



Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

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SANREM CRSP 2010 Semi-Annual Report

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**Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program**

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Executive Summary

Introduction

The Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP) promotes stakeholder empowerment and improved livelihoods through the discovery, organization, and dissemination of sustainable agriculture (SA) and natural resource management (NRM) knowledge. The approach is participatory, engaging stakeholders at all levels in research problem formulation within priority areas of inquiry, focusing on multiple countries and/or regions to facilitate scaling research findings up and out. Program efforts are competitively driven and organized through a nested landscape systems approach. Gender sensitivity is integral to the SANREM approach and reinforced by gender-sensitive participant training programs that include degree and non-degree plans. All activities link sustainable NRM with the economic concerns of local populations and the promotion of good governance.

The objectives of the SANREM CRSP program are to:

- increase scientific knowledge and technical innovations in SA and NRM
- improve knowledge management, education, and communication leading to behavioral changes in adaptation and adoption of new SA and NRM technologies and practices
- reform and strengthen SA and NRM governance, policies, and local institutions, and
- promote the functioning of sustainable resource-based local enterprises in national, regional, and global markets.

The majority of SANREM CRSP research is conducted through its Long-term Research Award (LTRA) programs. Currently, the SANREM CRSP Phase III LTRA programs are wrapping up and the new Phase IV LTRAs focusing on conservation agriculture production systems (CAPS) are just getting started. The five Phase III LTRA activities were awarded between January and March 2006 and will conclude between March 2010 and December 2010. Their wrap-up activities are described below. The SANREM CRSP Phase IV LTRA activities were initiated during the past quarter and this semi-annual report describes their start-up activities.

The semi-annual report also reports on progress of the four cross-cutting research activities (CCRAs) dealing with economic impact analysis, gendered knowledge, soil quality and carbon sequestration, and technology networks, and describes the accomplishments of the management entity (ME) during the first six months of Phase IV.

Phase III Long-term Research Awards (LTRAs)

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

Our research analyzed the effects of forest decentralization from a local community perspective. The research focused on the way in which property rights regimes and related local institutional arrangements may have been altered by the changes in public policy at the national level and the implications of those changes for resource sustainability and community livelihoods.

Throughout the project, we have relied on contacts at many levels to achieve our objectives. Roughly 2600 individuals participated in trainings and workshops throughout the course of the

project, ranging from user group members and community-based organizations, to local officials, to national level officials and NGOs. In addition to regular contact with user groups, our partner organizations formed National Advisory Councils that met regularly throughout the project to discuss findings and needs. Roundtables, trainings, and cross-community workshops created opportunities for stakeholders at multiple levels to come together for education and exchange. This multi-level approach culminated in international exchange meetings between the two countries in each region. Over the course of the project, we have produced 6 reports, 8 papers, 10 presentations, 5 abstracts, 3 fact sheets, 2 research briefs, and 2 newsletter articles that have been made available on the SANREM CRSP Knowledgebase (SKB).

Findings were based on the detailed data gathered at both the household and community levels in 24 forests across four countries, complemented by a national-level forest-community survey in the two Latin American countries. Data collected includes:

- Bolivia: 572 forest plots and 165 household surveys in 7 communities (2 funded by U. of Michigan); national survey of 200 forest communities
- Kenya: 146 forest plots and 702 household surveys in 7 communities
- Mexico: 204 forest plots and 288 household surveys in 5 communities; national survey of 146 forest communities
- Uganda: 254 forest plots and 720 household surveys in 9 communities (2 funded by U. of Michigan)

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

All aspects of research covered by the no-cost extension and additional support have made continuous progress during this half year. Our new household survey focusing on food security, technology adoption, and crops/market access was performed in October-November, 2009. The data have been entered, cleaned, and preliminary analyses have been completed. In the soil sciences, samples from the landscape-scale assessment have largely been analyzed for their chemical and physical properties. The team is now analyzing the data using principle component analysis. First results indicate weak effects of environmental parameters on crop yield and low comparative benefit of conservation farming (CF) as practiced by the farmers along a gradient of 280 households. This finding needs to be considered in the context of the total COMACO intervention area; interpretation of the weak comparative effect is confounded by variable farming practices and also by the fact that most non-COMACO farmers have implemented one or more CF techniques that they have learned from their COMACO neighbors or COMACO field days, as revealed by the new household level data.

Significant progress has been made on examining the impact of COMACO on carbon stocks in the Luangwa Valley. Samples have been collected from both agricultural and forest areas to determine the impacts of *Faidherbia albida* on active and total soil carbon as well as other nutrients. Preliminary results suggest significantly higher total soil organic carbon and nitrogen under *F. albida* canopy. Progress on measurement, reporting and verification strategies for adaptation of agroforestry for carbon markets was presented at the Agriculture and Rural Development Day at the UNFCCC 15th Conference of Parties to the Kyoto Protocol in Copenhagen, Denmark in December.

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

The extension continued support for graduate students who are finishing up this year. In Bolivia, project results were communicated to stakeholders in the Tiraque watersheds. In Ecuador, the final watershed modeling workshop was held.

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

A no-cost extension was provided to finalize activities related to knowledge sharing (*socialization*); participant training; and the soil quality, metagenomics, knowledge to action, and gender cross-cutting initiatives. Knowledge sharing activities were conducted in Umala and Ancoraimes (Bolivia) through January of 2010. The surveys conducted in Bolivia and Peru were completed and the databases developed. This will allow us to study changes since 2006.

The graduate students in the US are making good progress towards graduation. Aguilera defends in April, and Thibeault and Jensen defend in May. Turin passed her comprehensives in December and is in Peru conducting her field research. Students in Bolivia have finalized their fieldwork. Two students developed their theses with the gender cross-cutting initiative and completed their manuscripts. Three defended their theses in the last semester. MS students (Navia, Peñaranda and Yucra) in Bolivia have finalized their field research and are writing their theses. Two journal articles were accepted for publication during this period on climate change projections and livelihoods in the Altiplano of Bolivia. Findings from our project were presented by the USAID Climate Change officer at the Copenhagen meetings in December. Soil metagenomics and soil quality cross-cutting initiatives are progressing well. Additional funding is requested to complete the research.

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

Based on the findings of SANREM research, the International Development Enterprise (IDE) adapted their low-cost drip irrigation system to work more efficiently on sloping lands. The adapted technology significantly improves water and labor productivity, but is not adopted by farmers because it is not available in the local market. In Vietnam, the proportion of vegetable consumption that is home-produced has increased 16%. A vegetable agroforestry system (VAF) for katuk cultivation is in the early adoption stages in Indonesia. In the Philippines, both farmers and local government are supportive of VAF. A financial analysis of growing cacao under a cashew plantation in Vietnam showed that planting cacao under cashew canopy increased income by about 159% compared to the pure cashew system. The cacao-cashew system is already being adopted in nearby areas and continues to expand, showing the potential to reduce poverty in the province. SANREM-initiated incentive-based policy in the Manupali watershed in the Philippines will be continued by another NGO and has been recognized by local government as a promising Payment for Environmental Services (PES) innovation. A pilot vermicomposting project with women has also shown positive outcomes.

Scaling up has taken place through presentations, workshops, and publications. The team presented VAF and IDE drip technologies to the Department of Agriculture-Bureau of Agricultural Research (DABAR) staff in the Philippines. A special issue of the International Journal of Agricultural Engineering was published with selected papers from the first Southeast

Asia Soil and Water Assessment Tool (SWAT) SANREM-sponsored conference. The second international SANREM-sponsored SWAT-Southeast Asia Conference will be held in Vietnam in January, 2011. The World Association of Soil and Water Conservation (WASWAC) will publish the outputs of this project in a set of four books, including a summary book and one book for each country. The drafts for the Vietnam and Indonesia publications are about 95% complete. The draft on the Philippines is 40% complete, and the summary has not yet been started.

Phase IV Long-term Research Awards (LTRAs)

LTRA-6: A Conservation Agriculture Production System Program for the Central Plateau of Haiti

The SANREM-CRSP CAPS LTRA in Haiti was formally initiated December 15, 2009. In January, all the members of the Virginia Tech (VT) and Haitian teams met in Port-au-Prince and all facets of the project were introduced and discussed. After the Kick-Off Workshop both teams set off to visit the research sites, lay out the experiments, and discuss the specific protocols. The earthquake disrupted continuation of activities until March.

In March, the VT team returned to Haiti. Research plots were established and training provided to ensure proper research site management and data collection procedures. A visit was made to the campus of the State University of Haiti at Damien to observe the destruction. Many campus buildings were in ruins, and classes for seniors only began the week we arrived. We were not able to meet with members of the faculty or the Ministry of Agriculture.

LTRA-7: Conservation Agriculture as a Potential Pathway to Better Resource Management, Higher Productivity, and Improved Socio-Economic Conditions in the Andean Region

The SANREM-CRSP CAPS LTRA in Latin America was formally initiated January 7, 2010. The first few months of the project were devoted to administration: we have established contracts and budgets with each of our partner institutions. Our first-year work plan has been agreed upon, although we are still finalizing the full research design.

LTRA-8: Improving Soil Quality and Crop Productivity through Farmer Tested and Recommended Conservation Agricultural Practices in Cropping Systems of West Africa

The SANREM-CRSP CAPS LTRA in West Africa was formally initiated January 25, 2010. Over the past six months project initiation workshops were conducted in Ghana and Mali. All collaborators and participating partners were invited to discuss the goals, objectives and methods to be used in the project. At the end of the meeting the objectives, methods and potential regions and villages were identified and agreed upon by all the participating institutions and collaborators. Survey questionnaires were developed to gather baseline information and gender training material and procedures were synthesized. A minimum dataset for biophysical information and procedures was determined. Overall, the project is progressing as scheduled.

LTRA-9: Developing Sustainable Conservation Agricultural Production Systems for Smallholder Farmers in Southern Africa

The SANREM-CRSP CAPS LTRA in Southern Africa was formally initiated April 7, 2010. The University of Tennessee team has been working on acquiring a contract for this work in southern Africa over the past 6.5 months. We gained approval for the work in Lesotho in late December

and were denied approval for work in Zimbabwe due to the ongoing political collapse. We sought approval for both Malawi and Mozambique for two reasons; first, both of these countries would greatly complement the work in Lesotho, and second, our collaborator (Dr. Pat Wall, CIMMYT) has ongoing work in conservation agricultural systems in both countries. Within the past week we received approval for work in Mozambique and Lesotho. In fiscal year 2011 we will seek approval for work in Malawi from the USAID mission there. We are pleased that the contract is in hand and remain confident that significant progress in understanding conservation agriculture production systems (CAPS) can be completed as part of the SANREM team over the next five years.

During 2009 – 2010 we conducted field research in Maphutseng, Lesotho, focusing on soil fertility under the no-till basin method. This research will provide some data towards determining financially viable application rates that will need to be fine-tuned in future seasons. Recently several potential cover crops were planted in Maphutseng for a preliminary screening of biomass, survival, weed suppression, and ease of termination. Results from this study will be used to design future studies. We also had initial discussions with subsistence Basuto growers, fertilizer and seed suppliers, and sociologists on the impact of CAPS on smallholder farmers. We are hopeful that what we have learned this year in Lesotho will not only assist us with developing our future plans in Lesotho but will also assist us in our work in Mozambique next year.

Due to the uncertainty regarding the contract, little progress has been made with further developing work plans in Mozambique. However, as the next cropping season will start in November, planning of activities will be finalized during a multi-project and multi-partner planning workshop for conservation agriculture activities that will be held in Chimoio, Mozambique in September.

