4, meets USAID biotechnology attribution requirements.
- Gendered Access to Markets: Gendered Networks and Livelihood Alternatives. PI: Maria Elisa Christie, Virginia Tech. This project involves LTRAs 2, 3, 4, and 5.
- Linking Knowledge and Action: Meeting NRM Challenges in SANREM. PI: Esther Mwangi, John F Kennedy School of Government, Harvard University. This project involves LTRAs 1, 3, 4, and 5.
- Watershed Modeling and Assessment. PI: Conrad Heatwole, Virginia Tech. This project involves LTRAs 2, 3, 4, and 5.

Each of these projects was revised and the budgets developed for funding through the existing LTRA project subaward framework. All LTRA subawards were amended to include these additional scopes of work and associated funds.

The second PES seminar, "Pro-Poor Payment for Ecosystem Services", was held by SANREM CRSP and USAID for the agency's staff and guests on October 4, 2007. The full-day seminar, co-sponsored by the BASIS CRSP, was held at Virginia Tech's Northern Virginia Center in Falls Church. Presentations from the PES seminar are available at http://www.oired.vt.edu/sanremcrsp/menu_research/PES.PolicySeminar.Oct.2007.php.

The *USAID PES Sourcebook*, case studies of successful PES programs in Africa, Asia, and Latin America, and a user's guide for the PES knowledgebase on the SANREM website also are available online: <http://www.oired.vt.edu/sanremcrsp/PES.php>. Three SANREM sponsored journal articles on PES are now 'in press' in the Journal of Sustainable Forestry.

Two panels reviewed the SANREM CRSP over the past six months and the Management Entity was highly involved in providing full documentation and assistance to present research

results and management decisions since the initiation of the project in October 2004. Issues covered ranged from research methodology, program design, gender integration, governance, and administrative documentation. The External Evaluation Panel (EEP) submitted their review of the long-term research program in January 2008. This positive report recommended continuation of the SANREM CRSP for another 5 years after completion of the current phase. The Administrative Management Review (AMR) was initiated through a desktop review in October 2007 and the Management Entity was visited in February 2008. The AMR report also recommends a five-year extension of the SANREM CRSP.

The SANREM CRSP website was redesigned in October with a homepage centerpiece focusing on a recent achievement, innovation, or breakthrough from one of the LTRAs. The news archives page added a list of stories by headline. The SANREM CRSP Annual Report FY 2007 was compiled and submitted to USAID in January 2008.

We had a transition in the ME staff. Program Coordination Assistant Peggy Lawson retired and was replaced by Jane Lee.

The reporting period ended with eight SANREM CRSP partners presenting papers and posters at “21st Century Watershed Technology: Improving Water Quality and the Environment,” a conference March 29 to April 2 in Concepción, Chile. The focus of the conference, co-sponsored by the SANREM CRSP, was emerging problems and new solutions to managing watersheds to meet water quality and quantity standards. Attending the conference were 110 water resources professionals from 14 countries.

Long-Term Research Award (LTRA) Activities

LTRA-1: Decentralization Reforms and Property Rights: potentials and Puzzles for Forest Sustainability and Livelihoods

PIs: Elinor Ostrom, Indiana University
Krister Par Andersson, University of Colorado
Ruth Meinzen-Dick, CGIAR Program on Collective Action and Property Rights
Esther Mwangi, Kennedy School of Government, Harvard University
Bruce Campbell and Marty Luckert, Center for International Forestry Research (CIFOR)

Host countries: Uganda, Kenya, Mexico, Bolivia

I. Executive Summary of overall progress for the past six months

Partners are working towards completion of all promised site visits. Data collection is complete in 5 sites in Uganda and Kenya (out of 7 total in each country), 2 sites in Mexico (out of 5), and 3 sites in Bolivia (out of 5). Data collection is also complete for the nationwide survey in Mexico and 92% complete in Bolivia. Preparations are in progress for the remaining sites. However, delays in all 4 countries (political unrest in Kenya and Bolivia, flooding in Bolivia and Uganda, administrative issues in Mexico) set the timeline back, and all partners are reassessing their work plans. The Steering Committee worked with Mexico to develop a revised work plan. According to the new plan, Mexico will still complete all site visits by the end of Year 3, the same deadline as all other partner countries. Data from Mexico should be available for use in all SANREM analyses applied to the other countries.

In conjunction with this data collection, partners trained 194 people (35% women) so far this year, bringing the project total to 1192 (41% women). Trainings dealt with topics ranging from field techniques and data entry to increasing community understanding of responsibilities under forest laws and soil science. Trainees included residents of study sites, local officials, NGOs, government agency representatives, and others.

In February, members of the Steering Committee and several partners from Collaborating Research Centers participated in a meeting to discuss the status of the project and prioritize analytical products. The meeting was attended by Marty Luckert, Ruth Meinzen-Dick, Krister Andersson, Lin Ostrom, Esther Mwangi, Jacqui Bauer, Joe Bahati and Arthur Arinaitwe from Uganda, and several graduate students. Partners in Mexico and Bolivia participated by Skype. This meeting was extremely productive in assessing project progress and determining the plan for the remaining 18 months.

Results of the nationwide survey in Mexico garnered attention from a number of key stakeholders in the forest management sector, including representatives of the World Bank, the Food and Agricultural Organization, and the National Forest Commission. These organizations are interested in the results of the survey as well as the analysis carried out by Mexican colleagues. The results were presented at several national forums at which national forest policy makers participated.

The Bolivian team is still collecting data for their nationwide survey, but notes that the team is frequently not able to locate the relevant local authorities in charge of forest management. This substantiates previous findings of discrepancies between decentralization policies on paper and those on the ground.

In Uganda, partners are finding that much hinges on monitoring: the condition of Kapkwai Forest (Site 5) has improved greatly since rules regarding monitoring changed. Meanwhile, the opposite is occurring in Sango Bay (Site 4), where the morale of those responsible for monitoring is low because of inadequate compensation.

Also in Uganda, the PEN study has found that relatively wealthy rural households living adjacent to the central forest reserve experienced large gains in income from forests, total income, and the share of income from forests. However, households in the lowest income quartiles experienced moderate losses in forest income, and significant losses in the share of income from forests. Most of the gains are due to illegal timbering. Some recommendations emerging from this research include greater opportunities for communities to engage in legal activities related to the forest, and a thorough evaluation of the incentives facing forest officials to better ensure that they can (and want to) do their jobs as envisioned.

Significant findings and accomplishments:

- 1192 individuals trained in various topics related to the forest sector and decentralization.
- Plan developed for future analytical products
- Data collection is complete in 5 sites in Uganda and Kenya (out of 7 total), 2 sites in Mexico (out of 5), and 3 sites in Bolivia (out of 5)
- The nationwide survey in Mexico has caught the attention of a number of influential organizations, resulting in a diagnosis of the forest sector and policy recommendations by the Mexican partner.
- Large discrepancies exist between the decentralization policies that exist on paper and those that exist on the ground. Monitoring, personnel, and funding all have an impact, among other things.

II. Findings by Country

Kenya: In Site #5 (Ramogi), the team has found that community members face poor economic conditions, and agriculture output from the dry landscape is very low. The community depends on fishing, but invasion by water hyacinth in local water bodies has reduced the fish population. This has caused the community to turn to the forest to support their livelihoods. There are very few conservation efforts and it is only in the recent past that the National Museums of Kenya through the Research Program on Sustainable Use of Dryland Biodiversity has initiated an ecotourism project with community members. The project is also backed by other organizations outside the community including Maseno and Moi Universities.

The community has also established a forest association known as the Got Ramogi Community Forest Conservation Trust. This trust will eventually oversee the running of ecotourism projects in the area on behalf of the community. However, the community is yet to form an umbrella association for all the forest associations and CBO's in the area. There are small CBO's in the area and other associations directly or indirectly dealing with forests. These need to be integrated into one umbrella association to represent the whole forest community.

Bolivia: The team has completed 92% of the 150 surveys expected as part of the national survey of forest communities. The team notes that they were unable in many communities to find the person responsible for forestry even though this position is required by Law 1700 (dealing with decentralization). In some cases, this position was incorporated into bigger departments like the Dept. of Agriculture. We may need to reexamine our hypotheses related to municipal authority and the role of public agencies in community forestry.

Uganda: The condition of Kapkwai forest (Site #5), managed by Uganda Wildlife authority has improved greatly due to strong monitoring and enforcement of rules by park authorities. The Kapkwai Forest was degraded in the 1990s when it was being managed by the then Forest Department. Some changes in monitoring rules that lead to these improvements include:

- Communities access the park on specified days of the week (making it easy to monitor).
- Members of the collaborative resource management committee participate in monitoring and enforcing harvesting rules as laid out in the memorandum of understanding with UWA.

Monetary benefits from the park to communities are remitted to the district rather than directly to the communities neighboring the park.

- In the Sango Bay site (Site #4), morale of those involved in patrolling forest boundaries and monitoring illegal harvesting is low because of limited monetary incentives they receive from the NFA.

Researchers used the PEN study in Uganda to examine livelihood and sustainability impacts of Uganda's recent forest sector governance reform. For most Ugandans living in or near forests on private or customary lands, the impact of the forest sector reform on rural livelihoods is negligible. While the livelihood impacts of the reform are benign, the impact of the reform on forest sustainability is significant. Throughout western Uganda, forest cover and quality are declining rapidly. These findings indicate that in the forestry sector, decentralization to local government in Uganda has not had the desired outcome.

A second story emerges from the analysis of the transition from Forest Department to National Forestry Authority management of central forest reserves. We found that relatively wealthy rural households living adjacent to the central forest reserve experienced large gains in income from forests, total income, and the share of income from forests. However, households in the lowest income quartiles experienced moderate losses in forest income, and significant losses in the share of income from forests. The majority of forest income in the study area is from the sawn wood which is harvested and sold illegally. In this case livelihoods were improved due to the institutional failure of the National Forestry Authority to regulate and enforce timber harvesting. In the central forest reserve, there was limited evidence of major forest cover loss. However, indicators of forest quality suggest that forest degradation is taking place, which may have medium term ecological effects. Further, private and community forest surrounding the central forest reserve is being cleared at a rapid rate, which will undoubtedly place pressure on the central forest reserve in the future. The transfer of responsibilities for central forest reserves to the National Forestry Authority has not had the desired effect. Forests improved the livelihoods for only wealthy and with medium term ecological implications.

An important implication of these findings for policy makers is the differential effect of the reform on relatively wealthy and relatively poor households. A second key message for policy

makers is the extent of timber harvesting and marketing that is taking place in areas where these activities are known to be illegal and where the presence of forest officials is significant. Finally, indicators of change in forest cover and quality in private and community forests and the limited level of information and support rural households are receiving from District Forest Officers regarding sustainable forest management are evidence of implementation failures associated with the forest sector reform. District Forest Officers are pre-occupied with collecting revenues from timber and charcoal transport, and have no mechanism or incentive for effectively supporting rural households in sustainably managing resources. In addition, where the majority of timber related income accrues to non-local resource extraction specialists, rural households have few if any incentives to preserve forests.

Several policy recommendations emerge from this research. First, facilitating legalized engagement of local resource users in the sustainable harvesting of high value forest products and small scale forest enterprise development may increase awareness of the value of trees and forested land, increase income from forests, and reduce the incentive for corrupt officials to extract bribes from illegal producers. Second, the magnitude of forest cover loss on private and customary lands points to a looming crisis in Uganda. Improving local government capacity and financial support for woodlot establishment and mitigating further forest clearing is essential. Third, in the control group site, collaborative forest management agreements and the sharing of tourism revenues with local communities has a favorable effect on both livelihoods and forest management. Opportunities for community engagement in forest management outside of protected areas should be pursued, with the caveat that current community forestry initiatives in the study area have a limited positive effect on forest sustainability. These initial three recommendations may enhance both livelihood and sustainability outcomes. Finally, the incentives of forestry officials should be carefully evaluated. Currently there appear to be few incentives for forestry officials to do their jobs as they were envisioned.

III. Research progress by objective.

In February, members of the Steering Committee and several partners from Collaborating Research Centers participated in a meeting to discuss the status of the project and prioritize analytical products. The meeting was attended by Marty Luckert, Ruth Meinen-Dick, Krister Andersson, Lin Ostrom, Esther Mwangi, Jacqui Bauer, Joe Bahati and Arthur Arinaitwe from Uganda, and several graduate students. Partners in Mexico and Bolivia participated by Skype.

Dissemination:

- The Mexico team completed a diagnosis of the forest sector based in part on the SANREM nationwide survey at the request of the World Bank, FAO, and the National Forest Commission.
- Uganda prepared a policy brief discussing the roles of various stakeholders in the forest sector
- A paper co-authored by partners in Kenya, Uganda, and at IFPRI was presented by Ugandan colleague Abwoli Banana at the workshop on Forest Governance and Decentralization in Africa in Durban, South Africa. The paper is titled “Resource, recourse and decisions: incentive structures in forest decentralization and governance in E. Africa”.

- IFPRI completed a paper and a policy brief on decentralization and land tenure. The policy brief was done at the request of UNDP's Oslo Governance Center.
- A draft paper drawn from the Uganda PEN study is in progress exploring the effects of decentralization reforms on livelihoods. The tentative findings were presented at Indiana University, Purdue University, the Rights & Resources Group in Washington DC, and the Workshop on Forest Governance and Decentralization in Africa, held in South Africa. It will also be presented at the SANREM annual meeting.
- A second paper based on the Uganda PEN study will compare the PEN and IFRI methods of collecting household data. The tentative results were presented at a meeting of PEN researchers in Barcelona in January and at the Steering Committee meeting held in Bloomington in February.
- Bolivia PEN researcher Amy Duchelle gave a poster presentation of preliminary research results at National Science Foundation Interdisciplinary Graduate Education Research Trainee (NSF-IGERT) Sustainability meeting at University of Alaska, Fairbanks in October. She also presented results of her research on Brazil nuts as a guest lecturer in a Community Forest Management class at the University of Florida. The class was attended by 30 students and two faculty members.

Activities related to specific project objectives are listed below. Additional details on training activities are included in the Appendix.

Objective 1: Develop 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.

The extent of progress along the development pathway specified in the TOP framework varies depending on country and community. Activities under this objective are currently centered on completing data collection; findings are shared with community members as site visits are completed. In general, however, the degree to which this objective will be reached will depend on the successful completion of several crucial activities, including community training sessions on participatory research methods; community member participation in data collection, community research products (recourse and resource diagrams, community notebooks, and site visit summaries including community histograms and narratives), and interactive training workshops where research results are presented, shared and discussed with community members. The list below provides more details on progress made on each of the activities completed since October 1 under Objective 1.

- Pre-site visit trainings took place in Mexico Site 4 and Kenya Site 5; field work preparations took place in Bolivia Sites 4-5, Mexico Site 4, and Kenya Site 6. A total of 13 people were trained.
- Mexico trained 5 students to help with data collection. In Bolivia, 2 foresters were trained in the IFRI protocol, and in Uganda 5 research assistants were trained in data entry.
- An introductory meeting (held for larger audiences within the community) was held in Kenya Site #5. 83 people attended the meeting.
- Resource & Recourse diagrams were created for Uganda Site 5 and Kenya Sites 4-5.

- IFRI community and household data collection was completed in Uganda Sites 4-5, Mexico Sites 1-2, and Kenya Site 5. Data collection is in progress in Mexico Site 4 and Uganda Site 6; data entry is in progress for Kenya Sites 4-5.
- Data from the Uganda PEN survey and Bolivia PEN surveys 1-2 has been entered and cleaned.
- Site reports for Kenya Site 3, Uganda Site 4; Bolivia is preparing a community notebook that will be shared with the residents of Site 3 and that will contain all data, findings, and other information that the community can keep in their records.
- Two interactive, post-site visit trainings were held in Uganda Site 4. The first targeted members of 2 communities within the site who are involved in collaborative forest management with the intent of improving their leadership capabilities (40 attendees). The second focused on differing experiences between the National Forest Authority and the Uganda Wildlife Authority (33 attendees).
- Interactive trainings in Kenya Sites 2-3 needed to be postponed due to post-election violence. These will be rescheduled as soon as the situation permits.

Objective 2: Develop capacity within key organizations (esp. government agencies and NGOs) in the forestry sector to understand the impacts of policies on differentiated local actors and to adopt strategies for inclusion of such actors within broader policy processes.

The degree of advancement toward this objective varies widely depending on the country and community. Activities completed since October 1 under Objective 2 include the following. Many of the objectives relevant to this objective are also relevant to Objective #1 and are not repeated here. As with Objective #1, the work outlined below involves continued data collection, which fuels findings related to the effects of decentralization on livelihoods and forest sustainability. Partner organizations share this information as it is collected and analyzed with community-based organizations, policy makers, and others as part of the effort to develop capacity within these organizations. During the end of Year 3 and Year 4, findings will be synthesized across sites and shared on a larger scale.

- The Mexico team applied the nationwide survey to 24 additional communities to address data concerns in previously applied surveys. The survey is now complete. The Bolivia team has collected 92% of the planned 150 surveys. Data collection should be completed and entered next quarter.
- In addition to sharing information with local residents, the 2 interactive, post-site visit trainings held in Uganda Site 4 targeted local council members, Rakai District officials, and others. Details are above in item #7.
- In Bolivia, the team worked with Krister Andersson to host a training of the National Advisory Committee in institutional analysis in the context of community forest management. A total of 8 people attended, including representatives from the Autonomous University Gabriel Rene Moreno-Santa Cruz, the University of Fribourg (Germany), BOLFOR II, Jatun Sach'a, the National Forest Superintendent, and the National Forest Department.
- In Kenya Site 5, the SANREM team has enabled or helped sustain links between various actors and the community, including government departments and organizations like the National Museums of Kenya, the Research Program on Sustainable Use of Dryland

Biodiversity, the Tourist Trust Fund, the Dominion Group, Maseno and Moi Universities, and the Got Ramogi Community Forest Conservation Trust.

- The Kenya team also held meetings with CARE Kenya, Plan Kenya, and Action Aid. A new partner, Friends of Lake Victoria (OSIENALA), was added to the project.
- The Bolivia team assisted with a workshop about the new rule regarding community forest managers at the request of the forestry superintendent of Cochabamba
- In Uganda, a representative from the Uganda Wildlife Authority was closely involved with the training held in Site 4 as well as activities around Sites 5-6.
- Ugandan researcher Arthur Arinaitwe (who assisted with the PEN field study in Uganda) spent 3 months at the Workshop, working with graduate student Pam Jagger on various papers and other activities.

Objective 3: Develop effective monitoring techniques for use by resource user groups and their partners (including NGOs and local-level agencies) at the community level to assess the impacts of decentralization and other property rights reforms on natural resources (including biodiversity) and livelihoods

Activity on this objective will increase at the end of Year 3 and throughout Year 4, when we expect to focus on analysis and dissemination and exchange across communities and regions. Nevertheless, several trainings were conducted within communities and groups of policy makers that help achieve the aims of this objective. These activities help focus community members and their partners on the importance of monitoring and participation, which will increase the likelihood that they will be able to alter or at least anticipate policy decisions. The post-site visit trainings mentioned below address this objective on a local scale; as findings are synthesized across sites, such trainings will take place at a larger scale (cross-community, regional, international).

Activities completed since October under Objective 3 include the following.

- Two interactive, post-site visit trainings were held in Uganda Site 4. The first targeted members of 2 communities within the site who are involved in collaborative forest management with the intent of improving their leadership capabilities (40 attendees). The second focused on differing experiences between the National Forest Authority and the Uganda Wildlife Authority (33 attendees). These trainings increase the capacity of community members to participate effectively in the policy process by increasing cooperation and networking between the local communities, district forest services and local politicians. These ongoing trainings will help increase the ability of communities to monitor policy making and anticipate its effects on their livelihoods.
- Interactive trainings in Kenya Sites 2-3 needed to be postponed due to post-election violence. These will be rescheduled as soon as the situation permits.

IV. Significant training, capacity building, and networking activities

See Forms 16 and 17 attached. Available and relevant publications were entered into the SKB.

V. Research strategy and development objectives.

The work discussed above helped communities acquire skills (such as analytical and forest management skills), aspirations (learning how to increase the productivity of the forest), knowledge (of policy processes, assistance available, and rights under current policy regimes), etc. that will increase communities' capacity to participate in the decision making that affects their lives and resources. In addition, these activities increased contact between user groups and policy makers/practitioners, enabling increased awareness of the impacts of different policies at the local level (e.g., the impact on different property rights arrangements on behavior), knowledge of local customs and processes, etc.

One of the activities most clearly tied to impacting development is the post-site visit interactive trainings, of which two were held in Uganda. These trainings allow researchers to convey findings from the site visit directly to community members and to representatives from the organizations that impact forest management in their area. The training agenda can be tailored to each community based on data gathered there; in this case, researchers focused on building leadership and increasing understanding of the role of different government agencies in collaborative forest management. Increased knowledge of rights and responsibilities, and about the process by which policies affect forests and livelihoods, improves the ability of community members to monitor and participate in that process.

VI. Obstacles and challenges encountered

Uganda: heavy rains and flooding that had delayed work in Site 4 improved and allowed researchers to complete the remaining household surveys and to host a workshop for local residents. Slight delays in receiving funding for the new fiscal year impacted the ability of researchers to commence with fieldwork immediately. A shortage of fuel stemming from the strife in Kenya may affect planned field activities.

In addition, insecurity on Mt. Elgon is spilling over from Kenya. A tourist climbing to the peak of Mt. Elgon was killed a week before the site visit, and the research team required an armed escort to carry out forest surveys. Forest surveys in the second site on Mt. Elgon were postponed to the next quarter, when the security situation is expected to improve.

Kenya: The recent election in Kenya caused violence and protests throughout the country and this interfered with the ability of the research team to conduct all anticipated activities. For now, this has delayed a series of round table discussions that were planned in Aberdares, Tugen Hills, and Upper Imenti (Sites 2-4), and all field work is suspended until peace is restored. The LTR #1 Steering Committee asked for a status report from partners at KEFRI, and will consider a revision to KEFRI's work plan depending on this report.

KEFRI also continues to face challenges in getting all NAC members together, and has commented that only 3 NAC members showed real commitment to the project.

Bolivia: two team members left the organization, causing some small delays in fieldwork and analysis. These members were replaced and the new staff trained in survey techniques, decentralization issues, and other topics. The new team members are an economist and a forest engineer.

There were some delays in data collection due to flooding in various areas of the country, affecting more than 12,000 people. This also resulted in the team needing to fly rather than drive to various locations, which results in higher travel costs. Furthermore, there were changes in personnel at partner organization Jatun Sach'a, and the organization is closing its Cochabamba office (which may reduce communication between CERES and Jatun Sach'a in the future).

Mexico: The Steering Committee is continuing to work with the Mexican CRC to make up for delays in data collection. The CRC has developed a plan to complete all 5 sites by the end of Year 3, as originally intended. We developed a system of penalties for late reports, and Mexico received their first fine (of \$65) for a late report due in January. Additional data submittals are required before the second installment of Year 3 funds are issued.

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

PIs: Alex Travis and Alfonso Torres, Cornell University
Dale Lewis, Wildlife Conservation Society-Zambia

Host country: Zambia

I. Executive Summary of overall progress for the past six months

This research project is studying the Community Markets for Conservation (COMACO) model for biodiversity conservation to determine if it is economically sustainable, if it is achieving its conservation goals, and how the COMACO model can be adjusted to increase its effectiveness. Because COMACO focuses on alleviating poverty and hunger, and uses markets to link sustainable natural resource management practices with these outcomes, our research encompasses multiple disciplines including business economics, natural resource economics, soil, crop, food, and veterinary sciences, watershed analysis, and wildlife biology. Our research in this 6 month period has seen progress in each objective as described below. In particular, our research has matured in the individual disciplines such that benefits from one area are impacting research and host capacity building in other areas and points of synergy are noted. In addition, our groups are preparing for cross-cutting activities and data collection in the dry season, when roads become more passable throughout the Valley. Notable new developments included the identification by SANREM research that COMACO might benefit from participation in global carbon markets and a meeting of stakeholders representing various levels of governance (financed by the Norwegian Embassy, but utilizing SANREM research).

II. Research progress by objective.

Objective 1: To determine the extent to which the COMACO model can be economically self-sustaining and the effectiveness of the different COMACO model components. [Note: there are two main activities within this objective. These will be discussed separately, although the latter quantification of the cost of biodiversity conservation depends in part on data from the former.]

A. Business economic analysis:

1. **Progress toward completing Annual Work Plan tasks:** The harvest is yet to be collected, so data for year 3 are not yet available. Purchase of produce and grains takes place up through August. Historical data on the CTCs continues to be collected.
2. **Changes in research design/methods, obstacles encountered, and actions taken:** Progress on closing economic summaries of COMACO's last business year were slightly delayed pending final sales and invoice data, but are now in hand. However, templates for the different commodities that were developed by SANREM-sponsored research continue to be

used with success, and are being updated weekly. Due to success in food sciences, new products are being offered so the economic analyses are being expanded to track these new products.

3. Significant research findings: COMACO's burgeoning agroforestry/reforestation efforts position the organization to take advantage of the growing global carbon markets. COMACO has at least 3 identifiable opportunities: soil carbon sequestration through conservation farming, reforestation, and avoided deforestation. The reforestation efforts are likely to be the most easily developed, and will require new modeling for the mixed *miombo* and *mopane* woodlands, as well as for the agroforestry species being planted.

B. Quantification of the cost of biodiversity conservation through the COMACO model:

1. Progress toward completing Annual Work Plan tasks: A stated preference survey on tourists' "willingness to pay" for wildlife conservation was performed October/November 2007 and the data are being analyzed.
2. Changes in research design/methods, obstacles encountered, and actions taken: No obstacles were encountered that will change activities. Preparations are being made to collect different data sets this summer (e.g. the costs of anti-poaching patrols, trials and incarcerations) that will allow more costs/benefits to be added to the overall equation.
3. Significant research findings: This work endeavors to place economic values on wildlife species and wildlife-related activities. Preliminary data suggest that increases in wildlife are of statistically significant relevance to tourists. Values for different groups of species were quantified in terms of how much more tourists would be willing to pay for even 10% increases in populations. Willingness to pay increased with the size of the species, but even increases in smaller species held value for tourists. The data demonstrate that there is significant potential value to tourists in protecting wildlife in the Valley, and should also provide meaningful assistance to the Zambian Wildlife Authority as they manage the North and South Luangwa National Parks.

Objective 2: To identify and integrate new technologies into the COMACO model to improve its profitability, food security, and rural incomes.

1. Progress toward completing Annual Work Plan tasks: Progress is being made according to schedule in food sciences, crop/soil sciences, and veterinary sciences.
2. Changes in research design/methods, obstacles encountered, and actions taken: No major obstacles were encountered. Indeed, success has been greater than anticipated in the food sciences in terms of building host capacity and increasing COMACO revenue potential. Work in the veterinary sciences increased and is now incorporating more social surveys to determine whether improved poultry production related to vaccination trials for Newcastle Disease virus might impact local bushmeat consumption. These studies are highly complex, multi-factorial, and are just underway.
3. Significant research findings:
Food sciences: COMACO has embraced the recommended food safety and hygiene protocols and is currently interviewing applicants from the University of Zambia (UNZA) for positions as food science technicians at the CTCs to enforce these codes. Last year's technical consulting and experimentation regarding improving shelf life and food production led to reduced breakage of rice, translating into more product and profits. Peanut butter production practices and packaging were optimized to improve product

quality and extend shelf life. The packaging no longer suffers from oil leakage. Alternative rice production protocols led to the development of brown rice products.

Crop and soil sciences: Preliminary data suggest that above ground biomass yield production in maize ($t\ ha^{-1}$) from organic and inorganic amendments was in order of fertilizer + manure > fertilizer + biochar > gliricidia > manure > compost > control. On average, clay soils across the environmental gradient produced higher yields as compared to loam and sandy soils. However, with timeliness in application of organic manure and harvesting, the above results might change.

Veterinary sciences: Vaccination for Newcastle Disease is underway, with several cycles of vaccination already completed. Data are being collected on bird numbers, sale and consumption in the test and control villages. New survey questions were added to the data collection in an effort to see whether these activities are impacting bushmeat consumption. As many social and environmental factors undoubtedly impact bushmeat markets, we must be cautious in expectations regarding the ease of interpretability.

Objective 3: To determine the extent to which the COMACO model provides self-sustaining social institutions and meaningful roles for COMACO participants.

1. Progress toward completing Annual Work Plan tasks: Progress is well underway on all aspects of this objective as outlined in the work plan. Several surveys were completed. A major survey on farmer compliance with sustainable agricultural practices is underway.
2. Changes in research design/methods, obstacles encountered, and actions taken: No major obstacles were encountered to date, with the majority of gender data collection to come in September. Snaring in one chiefdom was noted as unchanged. This chiefdom is therefore NOT going to get the premium prices/unit that the surrounding chiefdoms are receiving. This will be an interesting test of the model, in terms of its ability to use market forces to encourage compliance with the best natural resource management practices.
3. Significant research findings. Networking by Cornell graduate student Ms. Vongai Kandiwa has produced a new collaboration with UNZA. Ms. Chisha Chungu is a graduate student and has been prepared for data collection regarding gender equity and the potential social/economic benefits to participating families, which she will be testing. She is currently visiting sites in the Luangwa Valley in anticipation of data collection in the fall.

A regional government stakeholder meeting was financed by the Norwegian Embassy, and attended by SANREM researchers Dale Lewis and Sam Bell (graduate student on the natural resource economic valuation project). The meeting was an important step in bringing together different levels of governance to discuss the Luangwa Valley as an integrated ecosystem and the possible roles of COMACO within it. Ecosystem-scale management strategies would be the desired long-term outcome.

Objective 4: To determine the extent to which the COMACO model improves biodiversity and watershed conservation.

1. Progress toward completing Annual Work Plan tasks: The survey on tourist “willingness to pay” was carried out and described above for Objective 1, because its data link economics with natural resources. Prof. William Schulze and graduate student, Sam Bell,

will be traveling to the Valley this summer (Zambian dry season) to collect data regarding different costs and benefits of the COMACO model. Watershed analyses are moving forward and will be described by PI Conrad Heatwole, in his watershed cross-cutting activities report. Multi-species aerial wildlife surveys were completed in the fall as planned. These included a survey of hippo populations in the northern Luangwa River, to complement one done in the southern Luangwa River at this time last year.

2. Changes in research design/methods, obstacles encountered, and actions taken: None noted.
3. Significant research findings: Heterogeneity in the wildlife distribution patterns was anticipated and has been found with the surveys. This is expected and is why repeated surveys over time are essential for interpretations. That said, the data show clear differences between the COMACO core areas and the areas where COMACO was not active/is just becoming active. Unlike the aerial surveys over woodlands, the hippo data taken from a single year's survey are much more representative of the actual total population, because the aerial photos are taken in the day, when the hippos are uniformly in the river. These data should be very useful in terms of long-term monitoring of ecosystem health and management, as well as in terms of assessing COMACO's impact on wildlife populations.