LTRA-10: Development and transfer of conservation agriculture production systems (CAPS) for small-holder farms in eastern Uganda and western Kenya

The SANREM-CRSP CAPS LTRA in East Africa was formally initiated on December 18, 2009. Since then we have been working to get the five host-country subawards in place. They have all been cleared and are nearly complete. We are in the process of recruiting graduate students at the University of Wyoming, Makerere University, and Moi University. Our entire project team met in Kenya and Uganda, 12-28 March 2010, to complete task 1 of Objective 1 – information gathering in support of developing our baseline survey. The team traveled to our four research areas in western Kenya and eastern Uganda to meet with NGO partners there and with farmers' groups. An important outcome of the trip was the opportunity for the five University of Wyoming PIs to meet and travel with NGO and university partners from Kenya and Uganda very early in the project.

Results of these meetings will form the basis of our second task, the baseline survey. We learned that, while there are many differences among the groups in the four areas, one common important issue regarding sustainable production is the prevalence of maize on maize production with repeated moldboard plowing and deep hoeing. This practice likely drives soil depletion through erosion and accelerated mineralization of soil organic matter. As a group we began to form a consensus that an important first step toward conservation agriculture will be to help farmers recognize hidden detrimental effects of plowing, and to work with them to design

alternative tillage methods compatible with existing systems, markets, labor availability, and other constraints. We are in the process of compiling our notes, correspondence, and literature to develop a survey instrument. We are on track to finalize the survey instrument by April 30 and then to complete the baseline survey in our four study districts by June 30. NGO partners have confirmed the availability of bi-gender teams to complete the surveys in each district.

LTRA-11: Sustainable Management of Agroecological Resources for Tribal Societies (SMARTS)

The SANREM-CRSP CAPS LTRA in South Asia was formally initiated December 9, 2009. The SMARTS project has focused on three major tasks during the first 4 months. These include: (1) Finalizing contractual agreements with the SANREM CRSP Management Entity (Virginia Tech) and our NGO and university subawardee partners was a drawn out process due to the intricate nature of the award requirements and the desire to collaborate extensively with our India partners in accomplishing the project's major tasks. With perseverance and the cooperation of many team members and university support staff, we have been able to establish formal partnerships with our main NGO partner in India, Agramee, and our main university partner in India, Orissa University of Agriculture and Technology (OUAT). This necessitated changes to the budget to accommodate the roles of our partners. The changes mainly involved shifting funds among the various partners to reflect the agreed-upon work plan responsibilities. (2) Hiring personnel and training graduate students to begin working on the project's research and capacity-building objectives has moved forward successfully. We have hired one US graduate student to work on this project and have gotten agreements from two other students to volunteer for the summer so that we can implement our model CAPS for the first year. (3) Planning for implementation of the first year's CAPS in early June 2010. We have been putting a lot of our effort into planning a set of model CAPS for this first year and developing training materials for farmers and NGO support staff. Our host-country partners have been very active in this effort. Agramee has identified a farm household in each of four different villages that has agreed to participate officially as a cooperator for implementation of the CAPS research and demonstration plots. The OUAT faculty team visited the villages to review their past research in the area with Agramee and discuss possibilities for novel CAPS. Part of our UH faculty team visited India in March to coordinate this effort with our OUAT and Agramee partners and the cooperating farmers.

LTRA-12: Conservation Agriculture for Food Security in Cambodia and the Philippines

The SANREM-CRSP CAPS LTRA in Southeast Asia was formally initiated March 11, 2010, 2010. An operational work plan for the first year of the project was developed for each country (Cambodia and the Philippines). Contracts have been finalized between Virginia Tech and NCA&T, and between NCA&T and country partner institutions Projet d'Appui au Développement de l'Agriculture du Cambodge (PADAC) and University of the Philippines Los Baños (UPLB) and Landcare Foundation of the Philippines, Incorporated (LFPI). The baseline survey instrument was drafted. Comments from team members were sought and the survey instrument is being finalized.

For both countries farmer volunteers have been identified and contacted. Agreements with these volunteers are being finalized. In Cambodia, the experimental design has been completed and 27 households with total area of 45 ha agreed to partner with researchers. In the Philippines,

researchers will meet with farmer partners during the kick-off meeting in late April to finalize the design.

Cambodian host country coordinator, Stéphane Boulakia, in his visit to NCA&T and VT presented how conservation agriculture can be an excellent tool for economic and territory development in Cambodia. A trip to Cambodia by Philippine scientists has been delayed to June 2010 due to the unavailability of funds. However, networking activities with partner scientists have occurred through e-mail and mobile phone communications. The search has started for a Ph.D. student who will study at NCA&T. In Cambodia there is a bright prospect from the Faculty of Agronomy from the Royal University of Agriculture (RUA).

Cross-cutting Research Activities (CCRAs)

Economic Impact Analysis CCRA

This CCRA will concentrate detailed analysis efforts on three to-be-determined LTRAs in different regions of the world. All LTRAs will be involved in sharing more general economic information. An M.S. student in Agriculture and Applied Economics has been recruited. Targeted LTRAs will be determined in consultation with PIs at the annual meeting and preliminary data gathering will begin shortly thereafter.

Gendered Knowledge CCRA

The Gendered Knowledge CCRA initiated Phase IV activities working with the Technology Networks CCRA to draft, revise, and publish the SANREM CRSP Working Paper 01-10, [Research Framework for Technology Network and Gendered Knowledge Analyses](#). The document was circulated among LTRA PIs. Application of the proposed methodology has been initiated in the field in Mali and Ghana with host country teams of LTRA-8 (West Africa). Presentations in Haiti, Mali, and Ghana introduced the CCRA to partners, and in the case of Haiti, to a group of university students that may collaborate in survey activities. A graduate research assistant (GRA) has been selected for the upcoming academic year. Communication continued with gender CCRA researchers from SANREM Phase III to revise manuscripts for a collective publication on gendered networks and market access.

Soil Quality and Carbon Sequestration CCRA

An agronomist was hired on March 1, 2010 to coordinate research activities associated with crop and soil sciences among the LTRAs. Dialogue among the biophysical scientists has resulted in a consensus to measure a common minimum dataset for soil chemical and physical properties, depths of measurement, crop chemical and physical properties, biomass data, climate data, and times of measurement. These parameters will allow scientists to quantify carbon sequestration, soil fertility status, infiltration rate, and yield under conservation agriculture production systems compared to traditional cropping systems at host country sites. Rates of erosion will be estimated as well.

Technology Networks CCRA

The Technology Networks CCRA initiated activities with the drafting, revision, and publication of the SANREM CRSP Working Paper 01-10, [Research Framework for Technology Network and Gendered Knowledge Analyses](#). This document has been circulated among LTRA PIs and application of the methodology has been initiated in the field in Mali and Ghana with host country teams of LTRA-8 (West Africa). Discussions have begun with other LTRA PIs to

incorporate questionnaire items into their baseline activities. A graduate research assistant (GRA) has been selected for the upcoming academic year.

Management Entity (ME) Activities

The SANREM CRSP Management Entity established the foundation for the Phase IV program with a new set of Long-Term Research Awards (LTRAs) and Cross Cutting Research Activities (CCRAs) during the first half of Fiscal Year 2010. Phase III LTRAs were given no-cost and education supplementary extensions to complete educational programs, culminate research and training activities, and disseminate their findings. Although this was a transition period between Phases III and IV, sustainable agricultural and natural resource management innovations, policies, and practices continued to be tested and the results disseminated through professional publications, extension documents, and various reports to partner organizations.

Phase III Long-term Research Awards (LTRAs)

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

Lead PI: Elinor Ostrom, Indiana University

Host countries: Uganda, Kenya, Mexico, Bolivia

Research Progress by Objective

The objectives for our project are closely intertwined, since all three objectives involve building different capacities among different stakeholder groups. For this reason, and because these complementary capacity-building activities must be considered together to assess the project's effectiveness, we will address all three objectives together in the section below.

Objective 1: to develop capacity within resource user groups at the selected forest sites to enable differentiated actors to identify, understand, and participate in forest governance, benefits, and policy processes

Objective 2: to develop capacity within key organizations 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

Objective 3: to develop effective monitoring techniques for use by resource user groups and their partners at the community level to assess the impacts of decentralization and other property rights reforms on natural resources and livelihoods

Critical Research Accomplishments

The primary accomplishments of this project revolve around the gathering of detailed data at both the household and community levels in 24 forests across four countries, complemented by a national-level forest-community survey in the two Latin American countries. Community-level data was collected following the International Forestry Resources and Institutions (IFRI) protocol, which captures both social and biological information. This collection of data allowed project partners to assess the institutional compatibility of stakeholder organizations, user groups, policy makers, and others involved in forest governance, and to identify gaps and capacity-building needs that would enable all involved to better achieve natural resource and livelihood goals. Data collected includes:

- Bolivia: 572 forest plots and 165 household surveys in 7 communities (2 funded by U. of Michigan); national survey of 200 forest communities
- Kenya: 146 forest plots and 702 household surveys in 7 communities
- Mexico: 204 forest plots and 288 household surveys in 5 communities; national survey of 146 forest communities
- Uganda: 254 forest plots and 720 household surveys in 9 communities (2 funded by U. of Michigan)

Throughout the project, we have relied on contacts at many levels to facilitate all three objectives. In addition to regular contact with user groups, our partner organizations formed National Advisory Councils (NACs) that met regularly throughout the project to discuss findings

and needs. The NACs also helped identify study sites, and provided a perspective on trends and policies at higher levels of governance. Roundtables, trainings, and cross-community workshops created opportunities for stakeholders at multiple levels to come together for education and exchange. This multi-level approach culminated in international exchange meetings between the two countries in each region, held in 2008 (for Uganda and Kenya) and 2009 (for Bolivia and Mexico).

Development Impact

In addition to enabling researchers to draw conclusions at national, regional, and international scales, the data gathering activities also benefit the inhabitants of the targeted communities by building skills, providing site-specific information, and otherwise improving local quality of life.

In an analysis of the overall project data (see Coleman *et al*, 2009¹; the findings below are excerpted from this paper), we found that:

- Decentralization was associated with increased forest investment (e.g. tree planting) in Mexico, Uganda, and Bolivia; forest investment actually dropped significantly in Kenya, a result that we had not predicted. This outcome may be because the reforms are so new that people perceive the new rules as institutional instability, and may require some time to adapt to the new institutional environment.
- Local-level rule making was expected to increase in all countries as a result of decentralization; however, the only significant changes in this variable occurred in Uganda. We speculated that the macro-level instability was so significant that user groups were induced to make local rules to compensate.
- The effect of decentralization on wealth inequality was expected to vary. In Mexico, we found a strong correlation with years of decentralization and a more equal distribution of wealth. In Uganda, wealth inequality increased significantly following decentralization.
- The anticipated effects of decentralization on expectations of forest conditions in the four countries were more difficult to predict. The effects on perceived forest conditions in Mexico were positive and very large, as we predicted. However, in the other countries decentralization policies had little effect on the perception of forest conditions compared to similar forests in the region.
- Because of these disparate findings, we argue that expectations related to natural resource decentralization should be adjusted to the context of the types of decentralization reforms being implemented and the country within which they are implemented. Decentralization includes a wide variety of concepts that should be explicitly defined when discussing any potential impacts.

The theory indicating how decentralization will vary by context is imprecise. The Coleman *et al* analysis indicates that the stability of reforms, scarcity of forest products, size of the forest units affected, and dependence of user groups on the resource will affect many decentralization goals. In addition, these effects might differ depending on details of the decentralization reform.

¹ Coleman, E., F. Fleischman, and J. Bauer. 2009. "Comparing Forest Decentralization and local institutional change in Bolivia, Kenya, Mexico, and Uganda." Working paper.