III. Significant training, capacity building, and networking activities

1. Form 16 attached, Ms. Chisha Chungu added, University of Zambia graduate student; Ms. Emily Steubing added, Cornell University veterinary student.
2. Form 17 attached.
3. Publications list with proper bibliographic citations enter into SKB

As noted above, the Royal Norwegian Embassy sponsored a regional stakeholder meeting that utilized SANREM research. This meeting brought together participants from several levels of governance and is a major first step toward an ecosystem-scale management plan. New contacts with the University of Zambia resulted in partnership on independent monitoring of family-level benefits/gender equality from COMACO participation. This is the third connection with the University that SANREM has facilitated (also food sciences and veterinary sciences).

IV. Research strategy and development objectives.

Our research strategies are essentially unchanged, although they expanded in the past 2.5 years as the project research and host nation capacity building matured. For example, our poultry vaccination work is being analyzed in terms of animal health impacts and economic impacts, and we are now trying to see whether there are social impacts in terms of natural resource utilization strategies (i.e. bushmeat harvesting). Another example is how food science research, experimentation and training resulted in both new and improved food products. These contribute to COMACO's success as a business, and therefore affect our economic analyses. The optimization/evolution of the COMACO model has progressed such that it can be a focal point in integrated, eco-system scale strategies.

Development objectives were achieved consistently ahead of schedule resulting in the following accomplishments:

- production of new food products (e.g. HEPS, brown rice)
- improved hygiene and safety facilitated new contracts for these products (e.g. HEPS)
- improved production practices (e.g. peanut butter to decrease oil phase separation, and to increase shelf life, rice to reduce breakage)
- improved product packaging (e.g. peanut butter to decrease leakage)
- business accounting and projections benefit greatly from the economic analyses and templates

These specific accomplishments are evidence of the progression of our SANREM research in terms of testing and optimizing the model. Testing the model revealed sub-optimal food production practices that would ultimately led to poor products that were not profitable or safe. Our research identified specific improvements that enabled COMACO to develop new products, decrease wastage, and improve their product quality, packaging, shelf life and marketability. These should lead to improved profits and facilitate economic self-sufficiency. Host capacity building and our facilitation of a relationship between COMACO and the University of Zambia have enabled these kinds of improvements to continue to develop over time. Additional SANREM research has tested the COMACO model's ability to operate as a business and found that its business records were inadequate identifying cost and profit centers. Generation and use of analytical templates and software changed the COMACO business approach. In sum, our research has begun to generate quite specific points of improvement in the model, while simultaneously identifying key points in the model that could be more broadly applicable to development outside of Zambia.

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

PIs: Jeffrey Alwang, Brian Benham, Darrell Bosch, Carola Haas, George Norton, and Mary Leigh Wolfe, Virginia Tech
Paul Backman and Jonathon Lynch, Pennsylvania State University
Duane Chapman, Cornell University
Willis Flowers, Florida A&M University
Sally Hamilton, University of Denver
Stan Wood, International Food Policy Research Institute (IFPRI)
Victor Hugo Barrera, INIAP, Ecuador
Mario Antonio Gandarillas, PROINPA, Bolivia

Host countries: Bolivia, Ecuador

I. Executive Summary of overall progress for the past six months

Progress is proceeding according to plans and all objectives are being met. We had a major training event on watershed modeling was held in Blacksburg, VA during February and March, for two professionals from Ecuador and one from Bolivia. In addition, workshops were held in Ecuador at the national and local (watershed) level. Equipment for monitoring stream flows and weather were installed in both sites, and participatory monitoring is being conducted. A graduate student from Virginia Tech collected data from October – November 2007 and will finish the analysis of determinants of potato variety adoption by June 2008. Combustion analysis for total soil carbon and calculation of carbon storage in the Rio Chimbo watershed by land use in each region was completed.

II. Research progress by objective.

Objective 1: Identify economic, social, political and environmental conditions in the watersheds and understand the determinants of these conditions.

1. Progress towards completing critical Annual Work Plan tasks.

Task 3.1A – in progress. All Cs-137 soil analyses were completed and we are currently using the results to estimate soil loss (Ecuador). In Bolivia, we established a field trial to examine how practices affect runoff (four treatments—initial year of data currently being collected).

Task 3.1.B –in progress. Soil carbon analyses were completed. Results from Tasks 3.1A and 3.1B are currently being incorporated into a manuscript that will be submitted to a peer-reviewed journal.

Task 3.1.C- In progress- Ecuador and Bolivia. Baseline data were collected and are being processed (Bolivia) and analyzed (Bolivia and Ecuador)). Student will defend MS thesis in

May 2008. Completed 2 extension bulletins on (i) integrated natural resource management and (ii) conditions in rural households and food security. Both are being reviewed by the INIAP publication committee.

Task 3.1.D – In progress – Ecuador and Bolivia: Available GIS data were assembled. Additional attribute data, particularly on soils and land use are being developed and obtained. Classification of land uses in Bolivia is continuing. Rainfall and stream flow data collection has begun under the watershed cross-cutting project (Heatwole). SIGAGRO (Ecuador) has incorporated socioeconomic data into the GIS.

Biomonitoring initiated at 8 sites in Illangama and Alumbre watersheds in Ecuador. Data are being entered on aquatic species and chemical composition of water. Chemical values are generally within expected limits. Installed a system for climatic and water monitoring in the two watersheds (Ecuador). In Bolivia, 6 monitoring stations were established.

Task 3.1.E – in progress. In Ecuador, baseline data were collected, but gender analysis has not yet begun. In Bolivia, we identified the main focus of the analysis (access to markets and gender roles in product marketing). Several participatory interviews were designed for market participants.

Task 3.1.F– Not yet initiated in Ecuador. In progress in Bolivia; irrigation systems were identified and geo-referenced; field work will begin in June 2008.

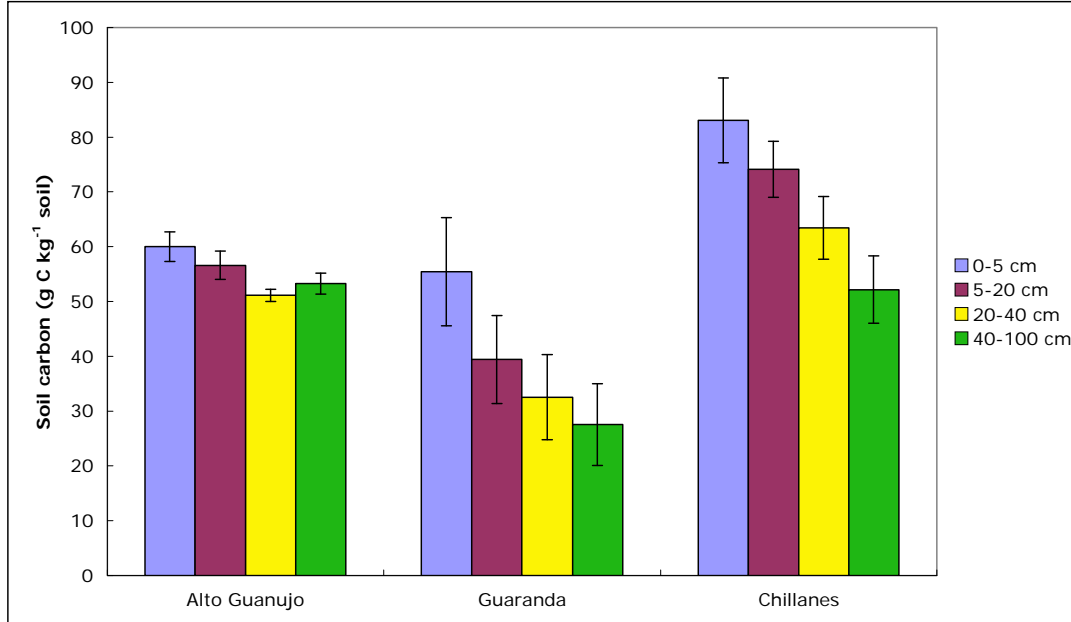
Task 3.1.G—Completed 3rd year of data collection in Ecuador. In Bolivia, we collected data in three zones between November 2007 and February 2008 using standard methods for biodiversity assessment. Publication is expected by May 2008.

2. Changes in research design or methods, obstacles encountered, and actions taken.

We decided to conduct a C-14 radiocarbon dating analysis on select soil samples to compare soil age by location in the watershed and confirm the hypothesis that sites with both high erosion rates and also high carbon levels have younger soils. This analysis is expensive (>\$200 per sample) but will provide key information for describing soil carbon dynamics in the watershed.

3. Significant research findings

- Although average soil carbon concentrations in g C kg⁻¹ soil were highest in Chillanes, average carbon storage on a m⁻³ soil volume basis are highest in Alto Guanujo (Fig 1) due to differences in soil bulk density (compaction).
- Carbon in the litter layer contributed minimally (<2 %) to total soil carbon storage
- These soil carbon values are similar to previously reported carbon levels in Chilean andisols under forest, tree plantation and pasture (Huygens et al., 2005) but slightly lower than those reported in pastures and coffee plantations in the Colombian Andes (Hoyos and Comerford, 2005).
- Several livelihood clusters were identified using the Ecuador baseline data.



Objective 2: Generate and validate environmentally sustainable alternatives to improve production systems and enhance income generation.

Task 3.2.A. - in progress. Since February 2007, we collected in the Alumbre (Ecuador) sub-watershed data on daily precipitation, runoff and total suspended solids. Data collection is ongoing. This year we established runoff trials in the upper Illangama sub-watershed.

Task 3.2.B. – in progress- Results of the fertilizer and nutrition trials are now available. Highlights include:

- No difference in yields between minimum and conventional tillage during 2006-2007.
- Nitrogen is the limiting nutrient in the maize trials. Other elements (phosphorous, potassium, and magnesium) did not affect yields.
- Distribution of nutrients within the plants is available.
- High rate of economic return for adoption of the recommended package.

In Bolivia, established a field trial to examine how practices affect runoff (four treatments—the initial year of data are currently being collected). Established experimental plots for four main products plus strawberries; began nutrient balances on plots.

Problems: extreme rainfall in Bolivia is affecting the representativeness of the research plots. Data may need to be collected for an additional year.

Task 3.2.C. – in progress. Ecuador: economic viability of livelihood alternatives is being investigated using the baseline survey data from task 3.1.C. Several meetings were held with

local farmers to understand their perceptions relative to income-earning possibilities. Several alternatives were identified in addition to factors that might improve incomes on-farm such as using soil conservation techniques and soil maintenance techniques. The latter include planting perennials such as blackberry, avocado, lemons and tree tomatoes. Enhanced exploitation of native forest products (Piquil, Chachacoma, Aliso, Nogal, Higuieron, Tilo, Yagual, Romerillo, Guarango, Laurel de Cera, Musancetas and Siete Cueros) were identified as a possible means of enhancing income generation.

Bolivia: baseline data were compiled; field study was initiated to analyze the determinants of variety choice among potato producers; potential for kanuahua, maca and strawberry production and sales is being analyzed. Maca markets were identified in Cochabamba and investigation is ongoing as to economic viability. Strawberry markets are also being investigated: research will be completed in June.

Task 3.2.D. – in progress. Ecuador: The dairy chain analysis for the Illangama watershed is continuing. Data are being analyzed to identify obstacles to broader participation in higher-valued markets. A market chain analysis is examining the role of intermediaries and determining whether producers are disadvantaged by the marketing system. Data on prices and sales are being collected. Bolivia: we are examining the role of information in determining marketing decisions among potato producers. Information access may constrain ability to enter into higher-valued markets.

Task 3.2.E.-- Completed. An article is being prepared from this analysis in Ecuador.

Task 3.2.F -- in progress. Research is looking (in both sites) of the potential use of endophyte bacteria in addressing disease problems. In Bolivia, means of controlling damage from nematodes are being investigated.

Objective 3: Create a means of evaluating the impacts of alternative actions, policies and interventions on income generation, and social and environmental conditions.

Task 3.3.A—in progress. Baseline data are currently being analyzed for both sites.

Task 3.3.B – in progress.

Task 3.3.C –in progress–Began evaluation of the SWAT watershed model for applicability in Ecuador and Bolivia. Input data files are being developed for the study watersheds. One specific ongoing study is evaluating the capability of SWAT to determine erosion potential within the Tiraque watershed in Bolivia. Work is being conducted on watersheds in both countries to determine appropriate representations of the topography for watershed scale modeling.

Objective 4: Build local capacity to evaluate policy alternatives, make and enforce decisions, and strengthen social capital.

Task 3.4.A –in progress– Benham (Biological Systems Engineering, Virginia Tech) developed and delivered two day-long watershed management workshops that addressed six steps in watershed management planning:

1. Building Stakeholder Partnerships
2. Watershed Characterization – Approach and Data Needs
3. Developing Water Quality Goals and Identifying Possible Solutions
4. Designing a Watershed Management Implementation Program
5. Implementing a Watershed Management Plan
6. Measuring Progress and Making Adjustments

Forty-four people participated in the 21 and 22 January workshops. Workshop resource materials were provided to all participants. Extensive interaction/discussion occurred during both workshops. Feedback about the workshops as communicated to Victor Barrera (the INIAP contact that made all local arrangements) was very positive.

Ecuadorian project participants J. Calles and A. Cárdenas (Ecociencia) and Dr. Wills Flowers from Florida A&M conducted a community-based workshop in the Alto Guanujo area on 23 January. Relationships with local governments are solid and local stakeholders are fully engaged in the process.

Task 3.4.B – in progress – Conducted a month-long modeling workshop at Virginia Tech for three trainees from Ecuador and Bolivia; details are given below (section III.2). Planning started for a modeling workshop to be held in Bolivia and maybe Ecuador in August/September 2008. That workshop will be conducted by the trainees and Virginia Tech personnel and will include sessions on the role of modeling in watershed management and training on the use of specific models.

- Participation of Rubén Botello (PROINPA) in the short-course: “Uso y distribución sostenible del agua en la agricultura” in Cochabamba, Bolivia. 11-15 February 2008.
- Elena Cruz (INIAP) and Ruben Botello participated in 21st Century Watershed Technology: Improving Water Quality and Environment, ASABE, Concepción-Chile 29 March-3 April 2008.

3.4.C. Training in integrated crop management, collection of cost of production data, marketing, organization, gender, and social analysis

- Training for 22 people in Ambato, Ecuador and 41 people in Riobamba on technology for integrated resource management and soil conservation (1 day, February, 2008)
- Soil conservation workshop in Chillanes, for 102 participants.
- Training on data collection for watershed management for 12 men in Bola de Oro and San José del Guayabal.

4. Changes in research design or methods, obstacles encountered, and actions taken.

One of the main obstacles encountered is the lack of historical weather data for the study watersheds. Data are available for purchase in Ecuador. We will probably purchase weather data after we confirm the timeframe that we want to look at, which will be a function of

availability of land use data for the timeframe. We will also investigate work being done at CIP-Lima on generating rainfall data as a function of vegetation indices generated from remotely-sensed images.

III. Significant training, capacity building, and networking activities

1. Degree training students supported (see Form 16).
2. Short-term training events conducted (see Form 17).

Conducted “Modeling Workshop” for three trainees (Ana Karina Saavedra, PROMIC, Bolivia; Adriana Cárdenas, Ecociencia, Ecuador; Carlos Montúfar, SIGAGRO, Ecuador) from February 10 to March 8, 2008; Workshop was conducted by Mary Leigh Wolfe, Conrad Heatwole, and Brian Benham, BSE, Virginia Tech. Activities included lectures, presentations, discussions, readings, and field trips focused on watershed modeling and the use of modeling for watershed management. Trainees learned about modeling concepts such as calibration, validation, sensitivity analysis and also some hands-on experience with several watershed models. The trainees each developed and made a presentation on modeling that they took home to share with colleagues.