Previous analyses of forest decentralization have focused on the macro level. We have looked instead at the behavior of local users. The changes and adaptations of local institutions and user behaviors in response to broader policy reforms, as well as the environmental outcomes of such reforms, need to be given greater attention.

Further analysis conducted during the extension period showed the following:

- Despite recent work that suggests that rights of access and use (to enter the forest and harvest) are the most important types of property rights for forest users, we find that households with rights of access are actually less likely to perceive the forest vegetation as having a high density than those who have no rights of access or use. Those with more complete property rights (management, exclusion, alienation) are those who are the most likely to rank the vegetative density of the forest highly.
- Property rights are most significantly and substantively related to high ranking of vegetative conditions in government forests, rather than community and private forests. Formal property rights are necessary in government forests to ensure that there is not over-exploitation of the forest stock, while less formal rights may be sufficient in community or private forests---in communities because informal norms exert control over behavior and in private forests because of informal contracts between owners and households.
- Households with property rights in government forests as well as other forests are more likely to rank the vegetative conditions in government forests more highly than those who only have rights in government forests. However, households with property rights in community forests as well as other forests are less likely to rank the vegetative conditions of community forests highly than those with property rights only in community forests. In other words: Those who rely solely on a community forest do not over-exploit it, while those who rely on a community forest as one among other types of forests which can be accessed, tend to rank conditions more poorly--perhaps because they have more forests to compare to or perhaps because they can exploit the community forest and risk violating social norms, yet still have some access to resources in other forests. Those who use only a government forest, however, are more likely to over-exploit the government forests, but when there are alternative forests available they switch their use to them.
- Households with more assets tend to rank all types of forest vegetation poorly. Those who are distant from markets are more likely to rank the forests poorly while those who live farther from the forest are more likely to rank the forest highly. When rules are perceived as fair, forest vegetation is more likely to be ranked highly. Forest subsistence is negatively related to vegetation in private forests, and not significantly correlated in government or community forests.

Uganda

In Uganda, the first SANREM site (Mabira forest) has been involved in a particularly contentious struggle to determine the fate of the forest. Throughout the conflict, SANREM partners have worked closely with neighboring communities like Kirugu and Nakalanga to strengthen forest management committees, monitor the level of illegal activities in the forests managed by the communities, and assist the communities in diversifying sources of income through pineapple farming and goat- and cattle-rearing.

Part of the learning experience also derived from exchanges between communities, exemplified by the trip arranged for leaders from Kyarukooka to Sango Bay, where there is a successful collaborative forest management system. Residents of Sango Bay's Mujanjabula and Mugamba settlements formed a "Save the Forest" Association; they carry out joint patrols with National Forest Authority officials, have planted a community woodlot, and also plant trees for timber and medicinal purposes. The level of illegal activities in the forests managed by the association is low and the forest has continued to improve. The group also visited neighboring communities who were in the process of forming forest management committees.

Community leaders from Nakalanga and Kirugu visited communities who have started collaborative forest management in nearby forest patches of Mabira Forest reserve.

During the extension period, half-day workshops were held in Wakisi, Malamaganbo, and Kakindo to discuss the roles of communities and local institutions in the management of forest resources following the implementation of the forest sector reforms. A policy brief in the local language (translated during the extension period) was used in the discussion and also distributed to the local leadership and members of the forest associations in the study sites.

Community-level learning was complemented by multiple other strategies, including the formation of a National Advisory Committee, whose members represented numerous scales of governance, and who could influence changes in policies as the need was identified. NAC members in Uganda also participated in feedback workshops to share research findings with forest user groups. Researchers noted that joint implementation (as embodied by the NAC and other steps to involve different players) showcased to researchers the validity of local knowledge, to local people the relevance and usefulness of science, and to local officials the usefulness of research in decision making, thus enhancing the acceptability of scientific research to local level practitioners.

Using these various mechanisms, Ugandan researchers found that there is an increasing rate of deforestation in the country but that there are some communities and districts where management of forest resources has improved (*Ecosystem and Community/watershed level*). They found that the participation of local communities and local councils in decision-making on forest issues is still limited (*Policy/market level*), and that there is an increased rate of tree planting by the private sector and individual farmers (*Farm household/enterprise*). Finally, they concluded that the National Forest Authority has made an impact on plantation establishment but has not been very successful in conservation of natural forests (*Policy/market*).

Kenya

In Kenya, the research team worked in collaboration with resource persons from other government ministries to equip community members with skills that would enable them to undertake forest management in their respective forests, including tree nursery management, seed production and storage, group dynamics, conflict resolution and leadership, business skills to manage PFM projects, basic bookkeeping, bee keeping, proposal writing, and participatory skills for problem identification. Training topics were selected based on community circumstances.

The Kenyan team noted an increase in the number of community forest organizations from one visit to the next; they also found greater awareness of Kenya's new Forest Act following the

team's site visit. Physical improvements were also evident, with a new electric fence in one site helping to prevent cattle from grazing in the forest. Another community developed an eco-tourism facility in collaboration with other organizations and with the advice of the research team.

Target communities in Kenya also showed an increase in the number of NGOs and community-based organizations working within the natural resource sector, and an increase in the number of government projects aimed at poverty alleviation (*Policy/market*). In Aberdares, examples included Green Zones and the Plantation Establishment and Livelihood Improvement Scheme (PELIS), both Kenya Forest Service initiatives; in Ramogi, PLAN International, Action Aid, and CARE Kenya were also active by the second visit. In the second case, the town council was taking a more proactive role in forest management than the team saw during their initial visit (*Policy/market*). They also found greater acceptance among foresters of community member involvement in forest management (*Policy/market*).

Analysis of the household surveys collected in Kenya showed the following:

- Most forests in the country face challenges due to population pressure, high poverty levels, and unemployment, which contribute to a high dependence on forest products. In all the sites, forest adjacent communities depended fully on the forests for all their energy needs, most of their poles and posts, all their herbal medicine needs and some of their construction needs. Some forests, such as Aberdares and Mau, were heavily degraded due to human impacts, which included clearing of large tracts of forestland for agricultural cultivation.
- Forests did not provide dependable cash income. A majority of the communities harvested products for subsistence use but did not rely on the forest products fully for cash income. Their needs for cash had to be supplemented through formal and self-employment, casual labor, small-scale business opportunities, remittances from relatives, and other sources. Poor farmers therefore dedicated limited time to forest activities.
- Government linkages with communities are poor due to conflicts between the forest managers and users, high corruption among the forest managers, poor forest management strategies, and poor communication flow to communities. Linkages with other stakeholders were also limited and only a few 'elite' were beneficiaries of information from non-governmental organizations. Most women and other marginalized groups were often left out of development activities mainly due to low or no education, lack of time to attend meetings, and lack of contacts within the local settings thereby limiting information flow. There was also a general lack of technical knowledge of forest management and conservation among community members thus limiting their involvement in management activities.
- Women are unlikely to inherit property (an exception is Aberdares, where unmarried women can inherit land) and are also disadvantaged by the expectations of the new forest act. For instance, due to low education, many could not be selected for leadership positions. Time constraints also affected their ability to attend meetings. Although women spent much time in the forest collecting products, they were rarely consulted about any forest management initiatives.
- The Ramogi Hills forest was selected as a good example of a sacred forest with strong cultural ties and institutions. Results from the study of this forest indicated that the rules crafted to protect the forest were respected by a majority of the community and there was fear and respect for anything regarded sacred; even illegal harvesters avoided harvesting

from within the sacred grove. Because the people value the sacred forest for its cultural and historical significance, they also made extra efforts to assist in the conservation and management of the forest, including use of energy-saving stoves and restrictions on the sale of wood products.

The Kenya team has also been involved in piloting an educational program in schools, starting with several schools adjacent to the Ramogi Hills, Kakamega, and Mau forest sites, to raise awareness of the importance of forest conservation. Children planted indigenous trees and established a nursery to raise thousands more. They hope to expand the program to schools across the country in the future.

Mexico

In Mexico, data from the national survey of 146 forest communities showed two clear tendencies: from 1994 to 2000, forest production grew by 49%, (from 6.3 million cubic meters of round wood to 9.4 million cubic meters). Five years later in 2005, timber production had dropped to the 1994 level. This loss of wood production during the early 2000s has occurred in the middle of a considerable increase in the national consumption of forest products, which grew from 16.3 million cubic meters of round wood in 2000 to 27.5 million in 2003 and 21.3 million in 2005. As a consequence, the deficit of forest products increased in volume and value: in those five years the volume of the deficit increased by 167% and its value grew by 222%, in spite of the relative monetary stability during this period. (*Ecosystem and policy/market level*)

The data on the performance of the forest sector during 2000-2005 reflects an important loss of community capacities to produce raw materials and add value to their products, a reality made even more alarming by the fact that public investment in the forest sector grew remarkably during this period. The analysis of the distribution of the increased public budget highlights some of the reasons for policy failures: 60% of the resources were invested in reforestation and plantations based mostly in top down approaches, with poor or little attention to the development of planning, management, administrative and productive local capacities.

Given an increasing national focus on restoration and conservation in Mexico, and because the majority of forests in Mexico are collectively owned, a failure to provide additional training and advice to forest communities could both further marginalize these communities and undermine the likelihood that these policies will succeed.

The national survey identified some of the main challenges faced in achieving sustainable forest management arrangements: (1) Right holders in the majority of ejidos are aging, and the generational replacement required for forest protection and community entrepreneurship is under threat in the majority of forest communities. (2) Tenure conflicts are frequent and have pervasive impacts on local peace and on forest areas. (3) Poverty is widespread and the income alternatives of forest populations are poor and often not compatible with the conservation of the forest cover. This is particularly true for those forest ecosystems with the highest biodiversity. (4) There are few incentives to sustain and develop local institutions. (5) Forest communities are facing a loss in productive capacity, and are becoming less able to compete in today's open markets. Most of these challenges have not been addressed by any public program; those that have tried to support local institutional and production capabilities are marginal in financial and political terms.

Social organization has not been perceived as a key resource by mainstream forest and environmental policies; on the contrary, policies have often negatively impacted community organizations because they disregard local collective property arrangements and the potential advantage of groups with communal social capital for sustainable forest governance. The results from the national survey in Mexico show that the communities with stronger organizations are also those with the more intense protection and conservation activities. Communities with developed and successful forestry experiences are only a small percentage of all forest communities, but their presence and success expresses the viability of community forestry as a driver of local economy in forest regions.

Bolivia

Researchers in Bolivia focused their final months of work on the preparation of numerous papers. They also participated in a national workshop on indigenous territories and forest valuation, and junior researchers received certificates from the Latin American Council of Social Sciences. Findings show a low level of efficiency in municipalities involved in forest management. The municipal governments have constructed infrastructure (including roads, drinking water systems, and electricity) in some areas but are largely absent from forest sector activities. The Forest Superintendence, charged with fulfilling the goals of the forest law, is largely absent as well. (*Policy/market*)

As part of the closing activities of the project, Bolivia hosted both a community exchange meeting and an exchange meeting with researchers from Mexico, held in series at the end of September. The community meeting was attended by 13 representatives from six of the Bolivian communities studied during the course of the SANREM grant, and gave community members an opportunity to build additional capacities as well as share experiences with other communities.

During the meeting, communities presented the details and challenges of forest management in their community and compared their experiences with other communities. All attendees learned about the design principles articulated by Elinor Ostrom, and were asked to apply these concepts to their own communities, followed by a general discussion. All communities received folders describing the physical, human, social, and institutional conditions of each community and the team's findings in their community.

This training was followed immediately by the exchange meeting with the Mexican research team; community representatives participated in this meeting as well. Both teams presented on the conditions and findings in their communities. In addition, one community (TIM Ivirgarzama) presented to the whole group about their experience as a subject of SANREM's research. Twenty additional participants joined in this meeting.