3. Publications list with proper bibliographic citation entered into SKB

IV. Research Strategy and Development Objectives

We made substantial progress toward sub-objectives, which contribute to our development objectives. (i) Identify economic, social, political and environmental conditions in the watersheds and understand the determinants of these conditions: we are well on the way toward completing this phase of research. (ii) Generate and validate environmentally sustainable alternatives in order to improve production systems and enhance income generation. Some alternatives might be new crops and new on- and off-farm income-generation strategies, and others would include technical improvements to existing practices. The field-level research is moving us toward completion of these tasks; we now will have a 2nd year for Ecuador and a 1st year for Bolivia. The studies of income-earning alternatives (including the market research) are also contributing to this objective—we have substantial data, but need to complete the analysis. (iii) Create a means of evaluating the impacts of alternative actions, policies and interventions on income generation, and social and environmental conditions. This sub-objective will take individual responses (changes in practices at the field, farm and market scales) and aggregate them to the watershed level. It will create a mapping between policy (and other interventions) and outcomes at the aggregate level. We are moving gradually toward a “watershed model.” During this 6 month period, we completed a major training effort, established necessary physical data-gathering procedures, and continued to construct the GIS-based data needed for modeling. The final sub-objective is: (iv) Build local capacity to evaluate policy alternatives, make and enforce decisions, and strengthen social capital. This is an area where we made substantial progress in Ecuador (through Dr. Benham’s visit), but need to reinforce efforts in Bolivia.

These research objectives will help us attain our TOP framework development objectives, which 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.

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

PIs: Corinne Valdivia, Peter Motavalli, and Jere Gilles, University of Missouri
Karen Garrett, Kansas State University
Anji Seth, University of Connecticut
Cornelia Flora and Jan Flora, Iowa State University
Jorge Cusicanqui and Magali Garcia, Universidad Mayor de San Andrés, Bolivia
Elizabeth Jiménez, Universidad de la Cordillera, Bolivia
Miguel Angel Gonzales and Javier Aguilera, PROINPA, Bolivia
Celia Turín and Silvana Vargas, Universidad Nacional Agraria La Molina, Peru
Carlos Laruta, Centro de Investigación y Promoción del Campesinado, Bolivia

Host countries: Bolivia, Peru

I. Executive Summary of overall progress for the past six months

The analysis of climate change projections has continued successfully, with PI Seth guiding PhD student J. Thibeault. Research was completed by Jimenez UC and Valdivia MU on livelihoods and perceptions of risks in two regions of Bolivia. Second year soil amendments, dynamics of pest research experiments, and crop varieties were established. Findings in soils show that increasing fallow length significantly increased total soil organic C and improved soil fertility parameters, but this result was not uniform across the communities. Frost affected crop production in the Bolivian Altiplano. Several publications were submitted, others published this semester. Participatory evaluations continued in all communities. Advocacy coalition methods training took place with Bolivian collaborators and was implemented in Apopata Puno. Investigators traveled to Peru and Bolivia, as well as between countries to coordinate research and train graduate students.

II. Research progress by objective.

Objective 1: Understanding the effect of drivers on soils, pests, biodiversity, landscapes and livelihoods.

1. Progress towards completing critical Annual Work Plan tasks.

Climate change analysis for the 21st century continues, and shows coherent deficits in early season rainfall and more intense and shorter rainy season for the South American monsoon region. A resulting manuscript, in collaboration with M. Rojas (U Chile) and S. Rauscher (ICTP) is in review for the journal Climatic Change. A manuscript on the analysis of projected changes in mean climate for the Altiplano, in collaboration with M. Garcia, is ready for submission to Geophysical Research Letters. Coordination with SENAHMI colleagues has been initiated, to collaborate on the calculation of extreme indices using observed datasets. Analysis will be part of a collaborative peer-reviewed publication. The lower elevation represented in the

models permits too much moisture. Further research is in progress to examine this. Therefore results for projected frost days and heat waves should be taken with caution. A manuscript with these results is in preparation with student Jeanne Thibeault as lead author. An article was published in a Bolivian journal, highlighting vulnerability to climatic hazards, consistent with observational data of climate trends over the past 30 years.

Significant progress was achieved during the last six months in soils research. Additional samples were taken in Umala to examine the effects of changes in fallow length and cropping systems on soil organic C fractions and other soil properties. The previous samples taken for this study were analyzed. Increasing fallow length significantly increased total soil organic C and improved soil fertility parameters, but this result was not uniform across the communities. An incubation study is being initiated to determine the labile and stable C fractions contained in these samples. Additional samples will be taken from Ancoraimes.

A. Romero and PI Jimenez analysis of the household survey in Bolivia contributed to the publications on climate and market effects on cropping system and soil quality and adaptation. In Santa María, Peru, plans were developed to set up soil experiments (in potato crop fields) to compare aynokas (community managed, privately used) vs. private landholdings to study current practices of soil management. Motavalli met with scientists in Lima in March. We also continued evaluation of potato tuber moth and Andean potato weevil to establish an integrated baseline of these populations and management in this climatic zone. This will be linked to our models of predicted responses of potato tuber moth to climate change in the Altiplano (objective 3). Students working on bachelor's thesis projects set up their research experiments in soils and pests.

On production systems, biodiversity and landscape analysis, students were selected for research on vegetation diversity in Umala and Ancoraimes. F. Navia, P. Zorogastua, and PIs coordinated activities for landscape research. Images for Ancoraimes from 2007 were provided by C. Heatwole, while other three sites remain. Costs are a constraint that we need to address to secure images for this research. We secured CIP collaboration. Participatory mapping training and analysis will be completed when the images are obtained. Research findings for on-going management of crop and varieties were presented by E. Jimenez at the International Conference organized for the Year of the Potato. Analysis of livelihood networks and markets in Umala and Ancoraimes was completed. Diversification and coping mechanisms were identified, and findings are being integrated with the biophysical research findings.

2. Changes in research design or methods, obstacles encountered, and actions taken.

Several communities were affected by frost. Actions were taken to address the impact on second year experiments. Financing was a constraint at the beginning of year 3, and so was personnel with the new activity implemented in Ancoraimes. In Peru, strained relationships between the team and the president of the community in Santa María slowed the process of installing the experiments. Coordination of the landscape research started in November, but progress will depend on the type and number of images we can obtain. Costs are a concern. P. Zorogastua, F. Navia and PIs will determine alternatives. Available images for April 2007 have 15 percent cloud cover. This has delayed training in ground truthing will begin as soon as we have the images.

3. Significant research findings.

Standardized measures of extreme precipitation and temperature were analyzed and demonstrate trends by mid century in: a) decreasing frost days; b) increasing heat wave duration, intensity of precipitation as well as numbers of consecutive dry days.

The evolution during the 21st century suggests moderate changes will be experienced by mid-century, with potentially much larger responses in mean and extreme climate by late century. Although these projections are consistent with the large scale circulation changes projected for the tropics and for the South American Monsoon, the projected trends in frost days and heat wave duration disagree with the recent observed trends in the region, which suggest increases in frost frequency. The observed increase in frost frequency may be explained by increased daytime evapotranspiration yielding drier soils and colder night-time temperatures, which may dominate the warming signal in the Altiplano. These results are an input to analysis on short term, medium term and 21st century adaptation.

Vulnerable populations in the region (Ancoraimes) facing desertification trends and heavy reliance on crops for income and production for consumption were depleting assets to cope with events. Households in this region have a higher level of concern with changes in climate, while in Umala concerns are with specific hazards, frost and drought, consistent with the pattern of warming in this region.

Formal credit institutions are currently not an option for the majority of households in both regions. Family networks are a main source of credit, especially those outside of the communities, consistent with seeking strategies that are not covariant with risks in the region, as well as temporary migration.

Objective 2: Perceptions with regard to drivers and resources, and to risks.

1. Progress towards completing critical Annual Work Plan tasks.

Analysis of the household survey with L. Rees continues, as part of her thesis research. A publication was completed and published in CIDES journal series that presents findings on the relationship between livelihood strategies, assets and risk perceptions. Abstracts were prepared for the annual meeting in the Philippines. J. Gilles traveled to La Paz to complete research on networks and climate indicators in January for a publication under review by Bulletin of the American Meteorological Society BAMS. Participatory evaluations continue in the field projects to capture farmers' perceptions of the soils, dynamic of pests, and crop varieties research. The Bolivian team developed a plan to share with farmer groups.

Recordings of the workshops on climate change were transcribed and translated from Aymara.

Farmers in Umala were asked to evaluate the soil amendment trials and those in Ancoraimes evaluated the soil amendment trials, quinoa and biodiversity of potatoes. The soil amendment evaluations were conducted at the time of potato flowering and harvest.

Capacity building activities on pest life cycles (weevil) were undertaken in Santa María, discussing current practices that affect pests. A poster describing the weevil life cycle was shared with the community.

2. Changes in research design or methods, obstacles encountered, and actions taken.

Assessment of participation in groups has shown that women face more barriers to participate. Strategies are being developed to address this constraint. Participation in evaluations by farmers has declined especially among women. This is largely due to the time demands required and the fact that farmers are less interested in repetition of experiments. Methodologies for participatory evaluations were standardized between sites and projects and organized in a way to reduce demands on farmer time. Time is a constraint in general for farmers, so the process of sharing knowledge with the communities is being coordinated among all the scientists in Bolivia. Time constraints are also a consideration given the amount of knowledge to return to farmer groups. As a result, integrated plans were developed for assessing practices as well as returning information.

3. Significant research findings.

Perceptions of hazards are high in both regions, consistent with the high percent of population that has experienced climate shock events. Feelings of dread about climate hazards and climate change are high, with frost and drought dominating Umala, and climate change concerns being higher in Ancoraimes. Pests are consistently perceived as a threat in all regions. Farmers' assessments of soil amendments rank organic amendments that include manure higher than others, even though research shows otherwise.

Data from San Jose Llanga in 1999 was compared with the survey results from 2006. There has been a significant decline in the use of traditional means for predicting weather and reducing climate related risk—in 1999 98% of the producers used these techniques versus 74% in 2006.

Objective 3: Practices and Information for Adaptation (Linking Local and New Knowledge)

1. Progress towards completing critical Annual Work Plan tasks.

Valdivia participated in the launching of the Mechanism for Adaptation of the Bolivian National Program on Climate Change in November Previous research completed by L. Rees shows a disconnect between institutional knowledge and rural communities' access to said knowledge. A data base that includes Bolivian and Peruvian household data was constructed to compare characteristics across all sites.

Groups of farmers representing communities from the higher part of the Ancoraimes watershed were formed to work with agronomists in the observation and application of traditional indicators.

Agronomic response and community perceptions of both the initial and residual effects of conventional and alternate fertilizer sources are being assessed. Combined applications of organic and inorganic fertilizer sources generally out yielded other treatments, but community perceptions often favor plant performance observed for cattle or sheep manure sources (objective 2). The field studies were established in all the test communities in Umala and are currently being harvested and evaluated by community participants. Incubation studies are being initiated to determine the soil C and N mineralization rates from the several conventional and alternate organic fertilizers (e.g., compost, peat moss).

Biology, pests and climate change scenarios are the focus of the KSU biology group and SANREM team members in UMSA and PROINPA. Garrett authored the following publications: (a) a paper on the utility of cultivar mixtures for potato late blight management across a climatic gradient, accepted pending revision in *Ecological Applications*; (b) a synthesis paper on plant disease in the context of ecosystem services, submitted in March; (c) two papers on climate change and plant disease risk, in press in a National Academy of Sciences publication and a book on climate change; (d) two chapters on sustainable disease management and potato late blight in developing countries; and (e) five teaching modules for international training in plant disease epidemiology and an associated teaching publication about their preparation, published in *The Plant Health Instructor*. Garrett submitted a publication that summarizes analysis and inclusion of new models of the effects of host biodiversity on epidemics (Garrett et al., in revision). Three publications review the impacts of climate change on plant disease risk. Publications on baseline populations of major potato pests and management of biodiversity are in preparation.

The field team in Puno overseen by the IPSS-UNALM team has engaged in continuing the advocacy coalition process in Apopata and initiated soils experiment in Santa Maria. The Apopata coalition research team has identified and carried out interviews with different stakeholders (from state and civil society) in Ilave and Puno. Two capacity building/training workshops took place in the communities: the first one in Apopata dealt with animal health and the second one that took place in Santa María dealt with the weevil life cycle. Reports and a poster were prepared by the technical team.

2. Changes in research design or methods, obstacles encountered, and actions taken.

In Ancoraimes, significant early frost damage and planting problems in November damaged all the field plots and only one field plot survived in the community of Chinchaya. In Santa María local politics resulted in suspension of advocacy coalition activities.

3. Significant research findings.

The KSU team evaluated the effects of climatic zone on the utility of sustainable disease management practices such as the use of cultivar mixtures of differing resistance. In regions where the season of potato production is longer, such methods have less impact, probably because there is a tendency for inoculum saturation. The effects of climate change may be greatest when there are thresholds, interactions, or positive feedbacks that impact risk (Garrett 2008). In addition to temperature and precipitation effects, rising CO₂ may also influence disease risk (Chakraborty et al., in review). Sustainable management of emerging diseases will require system-thinking to manage the portfolio of crops produced (Garrett and Cox 2008).

A synthesis with sponsorship by the US National Center for Ecological Analysis and Synthesis, evaluated plant disease in the context of ecosystem services (Cheatham et al., in review). Plant disease can decrease ecosystem services both directly, through damage to plants providing services, or indirectly, through the effects of steps taken for disease management. Host biodiversity can mediate the effects of disease.

Objective 4: Develop market access through strategies and institutions that contribute to resilience.

1. Progress towards completing critical Annual Work Plan tasks.

The advocacy coalition approach is being implemented in Bolivia and Peru to address market strategies that increase farmer negotiation. E. Fernandez Baca is leading the skills development team. The first training took place in Puno Peru with 6 Bolivian collaborators. The Apopata Peru research team continued with the advocacy coalition process. Apopata members identified and interviewed different stakeholders (from state and civil society) in Ilave and Puno dealing with alpaca production and fiber processing for added value. Since the visits to relevant stakeholders in Apopata just recently occurred, we cannot see yet any coalition emerging as a result of the identification of common goals and mental causal models. It is not yet obvious that agency has been formed.

The Bolivian team developed a plan to share survey results on markets and crops, using the advocacy coalition model. Figueroa and Valdivia's abstract to the AAEA meetings, on Participatory Market Chain Approach (PMCA) on Chuño Tunta Platform was accepted.

Coordination of the gender and markets research activities was on going. C. Turin and J. Thomas evaluated the livelihoods surveys of Peru and Bolivia, and developed a poster for presentation at the Puno Peru meetings. Market analysis for Ancoraimes and Umala were completed by A. Romero, and will inform farmers in both regions.

2. Changes in research design or methods, obstacles encountered, and actions taken.

The Spanish term for advocacy coalitions has been changed to *alianzas*. The former is a more complex term and difficult for people to relate with it. Two new undergraduate students selected are developing thesis projects on: 1) Local, regional and national market opportunities for local varieties of potatoes; and 2) Characteristics and implications of women's participation in the commercialization of crops with emphasis on marketing local (native) and introduced (commercial) varieties of potatoes in Ancoraimes and Umala, Bolivia, to understand the nature and characteristics of marketing and the role of coalitions to improve market strategies.

3. Significant research findings.

Assessment of the PMCA shows high transaction costs to participation by farmers in three communities of Umala, who currently are working to improve their markets for native varieties with PROINPA.