Significant Training, Capacity Building, and Networking Activities

Degree and Non-Degree Training Activities

In total, over the course of the project, partners have trained 1468 men and 1251 women from numerous backgrounds and on numerous topics. All of these individuals were trained in host countries. Participants ranged from user group members and community-based organizations, to local officials, to national-level officials and NGOs.

In addition, the project supported 8 students (4 male, 4 female) in degree programs.

Publications, Presentations, and Other Products

Over the course of the project, we have produced 1 dissertation, 6 reports, 10 papers, 10 presentations, 5 abstracts, 3 fact sheets, 2 research briefs, and 2 newsletter articles that have been made available on the SKB. Other materials will be entered as soon as they become available.

Networking Activities

In Kenya, an IFRI Regional Training was carried out and participants from different organizations and universities in Kenya and Tanzania were trained on the IFRI methodology and IFRI data management.

In Bolivia, the research team participated in a national workshop on indigenous territories and forest valuation for sustainable forest management and certification, held in Santa Cruz, Bolivia. The team also hosted the exchange workshop described above, attended by representatives from the NGO Jatun Sach'a, the Forest Superintendence, the Ministry of Rural Development, and others.

In Mexico, a part of the support of the SANREM project has been provided by the Instituto de Investigaciones Sociales of UNAM, enabling Leticia Merino's participation and giving access to office space, computers and vehicles for field work. The National Forest Commission (CONAFOR) and A have supported training activities with communities. Two NGOs, Grupo de Estudios Ambientales (GEA) and Grupo Autónomo para la Investigación Ambiental (GAIA) also supported one of the training activities.

In Uganda, partners produced a DVD geared toward researchers and policy makers that addresses forest policy and community forest management issues.

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

Lead PI: Alex Travis, Cornell University

Host Country: Zambia

Research Progress by Objective:

Objective 1: Social

Progress towards completing critical annual work plan tasks:

- Designed survey instrument, pre-tested survey, trained enumerators, and revised survey.
- Performed social survey of COMACO and non-COMACO farmers in the Lundazi area of the Luangwa Valley.
- Entered, cleaned, and analyzed data.

Significant research findings:

- No final results are yet available, but several important points have been confirmed. First, both the COMACO participants and non-COMACO participants still experience food

insecurity. Distinguishing differences in both social parameters and in soil/crop metrics between these groups is made difficult by the fact that conservation farming practices are becoming more generalized in the population.

Objective 2: Soil

Progress towards completing critical annual work plan tasks:

- Finished foliar analyses from 8 plots of each of the 280 farms to quantify plant nutrition along the environmental gradient.
- Generated landscape properties and terrain attributes from digital elevation models and compared them with the field data. This information is useful in examining the relationship between yield, landscape, and soil properties.
- Dissertation expected to be completed by August 2010.

Significant research findings:

- No significant difference was found in maize yields between conservation farming and traditional farming as farmer management practices varied considerably in both groups.
- There is no significant difference between farmer managed CF plots and researcher managed CF plots with gliricidia leaves or manure only due to nitrogen immobilization.
- Significant increased maize yields for plots with organic amendment (biochar, manure) together with (as opposed to without) fertilizer.

Objective 3: Natural Resources

Progress towards completing critical annual work plan tasks

- Soil samples were collected from different land use categories in the valley and on the plateau. Samples were collected from forests in order to estimate a maximum carbon stock level, and from agricultural areas (including conservation farming plots) to examine active and total soil organic carbon (and other nutrients) on agricultural lands. Soil samples were also collected from under the canopy of mature *Faidherbia albida* in these areas to investigate the impact of this species on soil carbon. The methodology involved replicate sampling at 0-15 cm, and 15-30 cm, from individual plots, along with replicated bulk density samples, in order to determine the degree of within-plot variability and help define future minimum (cost-effective) sampling strategies, shedding light on measurement, reporting and verification (MRV) strategies.
- Modeling the growth rate of *F. albida* is underway in order to estimate the rate of carbon sequestration possible in these agroforestry systems.
- The full dataset from the 2008 household survey has been cleaned and is ready for preliminary analysis
- The first draft manuscript of the contingent valuation study measuring the value of wildlife to South Luangwa National Park visitors is expected to be ready by the end of April.

Significant research findings:

- Preliminary results indicate significantly higher levels of total soil organic carbon and nitrogen under the canopy of *Faidherbia albida*. The value of COMACO's agroforestry

Significant Training, Capacity Building, and Networking Activities

One graduate student performed the social survey with partial support from this grant: Kim Bothi is mentored by Drs. Louise Buck and Jim Lassoie, and received assistance in survey design and analysis by a team led by Dr. David Lee.

One graduate student, Lydiah Gatere, is being trained through this grant in soil sciences. Her advisor, Dr. Johannes Lehmann, was able to present a small portion of the data to a forum on world hunger assembled by Jeffrey Sachs at Columbia University in October 2009, which afforded important networking opportunities. The interactions have led to one manuscript that is currently being submitted for publication.

Another graduate student, Sam Bell, is being trained through this grant in natural resource economics. He and business economics researcher John Fay were instrumental in highlighting the relevance of COMACO's agroforestry plans to developing global carbon markets. As noted in previous reports, non-SANREM funding was leveraged to pursue the carbon aims beyond the scope of the SANREM. In addition to the presentations at the COP15 meeting in December, Sam also presented his work to representatives of the Ministry of Tourism, Environment, and Natural Resources in Zambia.

Research Strategy and Development Objectives

Progress achieving milestones:

- For the soil work on conservation farming technology, field research and most of the laboratory analysis is complete. Write up is underway for publications.
- Landscape properties were generated to aid in examining the relationship between yield and soil properties. Work in progress could possibly lead to a map for Eastern Zambia that gives spatially-explicit information about average farmer yields and the total yield potential if conservation agriculture were to be adopted on a larger scale.
- Analytical work to quantify changes in carbon quality shortly after CF adoption has fully started, and will likely be completed in June 2010.
- Social science survey data have been collected and reveal important unanticipated benefits provided by COMACO to non-COMACO members in terms of technology adoption.
- Data on soil carbon will provide additional important information on the impact of agroforestry while simultaneously offering potential access to global carbon markets.

Contribution to progress along the development impact pathway:

- Improvement in soil fertility and conservation measures increases food security, thereby breaking the multifaceted nature of poverty. This research focused on the potential of conservation farming to alleviate food insecurity through increasing soil fertility with locally-available organic matter additions of contrasting quality.
- This study expanded on the empirical results described above by examining the reasons for the failure or success of conservation agriculture under certain soil and climatic conditions. From our preliminary results, we see that yield improvements vary significantly across the

- The intended map of potential yield in Eastern Zambia will be a valuable tool for the decision-making process and for giving policy advice.
- The impact of COMACO in the Luangwa Valley is greater than being limited to the impacts on its participants. This is important because it places value on extension training activities beyond the intervention itself.
- Although outside the scope of the SANREM CRSP per se, SANREM research has helped provide a foundation for important carbon MRV methodologies in complex rural landscapes.

Lessons learned relevant to development goals:

- To alleviate hunger with conservation farming, the principles of CF ought to be adapted and applied to local conditions. CF not functioning in the short term may be rectified by applying the principles to local conditions instead of taking a package of CF practices from one situation and superimposing the same package on other conditions.
- Technology adoption by non-participants can confound both social and biophysical quantifications of intervention impacts.

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

Lead PI: Jeffrey Alwang, Virginia Tech

Host Countries: Bolivia, Ecuador

Graduate students:

Nadezda Amaya (VT/AgEcon) defended her thesis in December 2009 and submitted it to the graduate school in January 2010. She returned to Bolivia and has drafted and submitted a paper for publication in World Development. She also completed a draft of a chapter for the SANREM gendered markets book.

Catherine LaRochelle (VT/AgEcon) is continuing progress toward completion of her dissertation. She has also completed two paper drafts, one on the role of risk in livelihood choice, and the other on spatial dispersion of livelihood choices and its impact on risk reduction and market choice.

Anissa Polatewich (Plant Pathology/PSU) is completing her degree as planned.

Stakeholder communication:

Jeffrey Alwang conducted two half-day workshops at PROINPA headquarters in Cochabamba with participation from a broad spectrum of stakeholders. Many comments were provided with the bulk of them focusing on the need for follow-up to the extensive community engagement. Stakeholders were also interested in continuing the watershed monitoring efforts.

Watershed modeling workshop:

A watershed workshop was held in April 2010 in Ecuador. It will be reported on at a later date.

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

Lead PI: Corrine Valdivia, University of Missouri

Host Countries: Bolivia, Peru

Research Progress by Objective

The on-going research is in the integration phase. Therefore the findings on dynamics and perceptions of changes (Objectives 1 and 2) are integrated with the practices and strategies to adapt to change (Objectives 3, 4, and 5). Several products have been or are being developed. These include journal articles that show the projections of climate change in South America (Seth et al.) and the Altiplano (Thibeault et al; Seth et al), as well as the process of integrating knowledge about livelihoods, perceptions of risks, and participatory processes (Valdivia et al). Along with these, two books are being finalized. The first contains most of the field research activities developed in Bolivia, including these research. The second is a book published through CIDES with research products that integrate and synthesize findings.

Objectives 3 and 4: Practices and Strategies to Adapt to Change

Peter Motavalli has organized with Sarah Beebout of IRRI a symposium entitled “Global Food Security in a Changing Climate” for the 2010 American Society of Agronomy Meetings in Long Beach, California, which will be occurring from Oct. 31 to Nov. 4, 2010. This symposium is co-sponsored by SANREM and will provide a forum for presentation of the research results from the project. The plan is to publish the research results in a peer-reviewed journal such as *Agricultural Systems*.

Objective 5: Capacities and Capabilities – Ability to Act

Field work activities took place through February of 2010 in Peru and January of 2010 in Bolivia. The surveys were completed and the databases have been developed. Knowledge sharing took place in Bolivia and Peru, where the results from the research were returned through the knowledge sharing methodologies developed. This included integrating the local knowledge, the participatory research findings, and the disciplinary research findings. Most of the products appear as extension publications in the SANREM Knowledge Base (SKB). Community participation varied by site. Although the intention was to hold knowledge sharing workshops in all the communities, only two of the four communities in the Central Altiplano (Bolivia) were engaged in the process. Problems in the other two communities prevented the final meetings from taking place, so the team contacted officials and delivered the products without workshops. In the Northern Altiplano (Peru) the communities’ process was different. It entailed returning the findings through multiple meetings. Both the marketing and climate products were returned in the context of soil and pest management findings. In this region, UMSA has been able to establish itself as a trusted institution through the project. It has a greater presence, and there is commitment to long-term collaboration with the communities. Universidad de la Cordillera and UMSA were in charge of the knowledge sharing process in Bolivia. In Peru knowledge sharing was conducted in the last semester, along with the survey activities led by Pedro Condor and Universidad del Altiplano. Reports are being finalized.

Fieldwork for the *Gender and Markets* crosscutting initiatives was completed and results returned to the communities during the knowledge sharing workshops. Two theses in Bolivia

were completed and the defense dates are pending. A working paper on gender in Peru is being finalized. Abstracts were submitted for inclusion in a proposal by the gender cross-cutting PI.

Progress towards completing critical annual work plans proceeds. Most of the activities now depend on the timing of the universities' committees to set up defenses for the students in Bolivia and Peru.

We continue to analyze data and develop articles and chapters with our collaborators. We continue to seek funding opportunities to accelerate this process.