Market Climate Interactions: 84.5 % of the population in Umala has suffered the impacts of climate shocks in the last 25 years. In Ancoraimes almost 100% have. The most remembered events in Ancoraimes are frosts, hail and floods, which have become stronger since 1997 and especially 2002. The strongest climate effect in the region was drought, especially during the 1980s. This has shifted to floods in the last eight years, consistent with expected present day trends in climate change. In this context, mechanisms to deal with shocks are necessary, but at this time farmers mostly have access to informal credit. Coping in Umala depends on savings and temporary migration. Only 19% of the population has access to public institutions for assistance. On the other hand, coping in Ancoraimes is linked to sale of livestock assets, which

further impacts on future income generation. Farmers' major concerns about losses are mainly related to climate, although the loss of assets is a result of lack of other mechanisms to deal with shock.

Objective 5: Capacities and Capabilities – Strengthen Ability to Act.

1. Progress towards completing critical Annual Work Plan tasks.

Research efforts on participation and agency continue. Three workshops were conducted in communities in Ancoraimes to present the results of the first year of project research and to assess community reactions.

Three PIs travelled during the first semester to the region to continue to foster coordination across research sites. Valdivia's travel focused on developing plans for sharing new knowledge with community groups, and to develop data bases that integrated baseline and monitoring. She also coordinated communication with other country stakeholders, SENAMHI and PNCC in Bolivia, and coordinated landscape research among UMSA, CIP, KSU and VT. Gilles coordinated climate networks research. Motavalli coordinated soils research in Bolivia and set up plans in Peru.

2. Changes in research design or methods, obstacles encountered, and actions taken.

The president in the community of Santa María has imposed conditions that are difficult to negotiate in order to continue with the Advocacy coalition process. UNALM investigators first tried to change the focus by starting with the experiments (aynokas-private landholdings) and then through the experiments entering into advocacy coalitions. The idea was abandoned before it was even put in practice. AC in this community has been suspended. Initial approaches to assess participatory research as part of KASAP were assessed, and monitoring of individuals and groups discussed.

The potato harvest delayed the fourth Ancoraimes workshop to April. Workshops in Umala scheduled for March had to be postponed because of the unavailability of quality maps of the area. The maps will arrive in time to do the workshops in May.

Research plans were revised by the Bolivian team, and a new structure of monitoring was set up with O. Yana and E. Yucra working under the supervision of J. Cusicanqui and E. Jiménez. A data base by individuals participating in assessments and a data base by household were developed to monitor participation, and to link with the livelihood strategies, capitals and assets, networks of information and activities in the baseline survey. The approach will be shared at the annual meeting with colleagues in Peru to develop a joint instrument for assessment (second household survey); one approach will be agreed to for monitoring and evaluation in year 3-4 to capture information on KASAP, and ability to act on new information.

3. Significant accomplishments

A very obvious lesson that has led us to stop AC activities: A process has to include the support of the leadership.

Several new students, Bachelors and MS, in Bolivia started their research projects, in October and November. Students in the Innovation MS Program at La Molina Peru were assigned research projects. Researchers in Bolivia and Peru were trained in SPSS. Farmers in

Peru and Bolivia were trained in pests (Andean weevil and white moth) and IPM through workshops. An MS student from the Innovation Program at La Molina, has been assigned to document participation and learning to action. Farmer workshop on animal health took place in Apopata, Puno. Field researchers in Peru had an introduction to the use of GPS. Knowledge sharing and evaluation took place in Bolivia with soils, pests and varieties of crops.

Various team members developed abstracts and posters for the Peru and Philippines meetings. E. Fernandez worked on a methodology to enable Community Governance for Market Integration and Adaptation to Climate Changes: Agency and the Advocacy Coalition Approach in the Peruvian Altiplano.

III. Significant training, capacity building, and networking activities

1. Update degree training students supported (complete and attach Form 16).

Training efforts in the soils-related research expanded significantly. An additional undergraduate thesis student in soil science was added to the Umala site. A M.S. student will be starting his soil-science research in Peru under the supervision of Drs. S. Garcia and J. Alegre at the UNALM. A new M.S. student in Agroecology will start her research in Bolivia on a soils-related theme. The Ph.D. student in soil science from Bolivia at University of Missouri has passed his qualifying exam and will present his SANREM-based research at the 2008 Annual American Society of Agronomy Meetings in Houston, Texas. An MS student in agricultural economics selected paper submission was accepted at the AAEEA. As part of the new biotechnology project in soil metagenomics, Lorena Gomez has started her MS at KSU. She has already given two poster presentations about the project.

KSU team published five peer-reviewed on-line training modules for the teaching of plant disease epidemiology in regions where libraries may have few resources (Esler et al. 2007, Esler et al. 2008, Garrett et al. 2007a, Sparks et al. 2008a, and Sparks et al. 2008b). Also published is a paper on approach to including students in writing these modules (Garrett et al. 2007b).

An MA Sociology student, O. Yana completed her thesis research and will present results at the Annual Meeting in April on women's participation in participatory research, using livelihood assets/capital baseline survey and qualitative interviews. J. Gilles taught 15 hours of classes at the doctoral program at CIDES, Universidad Mayor San Andrés in January.

2. Update short-term training events conducted (Form 17).

3. Update publications list with proper bibliographic citations and enter into SKB* (Form 18).

4. List any special events or networking activities.

Four major events were coordinated in the first six months and will take place between April 21 and 30. The first is a meeting with the National Program on Climate Change in Bolivia to share findings and identify areas of collaboration for out scaling of our approach and up scaling into their program. For the meetings are being coordinated by Drs. Seth, Gilles, and Valdivia with SENAMHI Bolivia and will analyze extremes for the modeling. This is a critical element of the climate change models. IPPS UNALM took the lead in organizing the annual meeting of the teams in Peru and Bolivia and the US meeting April 24 – 27 in Puno, Peru. Valdivia was invited by McKnight Foundation to organize a workshop in Lima on Climate Change and

Andean Production to inform current and future priority funding areas in this organization. Co-investigators from our institutions in Peru and Bolivia were invited to participate as well as our coPIs in the US.

Funding for a cross-cutting research activity in soil quality and soil metagenomics was received in March. Subcontracts were signed in April. The funds and projects are now in place. During this time KSU developed the metagenomics training materials. Motavalli coordinated activities on soil cross-cutting research activities in Bolivia. Fernandez Baca and Jimenez coordinated activities on Gender and Knowledge to Action. The last two are in-line with ongoing research activities, which made it possible to quickly implement these activities. On the landscape research C. Heatwole provided images for the Ancoraimes site. We will coordinate at the annual meeting in Puno how to proceed with the other four sites. Due to the delay in awarding year three, because of concerns that we would not spend 90 percent of our funding for year 2, we were only able to start reimbursing sub-awardees in November. We moved as fast as possible after the letter of award for FY2008 was received from the ME.

IV. Research strategy and development objectives.

1. Describe progress achieving TOP Framework milestones.

Significant progress has been achieved in understanding the impact of drivers at the household and regional level. In tandem, perceptions of risks and dread in objective 2 are consistent with findings in objective 1. Significant progress has also been achieved in analyzing climate trends of the past thirty years, as well as in the models of climate change for Altiplano for the medium term (30-50 years) and the 21st Century. Practices in soil amendments, crops varieties, and information for adaptation are in the second and first year of activities respectively. A severe frost affected research at one of the sites. A system of data collection to measure impact of participation to test the transformative hypotheses of the project has been developed and will be a focus of the next annual meeting.

2. Discuss any lessons learned relevant to development goals.

Advocacy coalitions as an approach to strengthen human agency is a skill the research team is currently learning. The team first implemented the process in Puno, and now it is being implemented in Bolivia. Involvement in advocacy coalitions depends on support from community officials and not only on members. This is a lessons learned in Santa María.

Several frost events resulted in losses to farmers, as well as research plots in the communities as the crops failed in Ancoraimes. While impacting on agriculture, events also impact people's perceptions, and these become a time for reflection on adaptation practices that may reduce the effect of extremes, which can in turn contribute to our goal in the impact pathway of shifting from response to prevention. This will be included in the discussions on vulnerability when information on climate maps is socialized.

Collaborators in Peru shared: a) the KASAP tool as a model to develop other baseline tools; b) the Advocacy coalition framework and the example of how it is being used in Puno in capacity building for social research workshops; and c) the Community Capitals and the Advocacy Coalition frameworks out scaling methodologies across regions with the Bolivian team.

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

PIs: Manuel Reyes, North Carolina Agricultural and Technical State University, USA
Robin Marsh, University of California-Berkeley, USA
Ronald Morse and Conrad Heatwole, Virginia Tech, USA
David Midmore, Central Queensland University, Australia
Howard-Yana Shapiro, Mars Inc. and University of California-Davis, USA
Raghavan Srinivasan, Texas A&M University, USA
Delia Catacutan, Agustin Mercado, and Rodel Lasco, ICRAF-The World Agroforestry Centre, Philippines
Suseno Budidarsono and Meine van Noordwijk, ICRAF-The World Agroforestry Centre-Indonesia
James Roshetko, ICRAF-The World Agroforestry Centre-Indonesia and Winrock International
Flordeliza Faustino, Liwayway Engle, Greg Luther, and Manuel Palada, AVRDC-The World Vegetable Centre, Taiwan
Ma. Elena Chiong-Javier, De la Salle University, Philippines
Victor Ella and Ma. Victoria Espaldon, University of the Philippines-Los Baños
Dang Thanh Ha, Nong Lam University, Vietnam
Jean Saludadez, University of the Philippines-Open University
Anas Susila and Bambang Purwoko, Bogor Agricultural University, Indonesia
Paul Catalan, Don Bosco Technical College, Philippines

Host countries: Indonesia, Philippines, Vietnam

I. Executive Summary of overall progress for the past six months

Work on vegetable-agroforestry compatibility is advancing rapidly with new findings that narrow the focus and advance the socio-economic work on the adoptability specific technologies. The drip irrigation work is successful and looks like it will be spreading quickly in the locality. Market value chain analyses identified several areas for further study, particularly concerning the introduction of indigenous species such as Katuk, Kucai, and Malunggay. Policy analyses in Vietnam and the Philippines determined that overall policies are supportive; however, these policies overwhelmingly benefit large-scale farmers. Further, it is recommended that incentives for good environmental practices are best negotiated at the local rather than the national level. Computer simulations of soil erosion are demonstrating that conservation practices, used by SANREM farmers for many years, need to be disseminated more widely. A communication study in Vietnam concluded that a participatory approach is more likely to achieve success with indigenous people, than the traditional technology transfer approach used with recent migrants. The gender work is gearing up with a gender awareness workshop under preparation. It was found that innovative strategies such as publication of techno-guide, pamphlets, and video documentation of farming practices enhanced farmer's awareness and knowledge of vegetable-agroforestry systems.

II. Research Progress by Objective

Objective 1: Develop economically viable and ecologically-sound vegetable-agroforestry systems.

1. Progress towards completing critical Annual Work Plan tasks

Several vegetable tree system studies demonstrated that there are vegetable-tree combinations, which can increase yield of vegetables even when vegetables are planted beside and partially shaded by trees. One result showed that integrating trees into vegetable systems increased vegetable yield by 5% to 30%. Net complimentary indices, which measure the benefit of vegetable-tree systems, were developed for some vegetable-tree combinations. Responses of vegetables to varying light intensities showed that some vegetables grow best in full sunlight, some in medium sunlight, and some in low sunlight with one study finding that pruning more than 40% of tree canopy reduced vegetable yields. Another study concluded that tree-vegetable competition is non-existent during the early tree establishment stage. Several indigenous vegetables, many of them more nutritious than traditional vegetables, were evaluated. Results were promising with many well adapted for growing alongside trees. Farmers were surprised that Malunggay, an indigenous tree vegetable, grew well in acid soils at high elevations. On the other hand, trees benefited from vegetables as well. It was found that planting vegetables in between cashew trees increased cashew yield.

Experiments on the 'International Development Enterprise' low-cost drip irrigation (IDE-drip) with chili-tree system indicated that drip will likely minimize vegetable-tree moisture competition. It was also found that IDE-drip in home vegetable gardens increased yields and substantially reduced labor compared with traditional hand irrigation. To enhance design of IDE-drip systems, an extensive evaluation of the water application uniformity coefficient of IDE-drip as a function of operating head and slope was conducted, which resulted in IDE-drip design guidelines for steep slopes. Tree root pruning and putting a plastic barrier between the pruned roots and the vegetables grown beside them, showed a 75% increase in chili yield. It is likely that increased chili yield can be attributed to a decrease in nutrient competition when the tree roots were pruned and barred with plastic.

From an extensive review of literature, it was found that *A. pintoii* has excellent prospects as living mulch for soil erosion control. It can also reduce use of chemical fertilizer and herbicide and may have aliphatic properties that can deter insect pests. Several trials to assess beneficial impacts of perennial peanut (*Arachis pintoii*) as a vegetable cover crop are underway. A no-till drill prototype was designed and fabricated, and test showed that it was able to cut *A. pintoii* bed cleanly up to a depth of 8 cm and a width of 9 cm. A prototype seeder, fertilizer applicator and dibbler were also designed and fabricated. Test results showed that the seeder had no problems delivering seeds and the fertilizer applicator dispensed about 45 grams per meter. The dibbler delivered 10 to 11 seeds per minute. Other studies showed that vermicost was an excellent media for chili pepper transplant production, and vetiver grass can prevent termites from destroying young cacao seedlings.

2. Changes in research design or methods, obstacles encountered, and actions taken

Some planned nutrient work on the vegetable-tree complementarities was eliminated for budgetary reasons. However, we were able to leverage work on the effect of trichoderma inoculation and on improving the management practices for transplant production of chili pepper. We learned that the root crop, Cunang, does not grow under local soil conditions and will reconsider these experiments elsewhere. We are slightly behind schedule on the establishment of the *arachis pintoii* as a cover crop, as it takes longer than expected for full establishment.

3. Significant findings.

Vegetable-tree systems:

- Net complementarity indices (a measure of a positive or negative impact of a tree species to vegetable yield) of *Eucalyptus torillana* tree, were developed for several vegetables.
- Integrating trees into vegetable systems with proper tree line/hedge spacing will increase yield by 5% to 30%.
- When pruning trees, removing more than 40% of the canopy reduces vegetable yield.
- Broad leaved trees, unless pruned, are not appropriate for vegetable agroforestry systems.
- 'Medium' light levels increased the yield of several vegetables when compared with vegetables grown under no-shade conditions.
- Drip irrigation increased yield of bell pepper planted perpendicular to a hedge of *Eucalyptus torillana* trees.
- Tree root pruning of *Eucalyptus torillana* trees and putting a plastic barrier along the root pruned hedge increased the yield of bell pepper planted perpendicular to the hedge. The plastic barrier likely minimized nutrient competition from trees.
- Tree-vegetable competition is non-existent during the early tree establishment stage.
- Planting vegetables in between cashew rows increase cashew yield.

Low cost drip irrigation system:

- International Development Enterprise (IDE) low cost drip irrigation system increased vegetable yields and saved water and labor when compared with hand irrigating vegetables in home gardens.
- The operating head of IDE low cost drip irrigation system had better emission discharge uniformity with a 3 m head than with lower heads.
- The steeper the slopes of the IDE low cost drip irrigation systems' submain, the poorer the distribution coefficient regardless of the operating head.
- There is no significant difference in uniformity coefficient of the IDE drip system when heads differed by 0.5 m.

Other experiments:

- A dibbler planter was fabricated and tested that can deliver 10 to 11 seeds per minute.
- A mixture of vetiver grass and compost with clumps of vetiver grass surrounding cacao seedlings controlled damage by termites on 6 month old cacao seedlings as good as termite pesticides.
- Malunggay (*M. oleifera*), a vegetable tree, surprisingly performed well in acid soils at higher elevations.
- Vermicost was an excellent media for chili pepper transplant production.

- From literature review, *A. pintoii* has excellent prospects as living mulch for soil erosion control, can reduce use of chemical fertilizer and herbicides, and may have aliphatic properties that deter pests

Objective 2: Develop a market value chain at the local, regional and national levels that builds upon existing marketing strategies.

1. Progress towards completing critical Annual Work Plan tasks

Several weak links were identified in market value chains: low use of technology, weak extension activities, inadequate supply of production inputs, poor marketing infrastructure, weak market linkage, and inadequate post harvest handling. Solutions are underway to strengthen these links. At one site, 30 women and men farmers visited a nearby village experienced in growing, handling and marketing the high demand indigenous vegetables, Kucai and Katuk. The participating farmers saw that Katuk and Kucai can be grown and marketed successfully and are enthusiastic about growing Kucai and Katuk on their farms. Furthermore, experienced Kucai and Katuk farmers will share their 'best practice' knowledge by going to the farms of their visitors. The project will provide 100 kg of Kucai seed and 60,000 stem cuttings of Katuk to facilitate development of commercial plots by participating farmers. Additionally, post harvest training will be held when Katuk and Kucai plots reach commercial maturity. In another site, a book is being written on market value chain research findings, which includes a review of market research and related literature particularly on vegetable marketing. Marketing action plans will be done after farm management analysis is completed. Surveys on farmer's marketing network will be conducted in connection with gender research.

2. Changes in research design or methods, obstacles encountered, and actions taken

Everything has proceeded according to plan.

3. Significant findings.

- TMPEGS-Vietnam reports that local demand for vegetables is increasing, but low use of technology, weak extension activities, inadequate supply of production inputs, poor marketing infrastructure and weak market linkage and post-harvest performance are all detriments to the development of agricultural markets in Nghia Trung.
- TMPEGS-Indonesia reports that Katuk and Kucai farmers and traders reported that
 - indigenous vegetables Katuk and Kucai have good prices, with prices increasing over time, demand higher than supply, and that goat and chicken manure are excellent fertilizers
 - Katuk grows well in about 25% shade, which was also confirmed by the 'T' studies; and grows well when planted with cassava
 - it is not known if Kucai grows well under higher shade conditions

Objective 3: Identify policy options and institutional frameworks that promote sustainability of vegetable-agro-forestry production and reward environmental services.

1. Progress towards completing critical Annual Work Plan tasks

Policy environments for vegetable agroforestry are supportive in two sites. However, vegetable agroforestry policies tended to benefit rich farmers rather than poor farmers. Hence, there is a need to alert government policy makers to revise vegetable agroforestry policies to address this bias. It was recommended that incentives for good environmental practices are best negotiated at the local rather than national level. An extensive paper on the policy environment of vegetable-agroforestry systems was completed.

2. Changes in research design or methods, obstacles encountered, and actions taken

Everything has proceeded according to plan.

3. Significant findings.

- The policy environment is supportive of vegetable agroforestry systems.
- Vegetable agroforestry policies tend to benefit the rich farmers rather than poor farmers.
- Incentives are best negotiated at the local rather than the national level.

Objective 4: Assess the short and long-term environmental and socio-economic impacts for farm families adopting integrated vegetable-agroforestry systems

1. Progress towards completing critical Annual Work Plan tasks

At one site, the environmental destruction caused by traditional vegetable production practices was alarming. Computer simulations of soil erosion in cropped areas are 55 and 157 times more soil loss than pasture and forested areas, respectively. It was encouraging though because in this site many vegetable farmers are practicing soil conservation methods, which can be traced to SANREM influence at the Lantapan site. A trend study of years of research at the Lantapan site found that income from agricultural employment has consistently declined, with agricultural wages lower than non-agricultural wages; and that use of pesticides, especially in vegetable production, has intensified, potentially endangering people's health and polluting natural resources. An economic study at another site showed that out of 6 vegetables analyzed, chili is the only vegetable that is profitable in an agroforestry system. A communications study on a third site concluded that a participatory approach is more likely to achieve success with indigenous people, than the traditional technology transfer approach used with recent migrants.

2. Changes in research design or methods, obstacles encountered, and actions taken

Difficulties in SWAT parameterization are slowing progress, but being resolved by the team. Since many of the technologies are not ready for dissemination, analyses of social acceptability were delayed.

3. Significant findings

- Initial SWAT simulations in the Philippines showed that cropped areas have erosion rates 55 and 157 times higher than pasture and forested areas, respectively. Potato production had the most erosion with soil losses 95 and 293 times more than pasture and forested areas, respectively.
- Benefit cost analysis in Indonesia showed that of 6 vegetables used in the light intensity study, only chili is profitable.
- In Vietnam, it was concluded that the participatory approach to technological innovation is more successful with the indigenous Stieng people while the traditional technology transfer approach is effective with the migrant Kinh and Hoa farmers.
- Philippines site:
 - Agriculture employment share in total employment has consistently declined over the last 36 years with agriculture wages lower than the non-agriculture wages.
 - Despite intensification of vegetable production, vegetable farmers are practicing soil conservation measures. This finding is encouraging, and could be a result of sustainable agriculture knowledge traceable to past SANREM influence.
 - There seems to be the continuous shift in land use away from cereal crops and into commercial crops like bananas, sugarcane, vegetables and coffee.
 - Use of agrochemicals in vegetable production intensified. These inputs have the biggest share in the production cost of crops.
 - Agricultural externalities due to chemical use are a growing problem and agricultural policy should focus on the measures to mitigate these externalities' impacts on health, water, soil and air

Objective 5: Provide mechanisms to ensure women's involvement in decision-making and sustainable production and marketing practices to improve their socioeconomic well-being within the vegetable-agroforestry system.

1. Progress towards completing critical Annual Work Plan tasks

Gender studies are in various stages. In one site, a book is being written integrating gender literature findings with gender survey results. On-going conversations with women and men showed that they organize their farm lives as partners. At another site, a first gender awareness workshop is being planned to improve the skills of village leaders in planning and implementing gender-sensitive policies, programs and projects, which ensure women's participation in vegetable agroforestry enterprise. All sites agreed on a cross-cutting study on gendered networks and livelihood alternatives.

2. Changes in research design or methods, obstacles encountered, and actions taken

This work is being coordinated with the Gender and Markets Cross-Cutting Initiative.

3. Significant findings

Nothing to note this period.

Objective 6: Build host country capacity to manage and disseminate integrated vegetable-agroforestry system.

1. Progress towards completing critical Annual Work Plan tasks

The TMPEGS website was expanded to include vegetable-agroforestry system related extension materials including techno-guides and pamphlets and video documentation of farming practices. Furthermore, the model farm approach video showcased tangible results satisfying the 'wait and see' attitude of the local farmers, which can increase the chances of adoption of vegetable agroforestry, practices within and outside the study area.

2. Changes in research design or methods, obstacles encountered, and actions taken

Everything has proceeded according to plan.

3. Significant findings

Nothing to note this period.

III. Significant training, capacity building, and networking activities

1. Update degree training students supported (See Form 16)

2. Update short-term training events conducted (See Form 17)

3. Update publications list with proper bibliographic citations and enter into SKB* (Form 18)

4. List any special events or networking activities

- Planning for the January 2009 SWAT-SEA international conference. Twenty-three institutions from all over the world involved.
(<http://www2.mcc.cmu.ac.th/swat/detail.php?data=organizer>)
- ICRAF-scientist Iwan Kurniawan facilitated a team of 19 male and 5 female farmers to network and engage with farmers who are experts in growing Katuc and Kucai. This farmer-to-farmer engagement will be encouraged to continue.
- ICRAF-Indonesia partnered with BPPT (Agency for Assessment and Replication) to use their land for production plot trials.
- ICRAF-Indonesia established linkages between a trader and local farmers to market Katuk, Kucai, and cassava.
- Bogor Agricultural University scientist Mahmud Raimadoya networked with JAXA, an earth observation agency, to obtain free medium resolution imagery of the SANREM site in Indonesia.
- ICRAF scientist Dr. Agustin Mercado reported that partnership with Australian Centre for International Agricultural Research and SANREM facilitated cross visits of farmers from different municipalities and provinces in Mindanao, including those areas controlled by the Moro Islamic Liberation Front (MILF)

- Rector and two other top administrators of SANREM-TMPEGS partner Nong Lam University visited NCA&T, the University of North Carolina-Greensboro, and North Carolina State University.
- Dr. Jean Saludadez from SANREM-TMPEGS partner UP-Open University, visited NCA&T and Virginia Tech.
- Juang Kartika, a researcher from SANREM-TMPEGS partner Bogor Agricultural University was sponsored by the Indonesian embassy for three months soil quality training at NCA&T. She also wrote review paper on *Arachis pintoi*.
- ICRAF-scientist Dr. Delia Catacutan visited Nong Lam University and introduced the Knowledge to Action concepts research method and Philippines policy review methodology.
- AVRDC-scientists Drs. Greg Luther, Manuel Palada and Wong Jong-Guy visited Nong Lam University and Nghia Trung village to conduct a participatory research appraisal and training.
- External evaluation panel reviewer Dr. Edwin Price visited with TMPEGS-Indonesia

IV. Research strategy and development objectives.

Many farmers are now aware of the benefits of vegetable agroforestry systems because of the successful results of the vegetable-tree studies. Farmers started producing indigenous vegetables, and because of the success in indigenous vegetable-tree ‘Malunggay’ testing, farmers requested Malunggay planting materially. Malunggay is very nutritious and farmers are better appreciating the benefits of vegetable home gardens.

SANREM participating farmers are enthusiastic about growing the high demand vegetable Katuk and Kucai. Katuk was found to grow well under trees and SANREM will provide 100 kg of Kucai seed and 60,000 stem cuttings of Katuk. SANREM found that good environmental policies are best addressed in local rather than national levels. Local government units are being encouraged by SANREM researchers to practice vegetable agroforestry.

A good example of TMPEGS impact is this quote from SANREM researcher Agustin Mercado: “. . . drip irrigation is now widely promoted at the municipal level in which the local government units provide funds for the purchase of drip irrigation kits to vegetable farmers thus allowing more farmers to benefit from the technology promoted by the SANREM project. This project also facilitated cross visits of farmers from different municipalities and provinces in Mindanao including those areas controlled by the Moro Islamic Liberation Front (MILF).”

Cross-Cutting Initiatives

Watershed Modeling and Assessment

PI: Conrad Heatwole, Virginia Tech.

I. Executive Summary

The goal of this activity is to enhance the impact of the SANREM CRSP mission by supporting and strengthening the long-term research activities (LTRAs) through technical support of watershed modeling activities and to initiate a cross-cutting activity in watershed modeling and assessment. Objectives are to: 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; and 3) design and implement low-cost community-based watershed monitoring programs.

This report period covers the startup of the project, and the major effort has been the installation of field instrumentation for watershed hydrologic monitoring, and specification and purchase of imagery to support land use classification in LTR project sites in Bolivia, Ecuador, Zambia, Philippines, Indonesia and Vietnam.

Between Oct 2007 and Feb 2008, project sites in Bolivia, Ecuador, and Zambia were visited twice. These trips selected site locations for hydrologic monitoring in consultation with field/watershed coordinators, prepared and installed field equipment, trained partners in flow monitoring, and collected field data for land use classification. The basic approach being used for stream flow monitoring is to select monitoring locations in the natural stream channel with a stable cross-section. At each location, a data-logging pressure sensor records pressure every 10 or 15 minutes. A non-vented pressure sensor is being used because of flexibility in installation options and simplicity of maintenance. A reference pressure sensor is located in each watershed to record barometric pressure, which is used to 'correct' the stream pressure data to give water depth. Sensor sensitivity is better than 1cm. A staff gauge at each site is used by a field observer to record water depth on a daily basis as a reference and validation for the sensor data. The stage-discharge relationship at each monitoring station is being developed to convert depth (stage) to flow rate, and requires measurement of flow rate for a range of low to high flow conditions. Basic equipment for flow measurement was provided for each watershed team including a flow meter, electrical conductivity testers, balance, and stopwatch. An important focus of the time in the field was to practice the flow monitoring techniques using the flow meter and the salt dilution (tracer) method in the mountainous locations.

In each watershed, weather stations, recording rain gauges, and manual rain gauges were installed to give good spatial coverage of the area. At least one complete weather station (rainfall, temperature, relative humidity, solar radiation, wind speed and direction, and barometric pressure) is located in each watershed, with 2-4 additional recording rain gauges throughout the watershed. Additionally, cooperating local observers record daily rainfall using a manual plastic rain gauge, and some of these observers also take daily readings of stream staff gauges. The connections of the partners in the watershed are very important and the interest and

commitment of local observers appears strong. This collaboration with local observers is very important for the completeness and quality of the overall data collection effort in the watersheds.

The salinity dilution (salt tracer) method for estimating flow rate in the streams is very important in some of the project watersheds because it is a flow measurement technique that is suitable for use in turbulent mountain streams. Training on flow monitoring using the salinity tracer method and flow meter was an important component of site visits, both to collect background data, but also to provide hands-on training to clarify methods and ensure quality control.

Training was a key element of all activities during these trips: reviewing basic concepts of watershed hydrology and fundamentals of monitoring for water balance assessment, and providing specific instruction related to the installation, operation, and maintenance of different types of instrumentation. This training has been accomplished primarily through ‘hands-on’ experience in the field.

Summary of accomplishments across the 8 project watersheds in Bolivia, Ecuador and Zambia:

- 21 stream gauging stations (pressure sensors and staff gauge) installed
- 7 weather stations installed and operating
- 16 recording rain gauges (tipping bucket) installed
- initial data on flow rates at each station
- training on flow monitoring using the salinity tracer method and flow meter for project teams at each location
- base imagery acquired for 8 project watersheds

II. Research Progress by Objective

Objective 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.

Work plan tasks are on schedule. The primary challenge is the acquisition of satellite imagery for the preferred time periods to enable specific classification goals (e.g. distinguish between crops and pasture). Cost, unavailability of satellite services, and difficulties with cloud cover (Andean sites in particular) are controlling factors beyond our control.

Specific accomplishments:

- Base imagery acquired for 8 project watersheds
- Land parcels digitized and 2007 basic land use classification for the Zambian Luelo and Kamwamphula watersheds.

Objective 2: Assess the impacts of climate variation and land use practices on agricultural sustainability and natural resource management at a watershed scale.

Work plan tasks are on schedule. The primary challenge is the acquisition of satellite imagery for the preferred time periods to enable specific classification goals (e.g. distinguish between crops and pasture). Cost, unavailability of satellite services, and difficulties with cloud cover (Andean sites in particular) were controlling factors beyond our control.

Specific accomplishments:

- Base imagery acquired for 8 project watersheds

Objective 3: Evaluate the accuracy and value of low-cost community-based monitoring of watershed hydrology.

Work plan tasks are on schedule. There were some challenges including significant floods that damaged a few stations. The rainy season is now largely over for Bolivia and Zambia and evaluation of the data from this season and preparation/refinement of the monitoring plan for the upcoming season will be a priority.

Specific accomplishments:

- 21 stream gauging stations (pressure sensors and staff gauge) installed
- 7 weather stations installed and operating
- 16 recording rain gauges (tipping bucket) installed
- initial data on flow rates at each station
- training on flow monitoring using the salinity tracer method and flow meter for project teams at each location
- Preliminary data for this first year from field observers and instruments for comparison

III. Significant Training Capacity Building, and Networking Activities

- Modeling workshop at Virginia Tech for Ana Karina Saavedra (Bolivia), Carlos Montufar (Ecuador), and Adriana Cardenas (Ecuador), 11 Feb – 8 Mar, 2008, in partnership with the LTRA-3.
- Informal training in hydrologic monitoring for host-country partners in Bolivia, Ecuador, and Zambia. This field experience includes selection of sites, installation of equipment, calibration and operation of equipment, flow monitoring techniques.