Soil Quality CCRA

Mid infrared scans were completed of humic acid extracted from soil samples received from Indonesia and the Philippines. In addition, all the survey results were compiled and analyzed. The Thai Ph.D. student completed her comprehensive exam and is in the process of working on her dissertation. She has had a severe illness and during her treatment she has been working on her dissertation. This illness has caused delays in her progress.

Metagenomics CCRA

The metagenomics cross-cutting project was designed to link with existing SANREM projects, adding complementary information about soil microbial community responses to agricultural management and about microbes that are potential indicators for soil degradation. The project is one of the first to use advanced sequencing approaches to address the sustainability of agricultural systems and we have successfully coordinated synergistic links with the other LTRAs. In LTRA-4 the focus is on the analysis of microbial communities in the Bolivian Altiplano and their responses to changing fallow periods and to the pressure to remove plants for fuel during fallow periods. The entire DNA sequencing information for this project has been performed, as well as preliminary analyses. A paper will be completed this summer and a poster of the findings will be presented at a scientific meeting. This project is a collaboration of colleagues at PROINPA, UMSA, and University of Missouri.

In LTRA-3, Neshmi Salaués (student with PROINPA) is focusing on the analysis of microbial communities across elevations in Bolivian inter-Andean valleys and across levels of soil quality. She has in hand the DNA from the samples, but additional funds are needed to prepare the samples for sequencing and to perform the sequencing. In addition to providing information about microbial diversity, this project will identify microorganisms that could be used as bioindicators of soil fertility. Using these bioindicators will make it possible to give farmers specific advice on land management strategies to increase the presence of beneficial microorganisms in their fields, which has the potential to improve agricultural production. Therefore, this research is of significant practical relevance for Bolivian farmers. This project is in collaboration with colleagues at PROINPA, Cochabamba, Bolivia. In Zambia, the samples collected by Lydiah Gatere (graduate student at Cornell) to evaluate the effects of conservation agriculture strategies on soil communities in Zambia are being analyzed. The sequences from this experiment are in hand and the plan is to analyze the data and write the paper later in 2010, in collaboration with colleagues at Cornell.

This project will provide a completely new perspective on the sustainability of soils in these agricultural systems. It will also result in three substantial papers in peer-reviewed journals, representing collaborations across the three LTRA projects.

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

No changes. There were difficulties in scheduling meetings with some communities. The actions taken consisted of delivering the socialization materials through the community officers in Umala.

Significant research findings

No changes from the findings reported at the end of year four. The following are some of the capabilities elements of the research design and how these are taking shape.

- In Bolivia, early warning systems networks are being developed based on the project. Bridging capital and networks were facilitated by the project through the development of trust, which was the result of the quality of the research products and the trust-building interactions with the communities.
- In Peru, research has given us a clearer view of the effect climate change is having on agricultural activities and livelihood strategies in both communities and on fiber commercialization specifically in Apopata. Findings have served as inputs for the formulation of development and research proposals that look at key issues for the community such as organizational strengthening through networking, and generating and acquiring knowledge to develop new strategies to face climate change, among other issues.
- In both countries the project became a trusted source of information, not only for farmers and government agencies, but also for USAID offices.

Significant Training, Capacity Building, and Networking Activities

Degree training students supported

The Bolivian Ph.D. Javier Aguilera sponsored by the project completed his comprehensive exams during the previous year and has been making progress on writing his dissertation. He has a dissertation defense planned for April 28th.

The Peruvian Ph.D. candidate Cecilia Turin passed her comprehensive examination and is currently in Peru conducting field research in the highland communities of Puno Peru. She has identified her study communities and is currently gathering baseline data

The American Ph.D. candidate, Jeanne Thibeault, is defending her dissertation May 3rd. She has published two articles and has submitted two additional articles for review on climate change in the Andes.

The American M.S. student, Nathaniel Jensen, funded by MU, is completing his thesis research on Adaptation and Vulnerabilities, and Socio Ecological Systems in Bolivia. He will be presenting a poster at the American Agricultural and Applied Economics Association in July on the geography of risks and capitals in the Altiplano. He will be defending his MS thesis in May, and has been accepted for doctoral studies at Cornell.

The Peruvian MS student Doris Bartolo, enrolled in the masters' program on Innovation for Development at the La Molina National Agrarian University (UNALM), is working on her thesis "Building new knowledge and participatory research within the context of climate change in four communities in the Peru-Bolivia Altiplano". So far she has collected data from the Peru project

but now needs to complete collection of information in Bolivia. With the aid of the IPPS, she is in the process of contacting our counterpart in Bolivia to arrange a visit to collect data.

The Peruvian MS student Clovis Baylon has also finished his course work and has already received approval for his thesis project “Traditional soil management (aynokas) and its effect on soil fertility.” He now needs to complete lab analysis and work on writing his thesis.

Christian Candela, who received half a scholarship, is also working on his thesis draft. His proposal "Effects of SANREM project participatory workshops over the capacities (attitudes and aptitudes) of participants" has been approved conditional on a certain number of changes that were incorporated. We are expecting him to finish and defend his proposal in December 2010.

Three licenciatura theses were defended at UMSA:

Mamani, B. 2009. “*Caracterización de suelos, según su índice de fertilidad y aptitud de uso, en el municipio de Acoraimes.*” Tesis de licenciatura, Universidad Mayor de San Andrés.

Quispe, M. 2010. “*Determinación del efecto residual de abonos (orgánicos e inorgánicos) en la humedad y la eficiencia del uso del agua en el comportamiento agronómico de la papa en la comunidad de Chinchaya (municipio de Acoraimes).*” Tesis de licenciatura, Universidad Mayor de San Andrés.

Sarmiento, J. 2010. “*Caracterización in-situ de los cultivos de papa (Solanum spp.) y oca (Oxalis tuberosa) en las comunidades de Chojñapata y Calahuancane del municipio de Acoraimes.*” Tesis de licenciatura, Universidad Mayor de San Andrés.

As indicated above, doctoral and MS students in the US are continuing as expected. A serious illness has delayed the research of the student in soil quality. Students in the region are also progressing well as described above. While thesis research has been completed the next step for many is waiting for the universities to assign juries for the defense.

Short-term training events conducted

Knowledge sharing activities were carried out between October 2009 and February 2010 to return the results of the research activities to the communities as part of the knowledge systems linking goal (Objective 1).

Updated publications list

Several reports and knowledge sharing products that are similar in format to those already in the SKB have been produced and shared with farmer groups. Other recent publications are either in press or are working papers that cannot yet be uploaded to the SKB.

Special events or networking activities.

Findings from our project were integrated into a presentation at the Copenhagen Meetings by John Furlow of the USAID Climate Change Team. The presentation was titled “Adapting to a World without Glaciers” and was presented at COP 15 on December 14, 2009.

Professor Gilles and the team from UMSA have participated with the National Program on Climate Change in Bolivia to train officers around the country on Climate Change Adaptation in October and November of 2009.

With the support of UMSA we continue to monitor pests in the communities of Ancoraimes.

Dr. Gilles and Dr. García are leading a monitoring project on climate in several communities of the Altiplano.

USAID Deputy Chief Officer Economic Growth and Environment contacted us to link with the office to provide research results on climate change for the Andes.

Research Strategy and Development Objectives

Progress achieving research milestones.

We have completed socialization of the products on dynamics of change and on-farm research on soils and pests. This should be an iterative process. We were only able to complete the first phase of the process, which brought back the findings on dynamics along with the findings on participatory research. In order to increase success it is desirable to continue the research collaboration with the farmers. We developed a proposal on conservation agriculture that would have allowed focus on specific practices to improve conservation of resources, especially soils and water. We were not successful in obtaining funds to continue the process of collaboration.

Progress along the development impact pathway

We have impacted knowledge, perceptions and skills. Farmers in our knowledge sharing meetings recognize climate changes and the potential impacts of new practices to adapt to the changes. The second survey and the knowledge sharing workshops are our mechanisms to assess those impacts. The workshops have been successful in 8 of the 10 communities in terms of involvement. Farmers hoped that the collaborations would continue.

Below is a summary of the results in Puno as an example of the project impact.

Training in both communities has been differentiated both by quantity of activities as well as by topics addressed. In Santa Maria, 30 capacity building activities have taken place around the following thematic axes: (i) Natural resources diagnosis, (ii) mapping and geo-referencing, (iii) Aynocas characterization and management, (iv) integrated weevil (*gorgojo de los Andes*) management, (v) animal health and (vi) advocacy coalitions.

The community of Apopata went through nine different training workshops which have been classified according to the following topics: (i) Natural resources diagnosis, (ii) mapping and geo-referencing, (iii) management of *bofedales*, (iv) animal health, (v) advocacy coalitions. The degree of participation was also different from that in Santa Maria. In Santa Maria there was a greater percentage of female participation (54%). The opposite was observed in Apopata where female participation was only 42%.

Capacity building activities seem to have been more useful for Santa María given that they were more in number and gave access to new technical tools that helped farmers to incorporate new practices such as collecting adult weevils, harvesting potatoes with cloths (*cosecha en mantas*) and installing live barriers using Tarwi (*Lupinus mutabilis*). In terms of soil management, the use of organic fertilizers has increased considerably. In Apopata, results have been less visible given that there were fewer capacity building activities.

However, when it came to networking activities, the community of Apopata made better use of this process because communal authorities were more willing to engage and participate in actions with local actors. As a result, strategic alliances with public and private institutions were established to build capacities for improved pasture management, preparation of project proposals, and trout production and management. The networking and alliance formation process with Santa Maria was abruptly ended and never continued due to the unwillingness of the communal president to participate and lead a community-based process; he preferred to depend on government assistance.

Discuss any lessons learned relevant to development goals

More time and iterations are needed in participatory research in the Andes, due to the nature of the production process and the high variability in climate presentations in the region. In order to address adaptation a longer time horizon is needed.

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

Lead PI: Manuel Reyes, North Carolina Agricultural and Technical State University

Host Countries: Indonesia, Vietnam, the Philippines

Research Progress by Objective

Goal: Communities in many forest and vegetable producing watersheds in Southeast Asia are suffering from poverty and degradation of forest, soil and water resources. The goal is to develop economically viable and ecologically sound vegetable-agroforestry systems (VAF) and to quantify the potential economic and environmental benefits of these systems.

Objective 1: Technology

Develop economically viable and ecologically-sound vegetable-agroforestry (VAF) systems.

Drip irrigation studies continued through additional funding from the International Development Enterprise (IDE). SANREM scientists found that the IDE drip system (IDE drip) had low irrigation efficiency on sloping land, so IDE engineers developed adjustable pressure lateral take-off valves (APLTV). SANREM scientists found that the APLTV significantly improved the water distribution uniformity of IDE drip. Results of profitability analysis of IDE drip for selected vegetable farms in the Philippines indicated a benefit-cost ratio greater than 1.0, averaging 1.18. A new set of drip equipment funded by IDE will be tested in June. SANREM has provided primary scientific backstopping for the development of these drip kits.

Objective 2: Marketing

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

Nothing to report for this period; objectives have been achieved.

Objective 3: Policy

Identify options and institutional frameworks that promote sustainability of vegetable-agroforestry production and reward environmental services.

Cross-Cutting Research Activity in Knowledge to Action (K2A) continued to progress:

- Conducted Research Feedback Session with researchers on October 8, 2009 in Malaybalay City, the Philippines
- Conducted Research Feedback Session with policy-makers, extension experts and farmers on October 9, 2009 in Malaybalay City, the Philippines
- Developed video production on K2A process of SANREM Phase III in Manupali watershed.
- Completed K2A case studies in Vietnam and the Philippines.