IV. Research Strategy and Development Objectives

Basic hydrologic data characterizing watershed response provides important information for quantifying water resources of a community. Identifying, defining and quantifying community resources are important steps in being able to ‘manage’ those resources. Hydrologic data is also critical for the calibration and evaluation of models that can be used to assess the long-term impact of climate and practice changes on the watershed. We rely on models as tools to evaluate the biophysical conditions and response of a watershed to a variety of activities and stressors. This cross-cutting activity supports the individual LTRAs in their impact assessment and will provide insight on the data, methods, and tools and their utility in that assessment.

Preliminary experiences with community monitoring has been positive. Observers were engaged, even enthusiastic in their participation. The quality of the data has been good to excellent, and provides valuable verification of the automated stations and logged data from sensors.

Assessing and Managing Soil Quality for Sustainable Agricultural Systems

Principal investigator (PI): Peter Motavalli, University of Missouri.

The goal of this project is to examine common soil quality issues across a wide range of climates, cropping systems and socio-economic conditions represented in the on-going SANREM-CRSP projects. Based on the objectives of this project, initial activities concentrated on collecting samples and developing methodologies for the 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. A Ph.D. student (from Thailand) based at the University of Missouri has started her research project and is currently evaluating methods to prepare samples for mid-infrared spectroscopic analysis. Samples collected from agricultural fields of varying fallow and cropping length in the Bolivian Altiplano are being tested as part of this initial evaluation.

A soil quality field kit has been adapted based on the KMnO_4 procedure developed by Ray Weil at the University of Maryland and is currently being tested across the U.S. by the U.S. Natural Resources Conservation Service. Two versions of the kit are being tested in this cross-cutting project. One kit contains a portable spectrophotometer and the other an interpretative card. Both the directions for use of the kit and the card were translated into Spanish. Three kits were taken to Bolivia and distributed to PROINPA in La Paz and Cochabamba and the other kit was provided to UMSA in La Paz. Field training for use of the kit was conducted in Umala in March, 2008. Based on this training several adaptations to the method were recommended. One unexpected problem with the method has been the difficulty in acquiring KMnO_4 in Bolivia since it is a controlled substance associated with illegal drug manufacture. An additional kit will be provided to UNALM in April for use in an associated project. Carolla Chambilla, a Bolivian professional working with PROINPA, will be funded through this project to undertake her M.S. degree at a Bolivian university. Collaboration with the cross-cutting soil metagenomics project has been initiated. Collection of samples from the Ancoriames community study site was delayed because of the need for fresh samples for DNA extraction. Peter Motavalli travelled to Bolivia in March and identified with our Bolivian collaborators several criteria for the site selection, timing of the sampling and sampling methodology. The purchase of a freezer at UMSA for soil sample storage until the training and extraction can be done was recommended.

Biotechnology: Soil Metagenomics to Construct Indicators of Soil Degradation

PI: Karen Garrett, Kansas State University.

A M.S. student at KSU, Lorena Gomez, with both Spanish and English language skills has been recruited to work on the project. She has begun training in the techniques for the project and training materials we will use in workshops with the Valdivia and Alwang projects are being drafted for publication in both English and Spanish in the open-access on-line peer-reviewed journal *The Plant Health Instructor*. Initial soil samples from the Travis project in Zambia are expected in June. The August workshop in La Paz is timed to coincide with collection of samples in Bolivia in coordination with the Bolivian student working on the project.

Gendered Access to Markets: Gendered Networks and Livelihood Alternatives

PI: Maria Elisa Christie, Virginia Tech.

Cross-cutting research collaborators refined questions and the research framework to better suit areas of collective inquiry. In addition, guidance was provided for development and reformulation of LTRA-2 and LTRA-3 student research questions and methodology. Considerable progress was made in identifying and summarizing key articles on gender and development, sustainable agriculture, and NRM research (120 in English and 26 in Spanish). These were added to the SKB. A subset of the 10 most useful references were sent directly to the PIs and participants in gender cross-cutting research. A summary was also provided on the SANREM webpage. Thirty key websites were also identified and added to the SKB. The gender workshop for 2008 SANREM annual meeting was planned and funding for participation of gender researchers in the annual meeting is being provided.

Linking Knowledge and Action: Meeting NRM Challenges in SANREM

PI: Esther Mwangi, John F Kennedy School of Government, Harvard University.

The knowledge to action cross cutting theme is intended to systematize the recording and analysis of the different strategies used by LTRA1, LTRA3, LTRA4 and LTRA5 to influence policy and practice, and to gain an understanding of what strategies worked and how research/policy linkages can be enhanced. Of the four research teams, one has just completed a survey of major stakeholders, both government and non government actors in the forestry sector. One other team has designed a questionnaire, which will be administered to stakeholders involved in the research program as well as the environmental parliamentary committee that influences policy making in the forestry sector. All teams will participate in a breakfast meeting during the SANREM meeting in Philippines in order to coordinate their efforts now that funding has been disbursed for the activity.

Policy System Coordinator and Technical Committee Chair

PI: Gerald Shively, Purdue University

Continued collaboration with LTRA partners in Vietnam on research topics related to smallholder agriculture and environmental pressure. Research on the sustainability of smallholder cocoa production systems was undertaken in Sulawesi leveraging the financial support of MARS/Masterfoods. Journal articles are in progress based on a survey conducted in 2006 among 750 cocoa resulting in a student thesis in 2007. Research aimed at better understanding agricultural resource allocation in Indian agriculture, through cooperative research with ICRISAT is mostly complete although some publication efforts are ongoing. One Ph.D. student has been identified for SANREM support for follow-on work on the topic of vulnerability and climate change. A series of papers (in collaboration with colleagues in Earth and Atmospheric Sciences) are in progress.

Appendix: Training Tables

SANREM CRSP Semi-Annual Report: degree training participants, cumulative as of FY 2008, March 2008

Student Name	Sex (M/F)	Nationality	Discipline	Country(s) Supported	Sandwich Program (Y/N)	Program		Degree	Funding (\$)		SANREM CRSP Advisor/PI (degree granting institution first)
						Start Date	End Date		SANREM CRSP	Non-SANREM CRSP	
Amy Duchelle	F	USA	Forestry	Bolivia	N	Aug-03	Jun-08	PhD	Y	Y	P. Pacheco (University of Florida)
Catherine LaRoche	F	Canada	Agricultural economics	Bolivia	N	Sep-06	Aug-06	PhD	Y	Y	Alwang/Bosch (Virginia Tech)
Diego Pacheco	M	Bolivia	Political Science	Bolivia	N	Sep-05	May-08	PhD	Y	Y	E. Ostrom (Indiana University)
Jeanne Thibeault	F	USA	Geography/Climate	Bolivia	N	Sep-06	Sep-09	PHD	Y	Y	A. Seth (University of Connecticut)
Olga Yana (UC)	F	Bolivian	Sociology	Bolivia	N	Sep-06	Sep-08	MS	Y	Y	E. Jiménez (Universidad de la Cordillera)
Patricia Uberhuaga	F	Bolivia	Economist	Bolivia	N	Aug-05	Jul-08	PhD	Y	Y	P. Pacheco (The Royal Veterinary and Agricultural University-Denmark)
Porfidia Ajata (UC)	F	Bolivian	Economics	Bolivia	N	Sep-06	Oct-07	MS	Y	Y	E. Jiménez (Univ. Andina Simón Bolívar)
Javier Aguilera Alcón	M	Bolivian	Soil Science	Bolivia	N	Aug-06	Sep-10	Ph.D.	Y	Y	Peter Motavalli (U. of Missouri Columbia)
Griselda Gonzales	F	Bolivian	Rural Development	Bolivia	N	Apr-07	Apr-09	MS	Y	Y	E. Jiménez (CIDES – UMSA)
Alejandro Romero	M	Bolivian	Rural Development	Bolivia	N	Apr-07	Apr-09	MS	Y	Y	E. Jiménez (CIDES – UMSA)
Elvio Herrera Aruquipa	M	Bolivian	Soil Science	Bolivia	N	Oct-06	Sep-07	ING	Y	Y	R. Miranda (Univ. Mayor de San Andres)
Blas Mamani Vargas	M	Bolivian	Soil Science	Bolivia	N	Oct-06	Sep-07	ING	Y	Y	R. Miranda (Univ. Mayor de San Andres)
Milan Mamani	M	Bolivian	Biodiversity	Bolivia	N	Sep-06	Aug-07	ING	Y	Y	Miguel A. Gonzales (UMSA)
Eliceo Tangara	M	Bolivian	Soil Science	Bolivia	N	Sep-06	Sep-07	ING	Y	Y	Javier Aguilera (UMSA)
Claudia Jarandilla	F	Bolivian	Plant Pathology	Bolivia	N	Sep-06	Mar-08	ING	Y	Y	Miguel A. Gonzales (UMSA)
Miriam Gomez	F	Bolivian	Plant Pathology	Bolivia	N	Sep-06	Sep-07	ING	Y	Y	Miguel A. Gonzales (UMSA)
Nelly Calle Kantuta	F	Bolivian	Agronomy	Bolivia	N	Nov-06	Aug-07	ING	Y	Y	Peñaranda/Ruiz (UMSA)
Antonio Paz Arcani	M	Bolivian	Agronomy	Bolivia	N	Nov-06	Aug-07	ING	Y	Y	Peñaranda/Ruiz (UMSA)
Julio Sarmiento Vargas	M	Bolivian	Agronomy	Bolivia	N	Nov-06	Aug-07	ING	Y	Y	Cusicanqui/ Cruz (UMSA)
Dora Aguilar Endara	F	Bolivian	Agronomy	Bolivia	N	Nov-06	Aug-08	ING	Y	Y	Cusicanqui/ Cruz (UMSA)
Viviana Vera	F	Bolivian	Plant Pathology	Bolivia	N	Oct-07	Sep-08	ING	Y	Y	Miguel A. Gonzales (UMSA)
Juan Sipe	M	Bolivian	Soil Science	Bolivia	N	Oct-07	Sep-08	ING	Y	Y	Miguel A. Gonzales (UMSA)
Carlos Cladera	M	Bolivian	Soil Science	Bolivia	N	Oct-07	Sep-08	ING	Y	Y	Miguel A. Gonzales (UMSA)
Miguel Gonzales Aldana	M	Bolivian	Plant Pathology	Bolivia	N	May-07	May-09	MS	Y	Y	Karen Garrett (UNALM)
Justin Thomas	M	USA	Rural Sociology	Bolivia	N	Sep-07	Aug-07	PhD	Y	Y	J.Gilles (University of Missouri Columbia)

Student Name	Sex (M/F)	Nationality	Discipline	Country(s) Supported	Sandwich Program (Y/N)	Program		Degree	Funding (\$)		SANREM CRSP Advisor/PI (degree granting institution first)
						Start Date	End Date		SANREM CRSP	Non-SANREM CRSP	
Nadezda Amaya	F	Bolivia	Economics	Bolivia	Y	Aug-07	Jun-09	MS	Y	N	Alwang (Virginia Tech)
José Carlos Claros	M	Bolivia	Agronomy	Bolivia	N	Sep-06	Sep-07	BS	Y	N	Botello (UMSS)
Richard Sánchez	M	Bolivia	Economics	Bolivia	N	Aug-07	Mar-08	BS	Y	N	Amaya/Botello (UNITEPC)
Sonia Tola	F	Bolivia	Plant Pathology	Bolivia	N	Nov-07	Sept-08	Lic	Y	Y	Jorge Cusicanqui (UMSA)
Lorena Gomez	F	Colombia	Soil Metagenomics	Bolivia	N	Jan-08	Sept-09	MS	Y	Y	Karen Garrett (KSU)
Freddy Navia	M	Bolivia	GIS Landscape	Bolivia	N	Sep-07	Dec-09	MS	Y	Y	Jere Gilles (UMSA)
Carolla Chambilla	F	Bolivia	Agroecology	Bolivia	N	Jan-08	Jun-10	MSc	Y	Y	Peter Motavalli (University of Missouri)
Edwin Yucra	M	Bolivia	GIS Climate	Bolivia	N	Sep-07	Dec-09	MSc	Y	Y	Jere Gilles (University of Missouri)
Mirco Peñaranda	M	Bolivia	Water Resources	Bolivia	N	Jul-08	Jul-10	MS	Y	Y	Jorge Cusicanqui (UMSA)
Marcos Willy Quispe	M	Bolivia	Soil Science	Bolivia	N	Oct-07	Sept-08	ING	Y	Y	Miranda (UMSA)
María Figueroa	F	Ecuador	Agricultural Economics	Bolivia	N	Sep-06	Aug-08	MS	Y	Y	C. Valdivia (Univ. of Missouri Columbia)
Erin Frank	F	USA	Plant Pathology	Bolivia	N	Aug-06	Sep-06	MSc	Y	Y	Karen Garrett (Kansas State University)
Lisa Rees	F	USA	Agricultural Economics	Bolivia	N	Jun-06	Aug-09	PhD	Y	Y	Valdivia/Marks (Univ. of Missouri)
Shauna P. Dendy	F	USA	Plant Pathology	Bolivia	N	Jun-06	Sep-09	PhD	Y	Y	Karen Garrett (Kansas State University)
Javier Osorio	M	Bolivia	BSE	Bolivia/Ecuador	N	Jan-07	Dec-09	PhD	N	Y	Wolfe (Virginia Tech)
Guido Yactayo	M	Peru	BSE	Bolivia/Ecuador	N	Aug-07	May-09	MS	N	Y	Wolfe (Virginia Tech)
Johannes Postma	M	US	Horticulture	Bolivia/Ecuador	N	Jun-06	Jun-09	PhD	Y	Y	Lynch (Penn State)
Mike Castelhana	M	US	Economics	Ecuador	N	Aug-06	Jun-08	MS	Y	Y	Alwang (Virginia Tech)
Amelia Henry	F	US	Soils-Horticulture	Ecuador	N	Jun-06	Jun-08	PhD	Y	Y	Lynch (Penn State)
Raul Jaramillo	M	Ecuador	Soils-Horticulture	Ecuador	N	Jun-06	Jun-08	PhD	Y	Y	Lynch (Penn State)
Eugenia Núñez	F	Ecuador	Social Science	Ecuador	N	Jan-07	Jan-08	BS	Y	N	Barrera (Universidad de Bolivar)
Moazir Celleri	M	Ecuador	Social Science	Ecuador	N	Jan-07	Jan-08	BS	Y	N	Barrera (Universidad de Bolivar)
Edwin Chela	M	Ecuador	Soil Science	Ecuador	N	Jan-07	Jan-08	BS	Y	N	Valverde (Universidad de Bolivar)
Julia Pryde	F	US	Engineering	Ecuador	N	Apr-06	Sep-06	MS	Y	N	Wolfe (Virginia Tech)
Martha González	F	Ecuador	Social science	Ecuador	N	Aug-06	Jan-08	BS	Y	N	Barrera (Universidad Estatal de Bolívar)
Rachel Melnick	F	US	Plant pathology	Ecuador	N	Jan-06	Sep-09	PhD	Y	Y	Paul Backman (Penn State)
Robert Andrade	M	Ecuador	Agricultural economics	Ecuador	N	Aug-06	Sep-08	MSc	Y	Y	Jeff Alwang (Virginia Tech)
Víctor Barrera	M	Ecuador	Social science	Ecuador	Y	May-06	Aug-09	PhD	Y	Y	Jeff Alwang (Univ. Politécnica de Madrid)
Edy Setyawan	M	Indonesian	Plant Protection	Indonesia	N	Aug-05	Dec-09	PhD	Y	Y	Rauf/Susila (Bogor Ag University)