Objective 4: Environmental and socio-economic impact

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

Economics of IDE drip irrigation technology and its adoption:

- Results of profitability analysis of IDE drip for selected vegetable farms in the Philippines indicated a benefit-cost ratio greater than 1.0, averaging 1.18. The payback period for IDE drip irrigated vegetable farms ranged from 1 year to 2.5 years.
- In Vietnam, evaluation of the economic feasibility of using IDE drip for home garden vegetable cultivation in an upland community showed that yield and income from vegetable cultivation in farmer's home garden increased only slightly when applying IDE drip as compared to farmer's current irrigation practice. However, in terms of resources usage, IDE drip helped farmers achieve significantly higher water and labor productivity in home garden vegetable cultivation.
- For both countries, there was no adoption of IDE drip by local farmers because it is not available in the local market. The drip irrigation for young cacao designed by Nong Lam University in 2007 also had no adoption due to high initial investment.

Adoption of vegetable agroforestry:

- In Vietnam, information on vegetable trials and nutrition benefits from vegetable consumption were transferred to local farmers. A survey on daily food consumption conducted in 2005 and at the end of 2008/early 2009 revealed that the home-produced vegetables share of total vegetable consumption increased by 16%.
- In Indonesia, adoption of vegetable agroforestry systems in Nanggung sub-district represented by katuk cultivation has entered the early adoption stage. This early adoption is in its critical stage and needs to be maintained through sound pest management and guaranteed supply of fertilizer. If this stage fails, farmers will not adopt.
- In the Philippines, vegetable farmers and local government favored VAF. Participation in the research and extension activities increased knowledge, skills, attitudes and aspiration among the vegetable farmers which could facilitate adoption of the VAF system in the area. However, farmers assess the availability of financial and input/output markets as they decide to adopt VAF technology.

Economics of growing cacao in cashew plantations and its promising rapid adoption:

- A financial analysis on growing cacao under a cashew plantation in Vietnam showed that planting cacao under the cashew canopy increased income by 159% compared to the pure cashew system. The net present value (NPV) increased from VND 47.7 million for one ha of pure cashew to VND 123.6 million per ha when cacao was planted under cashew canopy.

This study therefore supports the finding that there is an increase in the farm income levels when cacao is integrated into an existing cashew plantation. Furthermore, the cacao-cashew system continues to be more profitable than the pure cashew system even with a 60% reduction in cocoa price or yield.

- With support from the cacao program of Binh Phuoc province, the cacao-cashew system continues to expand in the province. High adoption rates of cacao are reported in the nearby Duc Lieu village and in Bu Dang district. Binh Phuoc has become the second province with substantial cacao area in the country. The cacao-cashew system has high potential for reducing poverty in the province. With a large cashew area in Binh Phuoc province and in other provinces in the South-East region and the Central Highland of Vietnam, there is a great potential to expand the cacao-cashew system.

Adoption of no weeding and reduced pesticide use in cashew plantations:

- Information on no-weeding practices for cashew production has been transferred to local farmers through various field visits and local workshops. Based on group discussions conducted with local farmers and village leaders in July 2009, the number of farmers applying either no-weeding or reduced weeding practices in cashew cultivation has increased by an estimated 18%.

Objective 5: Gender

Provide mechanisms to ensure women's involvement in decision-making and sustainable production and marketing practices to improve their socio-economic wellbeing within the vegetable agroforestry system.

Responding to the need of women farmers for cost-saving fertilizer inputs, a pilot vermicomposting project using an African nightcrawler species (*Eudrilus eugeniae*) was started with 10 women farmers who produced commercial vegetables and agroforestry crops in an upland barangay of Lantapan, Bukidnon. The technology was not only easy for women to adopt, but it also harnessed the interest and participation of male spouses and children. Replacing urea and chicken dung with vermicast generated savings that women could channel to pay for other pressing household needs. Based on some initial sales of worms and cast, it promises to be a lucrative source of additional income that could be sustained on minimal capital. Moreover, women's scientific interest was aroused as they experimented with different combinations of organic waste materials from VAF farms to produce the greatest worm and cast harvests. The major challenge lies in standardizing the women's vermicomposting practices.

The team contributed three papers to the cross-cutting gender research and results are in the cross-cutting gender project report.

Objective 6: Scaling-up

Build host country capacity to manage and disseminate integrated vegetable-agroforestry

- The World Association of Soil and Water Conservation (WASWAC) agreed to publish the outputs of this project in a set of four books entitled: 1) Vegetable Agroforestry Systems, 2) Vegetable Agroforestry Systems in Indonesia, 3) Vegetable Agroforestry Systems in the Philippines, and 4) Vegetable Agroforestry and Cashew-Cacao Systems in Vietnam. The drafts for the Vietnam and Indonesia studies are about 95% complete, the draft for the Philippines is 40% complete, and the summary has not yet been started. These books will be

packaged as a set of 4 books. An additional \$2400 has already been raised to supplement publication costs beyond that provided by SANREM. Mars, Inc. donated and the USDA-National Agroforestry Center purchased advanced copies for distribution to their staff

- The plan to fully test the incentive-based policy program was momentarily stopped due to the upcoming national and local elections this May 2010.
- The implementation of incentive-based policy started by SANREM will be continued through the World Agroforestry Center's Rewarding Upland Poor for Environmental Services (RUPES) project in Manupali watershed, where the incentive-based policy is considered as a new approach to reward environmental services.
- The Lantapan incentive-based policy has been identified by the Bukidnon Environment and Natural Resource Office (BENRO) as a locally promising innovation that promotes payments for environmental services (PES) through their TULSEA (Tree on multi-Use Landscape in Southeast Asia) project.
- The Lantapan incentive-based policy was shared with East African Landcare delegates as one of the local government's mechanisms to reward farmers.
- In the Philippines, VAF and IDE drip technologies were presented to the Department of Agriculture-Bureau of Agricultural Research (DABAR) staff and they are looking forward to hearing about the socioeconomic aspects of these technologies.
- IDE drip and VAF technologies were proposed to be included in the 2011-2015 DABAR agricultural research and development priorities.
- A special issue publication in the International Journal of Agricultural Engineering on selected papers presented at the first Southeast Asia Soil and Water Assessment Tool conference was completed.
- Workshops on beginners SWAT, advanced SWAT, MapWindows GIS, and stream restoration have been arranged to coincide with the second international SWAT-Southeast Asia conference in Vietnam, January 4-8, 2011 and are all advertised on the SWAT-SEA 2 website. This conference is sponsored by SANREM.
- The team contributed papers in the books for cross-cutting 'gendered network' and 'knowledge to action' studies and produced a video on the K2A process of SANREM Phase III at the Manupali watershed.
- As a spin-off, research on vegetable agroforestry in North Carolina (NC) was funded by the USDA and is now being implemented in three small farms in NC.

Significant Training, Capacity Building, and Networking Activities

- Presentation of VAF and IDE drip technologies to the Philippines' Department of Agriculture-Bureau of Agricultural Research (DABAR) staff.
- K2A research feedback session and workshop for Policy-makers, extension professionals and farmers

Research Strategy and Development Objectives

There are encouraging indications of early adoption of vegetable agroforestry and introduction of cacao in cashew plantations. IDE drip needs to be manufactured in the country for it to be adopted. The SWAT users in the Southeast Asian academic community have been growing. In Indonesia, SWAT has been incorporated in a course and in Vietnam many undergraduate and graduate students are being introduced to SWAT technology.

Phase IV Long-term Research Awards (LTRAs)

LTRA-6: A Conservation Agriculture Production System Program for the Central Plateau of Haiti

Lead PI: James R. McKenna and Steve Hodges, Virginia Tech

Host Country: Haiti

Research Progress by Objective

Objective 1: Assess the adaptability of existing agricultural production and livelihood systems for transformation to CAPS.

In December, the Virginia Tech team met to plan a January trip to Port-au-Prince and research sites at Corporant, Lachateau, and Maissade in the Plateau Central of Haiti. The research protocol for both the baseline study and in-field research was discussed and responsibilities for the implementation of these protocols were established. These matters were discussed with host country partners at the Kick-Off Workshop on 11-12 January 2010 in Port-au-Prince.

Unfortunately, just 25 minutes after we left the campus, Port-au-Prince was rocked by a 7.0 earthquake that changed everything. When we reached the Wozo Plaza Hotel in Mirebalais and realized the severity of the disaster, we postponed the field portion of our mission.

Over the next two months we monitored the situation in Haiti. A decision was made to postpone the baseline study originally planned for this spring as the number of individuals in households reflected the flight of relatives from Port-au-Prince. Also, with the university in ruins and classes canceled, recruiting our survey team became nearly impossible. This also delayed bringing the economist graduate student into the program this spring as planned. By mid-February it became apparent that conditions in the Plateau Central were stabilizing, so plans developed for the Virginia Tech agronomy team to return to Haiti to identify the research sites and present the research protocol to counterparts at Zanmi Agrikol and Caritas.

Objective 2: Increase the capacity of smallholders to adapt and improve CAPS.

In March, research sites were established at Corporant, Lachateau, and Maïssade. Research plots were identified and staked out, soil and bulk density samples taken, a percolation test conducted, GPS/GIS coordinates obtained, and the local agronomists trained in the research protocols. Haitian team members reviewed the research protocol and were provided the plot plans, bean seed, planting ropes, and data collection books. They were also provided a soil probe, milk scales, balance, min/max thermometer, rain gauge and bean disease compendium for each site.

Dr. Badio agreed to be present and assist with the planting of black beans at each site in April after the rainy season begins. He also took responsibility for mailing soil samples to the A&L Laboratory in Richmond, Virginia for analysis, and for receiving maize seed from the International Maize and Wheat Improvement Center (CIMMYT) in Mexico.

The only modification to the research protocol was the planting dates and locations of the black beans at Corporant and Lachateau. The Zanmi Agrikol agronomists pointed out that black beans are normally planted in the late fall at the elevation of our Corporant and Lachateau sites and that the success of spring planted beans was uncertain. However, at the higher elevations around the sites, farmers did plant beans in the spring. The decision was made to plant beans in farmer fields

on only one of the two planned April planting dates and save the seeds for the second planting date for a November planting at Corporant and Lachateau. At Maissade where the elevation is proper for spring bean planting, the beans will be planted on the two April planting dates originally planned in the proposal.

Objective 3: Strengthen the human and institutional research and extension capacity for CAPS.

In January, all of the members of the Virginia Tech and Haitian teams met at the College of Agriculture (Damien) in Port-au-Prince for the Kick-Off Workshop. All facets of the project were introduced and discussed. After the workshop both teams set off to visit the research sites, lay out the experiments, and discuss the specific protocols. The earthquake delayed the rest of the tasks for this objective.

Significant Training, Capacity Building, and Networking Activities

Degree training students supported:

A PhD student to work with Dr. Amacher has been identified, but not yet enrolled. We are searching for a PhD student to work with Dr. Thomason in CAPS.

Short term training events conducted:

Agronomists at Zanmi Agrikol and Caritas were trained to square, GPS, and stake out the experiments, take soil samples, conduct soil percolation tests, and take soil bulk density, as well as introduced to the research protocols (randomization, replication, seeding, data collection, and harvest techniques) for black bean, maize, and conservation agriculture research plots.

Research Strategy and Development Objectives

Progress achieving research objectives:

A kick-off workshop with all Virginia Tech and Haitian partners was held. Initially, there was a bit of concern from our Haitian partners as to the expectations the project placed on their time. But as the meeting went on, and more and more of the shared responsibilities came to light, there was a noticeable change and by Tuesday afternoon the team was beginning to come together. Research sites have been selected, sampled, and identified via GPS/GIS. Agronomists at Zanmi Agrikol and Caritas were trained in research protocol. Necessary equipment for data collection has been delivered for each of the sites, soil samples taken and analyzed, and bean and maize germplasm delivered to the sites.

Progress along the development impact pathway:

Progress has been made in building a strong team. Initial training of local agronomists has been conducted.

Lessons learned relevant to development goals:

External/environmental events can alter plans.

LTRA-7: Conservation Agriculture as a Potential Pathway to Better Resource Management, Higher Productivity, and Improved Socio-Economic Conditions in the Andean Region

Lead PI: Jeffrey Alwang, Virginia Tech

Host Countries: Bolivia, Ecuador

Research Progress by Objective

Objective 1: Identify and evaluate production practices and farming components that can be assembled into conservation agriculture production systems.

- We have identified locations for farmer field experiments based on findings from Phase III of the SANREM CRSP.
- Stakeholders in Ecuador have been engaged to identify key crops, to discuss CAPS components, to discuss alternative cover crops and to identify woody species that can be used in perennial strips.
- The CAPS to be developed and tested will be finalized during discussions at the SANREM annual meeting in Blacksburg.

Objective 2: Validate candidate CAPS in terms of impacts on: soil health, soil retention and carbon and other nutrient balances; sustained productivity; profitability; risk bearing; the environment; compatibility with household livelihood strategies; and social conditions including gender considerations

- Some experimental treatments have already been established and a limited number of field trials are being conducted on farmer fields in Ecuador. At the annual meeting, US and host-country scientists reviewed ongoing experiments and will prepare a revised plan by the annual meeting in Blacksburg in early May.
- We will make some changes to our originally proposed experimental designs based on field observation, group discussions, and project needs. In particular, we decided to expand investigations of cover crops to intensify potato-pasture systems in the upper Ecuador watershed, to examine means of increasing available potassium in Ecuador, and increasing soil fertility in Bolivia.
- In Bolivia, limited rainfall and highly degraded soils increase the need to find green-manure candidates that can prosper in near-drought conditions.
- The minimum data set for soil health proposed by the SANREM ME was discussed and will be adjusted to meet project needs.
- Means of measuring on-farm costs and benefits were established and have been shared with host-country partners.
- Data for developing a nitrogen index are being collected.
- In Ecuador, Victor Barrera has presented a successful proposal (for \$5 million) to SENACYT (the national services for science and technology—the NSF equivalent) to expand SANREM activities in three watersheds.

Objective 3: Promote adoption of the most appropriate CAPS by identifying mechanisms to increase the profitability of conservation agriculture

- Protocol for this research has been designed.
- In Ecuador, there is strong interest in the lower watershed for establishing a blackberry processing plant. Since blackberry production is a critical component of the proposed CAPS, SANREM will investigate this possibility and help the local government in identifying investors.
- In Bolivia, SANREM scientists are seeking ways to exploit PROINPA's potential in producing bio-inputs as supplemental inputs for local CAPS.

Objective 4: Design and evaluate mechanisms for disseminating results to similar areas

- No activities to report on.

Significant Training, Capacity Building, and Networking Activities

Meetings have been held in Bolivia with Fundacion Valles, the NGO that is administering the USAID-funded Food Security project. These meetings identified areas of collaboration. Meetings were held in both countries with local governments to obtain support and buy-in for SANREM activities.

In Bolivia, the team has focused on strengthening links between SANREM activities and USAID-supported projects. In Ecuador, strong linkages have been created between SANREM and local and regional governments.

A field-day with 18 participants (11 male, 7 females) was held on April 13 in Illangama, Ecuador.

LTRA-8: Improving Soil Quality and Crop Productivity through Farmer Tested and Recommended Conservation Agricultural Practices in Cropping Systems of West Africa

Lead PI: P. V. Vara Prasad, Kansas State University

Host Countries: Ghana, Mali

Research Progress by Objective

Research progress on Objective 1 is reported below. Activity related to all other objectives is yet to begin.

Objective/Activity 1: Baseline Surveys to Collect Initial Socioeconomic and Biophysical Conditions

The purpose is to understand which CAPs, under what specific conditions, can increase productivity and address the needs of farmers.

Progress towards completing critical Annual Work Plan tasks for Objective 1.

- Organized project inception workshop for all partners (Dr. P.V.V. Prasad and in-country PIs). Numbers of participants were about 54 in Ghana and 20 in Mali.
- Identified sites and villages for conducting baseline surveys and experiments (Dr. P.V.V. Prasad along with in-country PIs and partners)

- Developed questionnaires for baseline surveys (Dr. Tim Dalton along with in-country PIs and partners)
- Synthesized materials and plan for gender sensitization training (Dr. Nina Lilja)
- Developed minimum dataset worksheets and procedures for biophysical material (Dr. P.V.V. Prasad along with in-country PIs and partners).

Significant Training, Capacity Building, and Networking Activities

Two potential graduate students for degree training from Ghana were identified. They are currently preparing for TOEFL and GRE to initiate their application process. They will potentially start their degree programs in spring 2011.

Special events or networking activities

The project initiation meeting was conducted in Ghana (Wa) and Mali (Bamako) in November 2009. All participants of this project and other potential collaborators and NGOs were updated about goals of SANREM Phase IV and opportunities.

Briefing was given at the USAID – Ghana Mission about our project by Dr. J.B. Naab and Dr. P.V.V. Prasad.

Briefing and discussions were also initiated at the USAID- Mali Mission about our project by Dr. M. Doumbia and Dr. P.V.V. Prasad.

Connections with Peace Corps were initiated and will be followed for developmental activities.

Dr. Keith Moore (Associate Director of SANREM) and Dr. Maria Elisa Christie visited Mali and Ghana to assess the initiation of our project and develop technology networks and gendered knowledge cross-cutting research activities and develop linkages with USAID Missions.

LTRA-9: Developing Sustainable Conservation Agricultural Production Systems for Smallholder Farmers in Southern Africa

Lead PI: Neal Eash, University of Tennessee

Host Countries: Lesotho, Mozambique

Research Progress by Objective

Objective 1: Integrate cover crops into CAPS to protect soil from erosion, provide weed suppression or control, include crop rotations that provide forages for livestock, improve soil quality as measured by soil carbon C, decrease risk and vulnerability to drought.

Cover crops have been planted in Lesotho and will be continually evaluated over the winter and into the spring. Discussions with collaborators in Mozambique are forthcoming.

Objective 2: Determine the agronomic and economic fertilizer rate for maize in both the basin and machine no-till methods.

To date, some successful research trials and demonstrations have been established with our partners at the National University of Lesotho and Growing Nations at Mohale's Hoek. Research

this past year has focused on understanding factors that determine maize yield in Lesotho (planting date, plant populations, fertilizer rate, and weed management).

In Lesotho fertilizer rate studies have been implemented but not yet harvested. Following harvest we will evaluate the data to determine how this study should be changed for next season. Initial observations suggest that yields will probably surpass at least 4 t/ha. Discussions with collaborators in Mozambique are forthcoming.

Objective 3: Characterize the composition and contribution of N and C from legume/grass cover crops and determine the best species for maintaining soil residue cover until after maize crop harvest.

In November 2009 we held discussions on future work that will be centered on cover crops for weed suppression, biomass production, grain production, and residue cover. Cover crops that will be assessed include wheat, barley, oats, and rye. For example, we are exploring two different wheat treatments in our studies due to work we completed on a different funded grant proposal. One of our wheat treatments will be harvested for grain (by hand, heads only) whereas the other treatment will be grown as a biomass crop and rolled flat after maturity. The reason for this is the fact that (we perceive) it will be difficult to get farmers to produce a food or a cover crop such as wheat and not harvest the grain as is the common practice with most cover crops. We will also establish a number of legume cover crops to assess the potential of including a legume with the cereal/grass cover crop. Legumes to be included will be medics, subterranean clover, rose clover, sweet clover, sweet vetch, grazing vetch, pink serradella and sweet narrow leaf lupine. A plot plan for this study was developed with our partners during our visit in November 2009.

Different cover crop species have been planted in Lesotho and will be evaluated for N and C composition during the winter growing period. Similar work will be initiated in Mozambique following discussions with collaborators.

Objective 4a: Determine the short- and long-term impacts of CAPS on gender equity especially in terms of household income and economic impact and involve women in decisions that impact their welfare

While in Lesotho in January we had discussions regarding how to determine the impacts of CAPS. Impromptu, semi-structured interviews were conducted with women engaged in CAPS to gain initial insight into how CAPS have been introduced, motivation for adoption and expectations for incentives and outcomes. In November in-depth participatory research will be conducted in Lesotho with results from this work used to streamline our participatory research efforts in Mozambique.

Objective 4b: Evaluate ways and means to improve fertilizer adoption rates among smallholder farmers, the degree to which market structure influences fertilizer use, and determine welfare implications based on price margins.

Field research during the current growing season will provide data to assist with understanding fertilizer economics in smallholder maize production. Preliminary data, in the form of spot prices for key inputs and outputs in Lesotho, were obtained from contacts whose acquaintance was developed and strengthened during the trip in January/February. Work in the coming year will further investigate these interactions.

Significant Training, Capacity Building, and Networking Activities

We have two U.S. M.S. students working on this project. At this point we do not have any significant training or publications to report. That said, we have developed an internal database that houses all of the articles, reports, data and other information that either has been generated in the literature and by partners or directly by the project team. This information is available to all of our immediate project team and is serving as the foundation of our literature review and intercontinental workspace.

In early February we met with the U.S. Ambassador to Lesotho, Mr. Robert Nolan, Mr. Craig Anderson (Management Counselor), Ms. Elizabeth Power (Deputy Chief of Mission), and Ms. Sara Devlin (PDEP Officer) to discuss our USAID objectives. We met with them for an hour, discussing our ongoing demonstrations and research. The ambassador and his staff were enthusiastic in their support for our work and hope to visit the research site in Maphutseng.

Research Strategy and Development Objectives

In Lesotho we have made some progress understanding the overall potential of the conservation agriculture systems. Once we have the yield data analyzed we hope to collate the results and assess what changes need to be made for the upcoming season. In Mozambique we hope to meet soon with our collaborators and figure out ways and means to assist their respective research and outreach programs. The biggest lesson we learned (relearned!) is the age old lesson one hears about Africa—you can never have too much seed or fertilizer on hand prior to the planting season. In Lesotho we will have more seed and fertilizer stockpiled a minimum of one month prior to the onset of the rainy season.

LTRA-10: Development and transfer of conservation agriculture production systems (CAPS) for small-holder farms in eastern Uganda and western Kenya

Lead PI: Jay Norton, University of Wyoming

Host Countries: Uganda, Kenya

Research Progress by Objective

We are on schedule with no changes to our Annual Work Plan tasks.

Objective 1: Compile information for prototype CAPS development. Assemble stakeholder advisory groups for each area.

We completed **task 1, Gather information on existing local/regional CAPS**, during a March 12-28 trip to our research areas by our team. During the trip we met, exchanged information, and discussed potential collaboration with a wide range of organizations (see Networking in section below). We met with local, national, and international organizations working on agricultural development and gained significant insights about issues, constraints, and current projects. We also initiated essential collaborative relationships. During meetings we split into two groups by gender and asked series of questions about important crops and livestock, procedures for growing maize and other crops, and concerns about markets, labor, expenses, and other issues. We are in the process of compiling our notes and information from these meetings. Preliminary conclusions that will contribute to development of our baseline survey of smallholder farmers/stakeholders include:

- Though there are many alternative crops and cropping systems being developed and introduced to farmers, as well as programs in place to subsidize fertilizer purchases and improve access to fair markets, there is little adoption by the farmers we talked to. Most do not have access to fertilizer subsidies for a number of reasons, and describe unfair market practices as a major problem;
- Continuous maize production that includes plowing twice before planting, and then two deep weedings, is practiced on most of the land in all the districts. There are differences in practices, such as intercropping with beans, use of fertilizers, use of improved varieties, use of pesticides, plowing traction, and second-season crops, but intense, repeated tillage is the norm;
- Alternative tillage practices that reduce disturbance and leave more residue on the surface are not on the agenda of large research organizations, but are being promoted by at least two NGOs: ACT and KENDAT;
- From this preliminary data, we think that we can make an important contribution by informing collaborating farmers about the downsides of repeated plowing and then working with them to co-design approaches to achieve the benefits without the detrimental effects. We think that the benefits of weed control and softening the soil are readily apparent, but the detrimental effects – plow-pan compaction, accelerated soil organic matter loss, and erosion – are not.