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						Start Date	End Date		SANREM CRSP	Non-SANREM CRSP	
Juang Kartika	F	Indonesian	Horticulture	Indonesia	N	Aug-07	Dec-08	MS	Y	Y	Anas Susila (Bogor Ag University)
Tisna Prasetyo	M	Indonesian	Horticulture	Indonesia	N	Aug-07	Dec-07	MS	Y	Y	Anas Susila (Bogor Ag University)
Didik Hermanto	M	Indonesian	Horticulture	Indonesia	N	Aug-07	Dec-07	BS	Y	Y	Purwoko (Bogor Agricultural University)
Prima Rahanita	F	Indonesia	Horticulture	Indonesia	N	Aug-07	Dec-07	BS	Y	Y	Anas Susila (Bogor Ag University)
Ratna Pambayun	F	Indonesia	Horticulture	Indonesia	N	Aug-07	Dec-07	BS	Y	Y	Purwoko (Bogor Agricultural University)
Novita Novaliana	F	Indonesia	Horticulture	Indonesia	N	Aug-07	Dec-07	BS	Y	Y	Purwoko (Bogor Agricultural University)
Mega Ayu Lestari	F	Indonesia	Horticulture	Indonesia	N	Aug-07	Dec-07	BS	Y	Y	Purwoko (Bogor Agricultural University)
Nia Kurniatusholihat	F	Indonesian	Horticulture	Indonesia	N	Aug-07	Aug-07	BS	Y	Y	Purwoko (Bogor Agricultural University)
Moussa Keita	M	Mali	Local Development	Mali	N	Jan-04	May-08	MS	Y	Y	Moore/Cissé (Delta-C)
Gustavo Garcia Lopez	M	USA	Political Science	Mexico	N	Aug-05	Sep-09	PhD	Y	Y	E. Ostrom (Indiana University)
Jorge Pretel	M	Peruvian	Statistics	Peru	N	Mar-07	Sept '07	ING	Y	Y	Karen Garrett (UNALM)
Cecilia Turin Canchaya	F	Peruvian	Rural Sociology	Peru	N	Aug-07	Aug-07	Ph.D.	Y	Y	J. Gilles (University of Missouri Columbia)
Clovis Bailon Flores	M	Peruvian	Agricultural innovation	Peru	N	Mar-07	Dec-08	MS	Y	Y	S. Vargas (Univ. Nacional del Altiplano)
Jenny Choque Flores	F	Peruvian	Agricultural innovation	Peru	N	Mar-07	Dec-08	MS	Y	Y	Jan Flora (Uni. Nacional del Altiplano)
Doris Bartolo	F	Peruvian	Agricultural innovation	Peru	N	Mar-07	Dec-08	MS	Y	Y	S. Vargas (Univ. Nacional del Altiplano)
Helen Villanueva	F	Peruvian	Biology	Peru	N	Nov '06	Nov-08	MS	Y	Y	Karen Garrett (UM San Marcos)
Christian Candela	M	Peruvian	Agricultural Innovation	Peru	N	Mar-07	Sep-09	MS	Y	Y	Fernandez-Baca (UNALM)
Alex Fernandez	M	Peruvian	Agricultural Innovation	Peru	N	Mar-08	Sep-09	MS	Y	Y	Fernandez-Baca (UNALM)
Olga Rita Quispe	F	Peruvian	Agricultural Innovation	Peru	N	Mar-08	Sep-09	MS	Y	Y	Fernandez-Baca (UNALM)
Pedro Camacho	M	Peruvian	Agricultural Innovation	Peru	N	Mar-08	Sep-09	MS	Y	Y	Fernandez-Baca (UNALM)
Janice B. Sevilla	F	Filipino	Envi. Science	Philippines	N	Nov-06	Mar-09	M Sc.	Y	N	V. Espaldon (UPLB)
Laarni Lacandula	F	Filipino	Envi. Science	Philippines	N	Oct-06	Mar-07	PhD	Y	N	V. Espaldon (UPLB)
Charmaine T. Pailagao	F	Philippines	Environmental Science	Philippines	N	Apr-07	Sep-08	MS	Y	Y	Espaldon/Catacutan (UPLB)
Nathaniel Alibuyog	M	Philippines	Agricultural Engineering	Philippines	N	Oct-06	Sep-08	PhD	Y	Y	Victor Ella (UPLB)
Noel Gordolan	M	Philippines	Agricultural Engineering	Philippines	N	Oct-06	Aug-07	BS/MS	Y	Y	Victor Ella (UPLB)
Evelyn Lwanga	F	Uganda	Political Science	Uganda	N	Aug-01	May-08	PhD	Y	Y	E. Ostrom (Indiana University)
Pam Jagger	F	Canada	Political Science	Uganda	N	Sep-03	Sep-08	PhD	Y	Y	E. Ostrom (Indiana University)
Vuong Hoang Cuong	M	Vietnam	Agriculture Economics	Vietnam	N	Aug-06	Jan-07	Bs	Y	Y	DT Kim Lan (Nong Lam University)

Student Name	Sex (M/F)	Nationality	Discipline	Country(s) Supported	Sandwich Program (Y/N)	Program		Degree	Funding (\$)		SANREM CRSP Advisor/PI (degree granting institution first)
						Start Date	End Date		SANREM CRSP	Non-SANREM CRSP	
Hoang Van Anh	M	Vietnam	Agriculture Economics	Vietnam	N	Aug-06	Jan-07	Bs	Y	Y	DT Kim Lan (Nong Lam University)
Huynh Van Lao	M	Vietnam	Agriculture Economics	Vietnam	N	Oct-05	Nov-07	MSc.	Y	Y	DT Ha (Nong Lam University)
Rasmus Lybaek	M	Denmark	Information & Media Studies	Vietnam	N	Oct-06	Dec-06	MSc.	Y	Y	DT Ha (Aarhus University, Denmark)
Luong Thi Bich Van	F	Vietnam	Ag Economics	Vietnam	N	Sep-04	Dec-07	Bs	Y	Y	LV Du, DT Ha (Nong Lam University)
Pham Thi Kieu Trang	F	Vietnam	Ag Economics	Vietnam	N	Sep-04	Dec-07	Bs	Y	Y	ND Thanh, DT Ha (Nong Lam University)
Le Van Nhu	M	Vietnam	Agronomy	Vietnam	N	Jan-08	Dec-08	Bs	Y	Y	Le Van du (Nong Lam University)
Erin McDonald	F	USA	Veterinary Medicine	Zambia	N	Jun-05	May-08	DVM	Y	Y	Lucio/Torres (Cornell University)
Vongai Kandiwa	F	Zimbabwean	Development Sociology	Zambia	N	Sep-04	Jul-09	PhD	Y	Y	Eloundou-Enyegue (Cornell University)
Lydia Gatere	F	Kenyan	Soil & Crop Sciences	Zambia	N	May-06	May-10	PhD	Y	N	Johannes Lehmann (Cornell University)
Samuel Bell	M	Australian	Applied Economics and Mgmt	Zambia	N	Sep-05	May-10	PhD	Y	N	William Schulze (Cornell University)
Buttke, Danielle	F	USA	Biomedical Sciences	Zambia	N	Aug-04	May-10	DVM	Y	Y	Alexander Travis (Cornell University)
Chisha Chungu	F	Zambian	Social Science	Zambia	N	Apr-08	Apr-09	MS	Y	N	Eloundou-Enyegue (Cornell University)
Emily Steubing	F	USA	Veterinary Medicine	Zambia	N	Jan-08	Aug-08	DVM	Y	Y	Lucio/Torres (Cornell University)

SANREM CRSP non-degree training, FY 2008 (October 2007-March 2008)

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
Bolivia						
Seminar	Jan 2008	Students UMSA	12	3	PROINPA	Capacitating of students in participative evaluations
Seminar	Jan 2008	Umala communities	36	9	PROINPA	Training farmers on Integrated Management of Crops quinoa
Seminar	Feb 2008	Umala communities	36	9	PROINPA	Agroecological analysis
Seminar	Feb 2008	Umala communities	36	9	PROINPA	Pheromones practices (plagues quinoa and potato)
Short Course	Nov 2007	Graduate students working with household survey data base	1	3	Universidad de la Cordillera	Introduction to SPSS Quantitative approaches to SSCC research
Short Course	Nov 2007	Graduate students working with household survey data base	1	3	Universidad de la Cordillera	Use of SPSS for descriptive statistics to analyze the household surveys
Short Course	Dec 2007	Graduate students working with household survey data base	1	3	Universidad de la Cordillera	Regression analysis techniques to analyze the household surveys
Short Course	Dec 2007	Graduate students working with household survey data base	1	3	Universidad de la Cordillera	Cluster analysis techniques to analyze the household surveys

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
Short Course	Jan 2008	Doctoral students CIDES UMSA	4	5	J. Gilles, University of Missouri Columbia	Participatory research, networks, knowledge systems
Short course	Feb. Mar. 2008	Four communities Ancoraimes	55	35	Universidad Mayor San Andrés	Training on handling chemicals in agriculture
Workshop	Oct. 2007 and Jan. 2008	Chinchaya	6		Universidad Mayor San Andrés	Water balance in the Chojñapata Watershed: management plan formulation
Workshop	Oct 2007	Communities	36	9	PROINPA	Quantify the different weevil species
Workshop	Nov 2007	Project Students SANREM (PROINPA, UMSA, IPSS)	4	1	PROINPA	Train students to identify the potato weevil and setting of traps
Workshop	Nov. 2007	National Advisory Committee	7	1	CERES / U. Colorado	Trained NAC members and others in community forestry and institutional analysis principles
Workshop	Dec 2007	Umala municipal authorities and representatives of the participatory communities	37	8	PROINPA	Diffusion of results about potato pests and quinoa
Workshops	Feb 2008	Ancoraimes, Chinchaya	8	5	Universidad Mayor San Andrés	Participatory evaluation on soils
Workshop	Jan-Mar 2008	Foresters	2		CERES	Trained in IFRI forest data protocol
Workshops	Apr 2008	Ancoraimes, Chinchaya	35	15	Universidad Mayor San Andrés	Participatory evaluation on soils, pests and soil fertility
Workshops	Apr 2008	Ancoraimes,	20	10	Universidad Mayor	Participatory evaluation on soils, pests and

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			Men	Women		
		Calahuancani			San Andrés	soil fertility
Workshops	Apr 2008	Ancoraimes four communities	68	42	Universidad Mayor San Andrés	Participatory Maps Assessment
Workshop	Apr 2008	Ancoraimes four Communities	68	42	Universidad Mayor San Andrés	Sharing knowledge on pests, soils, biodiversity and climatology
Ecuador						
Field day	Jan 2008	Farmers	12		INIAP/Virginia Tech	Data collection methods
Short course	Feb-Mar 2008	Host-country professionals	1	2	Virginia Tech-BSE	Watershed modeling
Workshop	Nov 2007	Farmers	100		INIAP	Soil conservation
Workshop	Jan 2008	Project partners	18	5	Benham (Virginia Tech)	Watershed management
Workshop	Jan 2008	Farmers and stakeholders	17	4	Behnam (Virginia Tech)	Watershed management
Workshop	Feb 2008	Farmers	16	6	INIAP	Natural resource management
Indonesia						
Study Tour	January 22, 2008	Farmers	19	5	ICRAF-Indonesia	To improve farmers' knowledge and skills on good management and marketing of vegetables; encourage farmers that they can succeed because they saw successful farmers; replicate good practice from successful farmers;

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			Men	Women		
						and network with successful farmers
Kenya						
Workshop	Oct-Dec 2007	Community members in Ramogi Hills (Site #5)	4	6	KEFRI	Trained in IFRI/SANREM data collection and PRA methods
Workshop	Oct-Dec 2007	Community members in Ramogi Hills (Site #5), government officials, members of civil soc orgs	49	34	KEFRI	To discuss expectations and responsibilities under the New Forest Act, which focuses on community participation in forest management
Mexico						
Workshop	Jan-Mar 2008	Community members in Site 4 (Comaltepec)	3		UNAM	Trained community members in forest mensuration techniques
Workshop	Jan-Mar 2008	Grad/undergrad students	1	4	UNAM	Trained students in IFRI and data collection techniques
Peru						
Short course	Feb 2008	Puno technical team	3	2	Universidad Nacional Agraria La Molina	To learn how to use SPSS
Short Course	Nov 2007	Researchers at graduate Innovation module Puno	3	3	Universidad Nacional Agraria La Molina	Advocacy Coalition Methodology
Workshop	Nov 2007	Puno and Lima	4	5	Universidad	Adjust work and Discuss work plan for

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			Men	Women		
		Research team			Nacional Agraria La Molina	year 3
Workshop	Nov 2007	La Paz Team Farmer Knowledge Sharing Plan	6	7	Valdivia and Jimenez At UMSA La Paz	Identify products, methods, and assessment procedures
Workshop	Jan 2008	Community members of Apopata	20	22	Universidad Nacional Agraria La Molina	To train farmers on animal health issues
Workshop	Feb 2008	Community members of Santa Maria	12	17	Universidad Nacional Agraria La Molina	To train farmers on the biological cycle of the Andean weevil
Workshop	March 2008	Community members Apopata	5	5	Universidad Nacional Agraria La Molina	To prepare for interviews with stakeholders
Philippines						
Uganda						
Short Course	Oct-Dec 2007	Graduate students	3	2	IU/CIFOR	Trained in data entry and cleaning in Access
Short Course	Jan-Mar 2008	Grad/undergrad students	3	2	UFRIC	Trained in data entry and cleaning using Access
Workshop	Oct-Dec 2007	District officials involved in NRM, local council members	30	10	UFRIC	To strengthen leadership and management capabilities in local communities involved in collaborative

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
		and forest association members in Rakai District (Mugomba and Mujanjabula)				forest management
Workshop	Jan-Mar 2008	Residents, local council members, forest assn members in Site 4 (Rakai District)	24	9	UFRIC	Comparing collaborative resource management under UWA-managed national park and collaborative forest management under NFA-managed forest reserves
USA						
Vietnam						
Field Day	December 6, 2007	Farmers collaborators, Local farmers	4	3	Nong Lam University	On-field training on drip irrigation to set up on-farm trial with vegetable drip system .
Short Course	March 21, 2008	NLU researcher, students	3		Nong Lam University	Hand on training in using soil quality test kits.
Workshop	November 27, 2007	AVRDC Researchers, NLU researchers, students	7	2	AVRDC , Nong Lam University	Orientation meeting with Vietnam PRA team and training and discussion on PRA method and guideline for PRA field survey and interviews.
Workshop	November 28, 2007	AVRDC Researchers, NLU researchers, local	19	12	AVRDC , Nong Lam	Meeting and discussion on pest problem in cashew and vegetables and

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
		farmers			University	priority for research.
Workshop	March 17-18, 2008	ICRAFT scientist, NLU researchers, students	2	8	ICRAFT Philippines, Nong Lam University	To discuss on findings from policy review relating to VAF and workshop to develop analytical framework for cross-country analysis of VAF policy
Zambia						
Workshop	March 2008	Management staff from all CTCs	10		WCS COMACO	Training update in best inventory, marketing , and production practices
Workshop	March 2008	CTC financial staff	12		WCS COMACO	Training in better accounting practices and financial management. New software taught and implemented.
Workshop	April 2008	Farmers leading their individual producer group's apiaries in the Lundazi and Mfuwe areas	40		WCS COMACO extension staff and trainers	Improve bee husbandry and honey production
Workshop	September 2007	Zambia Wildlife Authority Rangers undertake an advanced course in wildlife monitoring for game management areas	18		WCS COMACO extension staff	Provide qualified staff to oversee the collection of data used to assess wildlife use and populations trends, particular attention given to lion monitoring
Workshop	November	Lead farmers	20		COMACO	Train farmers in sustainable cotton

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	2007	representing 500 farmers in new producer groups in the Magodi area and Mfuwe			extension training staff	farming practices that will allow them and COMACO to enter the organic cotton market