These preliminary impressions will inform development of our baseline survey, which will form the basis for focus-group and advisory-group discussions (Objective 2) to shape feasible CAPS to be evaluated under Objective 3.

Objective 2: Define the traditional system and develop prototype CAPS for each area that build upon local knowledge, traditional practices, and address agronomic and socio-economic constraints.

This objective will be pursued during the summer months.

Objective 3: Evaluate agronomic, ecological and economic sustainability of CAPS compared to traditional practices.

Work on this objective has not yet been initiated.

Significant Training, Capacity Building, and Networking Activities

Degree training students supported:

We are in final stages of recruiting two PhD students at the University of Wyoming from the host countries, as well as one MSc student at Makerere University, Uganda, and one at Moi University, Kenya. We circulated the announcement during our recent trip and received over 30 applications.

Short-term training events:

The first task completed to date focused on listening rather than training, but Dr. Jay Norton took an opportunity to provide technical staff of KACOFA (Kapchorwa Commercial Farmers Association) in the hilly Kapchorwa district information on soil loss processes and plow effects so that they can begin to formulate design solutions with the farmers they work with.

Special events or networking activities:

Our completion of task 1 in Objective 1 involved networking activities. To build upon these relationships we have developed a website where we have posted information on the project and will continue to provide updates (<http://uwyosanrem.wordpress.com/>). The site includes a password-protected page that our core team uses to post relevant information and working documents.

List of contacts made:

- CIAT Tropical Soil Biology and Fertility Program, Nairobi. Dr. Saidou Koala, AfNet coordinator, and Dr. Pieter Pypers, soil scientist;
- Kenyan Network for Dissemination of Appropriate Technology (KENDAT), Nairobi and conservation agriculture field site near Mwea. Dr. Joseph Mutua;
- USAID Kenya Mission, Nairobi. Allen Fleming, Director, Agriculture, Business and Environment Office, and Dr. Peter Ewell, Regional Agricultural Advisor;
- Kenya Agricultural Research Institute, Nairobi. Dr. P.T. Gicheru, Director, including the soil survey/GIS facility and soil fertility testing laboratory;
- African Conservation Tillage (ACT) Network, Nairobi. Saidi Mkomwa, Executive Secretary;
- CGIAR International Livestock Research Institute, Nairobi. Teleconference with Shirley Tarawali, Director, Jan de Leeuw, Bruno Gerard, and Alan Duncan from Addis Ababa; Nils Teufel from Delhi; and Carl Rich from Oslo;
- Moi University, Eldoret, Kenya. Soil Science faculty and students;
- Manor House Agriculture Centre, Kitale. Met with staff and trustees, signed subaward;
- Farmers' group near Tororo, Uganda, and associated agricultural marketing information center;
- Farmers' group near Mbale, Uganda;
- Kapchorwa Commercial Farmers Association (KACOFA), Uganda. Director David Kissa with field facilitators and board members, district environmental officer, Land Care Chapter officer;
- Kapchorwa farmers' group, Uganda;
- Farmers' group near Chwele, Kenya;
- Chwele Market and Kenya Agricultural Commodity Exchange (KACE) Office;
- SACRED Africa staff, board members, and students;
- Two farmers' groups near Bungoma;
- Kenya Climate Change Working Group, Nairobi. Susy Wandera, steering committee; and
- Eugene Wamalwa, Member of Parliament from Trans Nzoia District, presidential candidate, and farmer interested in developing legislation to support conservation and equitable market access.

Research Strategy and Development Objectives

Progress achieving research milestones:

Task 1, information gathering on current agricultural projects has provided a depth of information and formed working relationships with important organizations and individuals that will facilitate a successful baseline survey and subsequent CAPS development, testing, and transfer.

Progress along the development impact pathway:

Our networking activities and interviews with farmers and development workers help us to develop insights on what types of work have the best chance for broad impact. Our impression from those discussions and field visits is that CAPS development will need to start with a small increment concentrated on conservation tillage practices before larger cropping system and livestock management changes can be introduced or adopted. The baseline survey and focus group activities in Tasks 3 and 4 of Objective 1 will further explore this impression.

Lessons learned relevant to development goals:

During our trip to complete task 1, we learned that we have a well-rounded research team that can work well together and come to consensus on complex strategy and design issues. Importantly, we developed a preliminary strategy to focus on conservation tillage practices as a first step toward complete CAPS. The strategy will be tested and refined during the baseline survey and focus group activities.

LTRA-11: Sustainable Management of Agroecological Resources for Tribal Societies (SMARTS)

Lead PI: Travis Idol, University of Hawaii

Host Countries: India, Nepal

Research Progress by Objective

Based on our 2010 work plan, we are on track to complete our goals in the time specified.

Objective 1: Determine the set of CAPS to study using Participatory Rural Appraisal (PRA), including risk analysis

We were not able to accomplish Task 1 of Objective 1 “Conduct baseline survey in 10 villages...” by April 2010. The baseline surveys, risk analysis, and consultation with stakeholders are scheduled to be completed by August 2010. We are planning to visit India in late May 2010 to initiate this work. We also have two graduate student volunteers who will be spending one month each in India to complete these tasks, under the supervision of our UH faculty team and with the support of Orissa University of Agricultural Technology (OUAT) faculty and Agramee partners.

Objective 2: Explore stakeholder preferences for CAPS

The graduate students who will be completing these research tasks have been involved in our planning processes so that they have a thorough understanding of the project goals and their specific roles. Now that the subaward terms and contracts are finalized with our partners in India, we have begun hiring technical support staff and recruiting graduate students and host-country fellows, as outlined in the project. We plan to initiate this work during our visit to India in late May 2010. The support staff will receive extensive training on research methods and requirements. Our graduate students will complete these tasks under faculty supervision and with the support of our host-country partners. We anticipate it will take two months after collection of the data to analyze it within the model frameworks; these tasks are scheduled to be completed by October 2010.

Objective 3: CAPS implementation and training

We are on track to implement our model CAPS for the first year in May-June 2010. We are planning to train farmers and support staff on implementation, management, and monitoring of the CAPS field plots during our upcoming visit to India. Our graduate students will install the runoff and erosion monitoring plots this summer. We will visit India again in December 2010 to evaluate the performance of the CAPS.

Changes in research design or methods, obstacles encountered, and action taken

The only significant obstacle that has caused us to change our research design is the recognized difficulty in implementing research plots with several farm households in 10 separate villages. We have scaled back this design for the first year to one farm household in 4 separate villages. We plan to expand the number of households and villages based on our experience this first year. Instead of greatly expanding the number of researcher-controlled experimental plots, we will encourage farmers to implement preferred CAPS under their own control. We will use these plots as real-world examples of CAPS implementation for comparison with conventional farming methods in our research design.

Objective 4: Use Participatory Action Research (PAR) to promote reflection, evaluation, and continuous improvement of CAPS

As part of our planned training this summer, we will introduce the principles of PAR and how they can be applied within the context of this project.

Objective 5: Build capacity of farmers, NGO's, and universities in country

We have begun to hire village technicians and professional staff at Agramee. We will hold training on principles of PAR this summer. We are planning to co-host a symposium with Agramee in December 2010 to establish an NGO-university network around the CAPS. We are beginning to recruit graduate students for the remaining UH graduate assistant positions and host-country fellowships.

Significant Training, Capacity Building, and Networking Activities

We have hired one US graduate student to work on this project and have gotten agreements from two other students to volunteer for the summer so that we can implement our model CAPS for the first year.

Part of our UH faculty team visited India in March to meet with our OUAT and Agramee partners and the cooperating farmers to discuss research capacity, roles and responsibilities, training needs and opportunities, and specifics of the CAPS research objectives and methods. This meeting was very fruitful and has allowed our UH team and partners to better select model CAPS for the first year that have the best chance of improving crop yield and natural resource quality and that would meet the needs and capabilities of the farmers involved.

Research Strategy and Development Objectives

Progress achieving research milestones.

We have established partnerships with our key NGO and university partners in India. We have discussed respective roles and responsibilities, and we are using our upcoming implementation of the first-year CAPS as a way to formalize these. We are discussing training needs, opportunities, and methodologies. Our visit in March was very helpful in establishing

partnerships, assessing partner capacity, discussing roles and responsibilities, selecting model CAPS for the first year and establishing locations and farmer cooperators for implementation.

Progress along the development impact pathway.

These are the first steps necessary to carry out our research and capacity-building goals. We feel we have made adequate progress in planning and building initial capacity to begin accomplishing these goals. We do not foresee any major obstacles to accomplishing our tasks on time and within the outlined framework and methodologies specified. Our partners are absolutely essential to project success. They have been asking good questions and discussing key topics with us to ensure we can carry out our tasks, so we feel they understand what we want to accomplish, agree with our goals and objectives, and are eager and willing to partner with us to achieve them. The students we have hired and recruited have the training and interest necessary to carry out specific tasks under our direction and with the support of our partners.

Lessons learned relevant to development goals

The main lesson we have learned is to stay in frequent communication with host-country partners and to give them the freedom and the responsibility to contribute to setting specific goals, timelines, and developing tasks so that they feel confident that they can fulfill their roles and responsibilities. It also allows them to be comfortable suggesting changes and requesting support or resources to accomplish their tasks. We also feel it encourages them to commit to the project's objectives and specific tasks. This is the essence of collaboration as opposed to just cooperation. In the end, collaboration is more likely to result in long-term changes because the host-country partners are more likely to adopt and adapt the ideas, strategies and methods of the project for themselves. This should result in more rapid and wider dissemination among stakeholders. It also establishes the basis for continuing and growing partnerships between US and host-country institutions and stakeholders.

LTRA-12: Conservation Agriculture for Food Security in Cambodia and the Philippines

Lead PI: Manuel Reyes, North Carolina Agricultural and Technical State University

Host Countries: Cambodia, the Philippines

Research Progress by 'GETS' Objectives

Goal: To show that conservation agriculture (CA) principles (the practice of minimal soil disturbance, continuous mulching and diverse species rotations) constitute the best 'tool box' to create sustainable permanent cropping systems for annual production under wet tropical conditions in Cambodia and the Philippines and to show that CA will reverse soil degradation, increase crop yield and profits and reduce the labor burden on women.

Objective 1: Gender

Pinpoint gendered limitations and advantages that can promote adoption of CAPS, and determine if CAPS will increase labor burden on women in Cambodia and the Philippines

The baseline survey instrument was drafted. This instrument will identify established patterns of gendered division of labor in farming households, gendered knowledge of agricultural practices (historical antecedents), its changing patterns, and problems encountered. Comments from team

members were sought and the survey instrument is being finalized. In Cambodia students who will conduct the survey have been recruited.

Objective 2: Economics

Identify field- and farm-level CAPS that will minimize smallholder costs and risks while maximizing benefits and adoption in Cambodia and the Philippines

A draft survey instrument for baseline data gathering of socio-economic and agronomic (physical) information/data had been completed with suggestions from partner institutions during the period covered. The sampling frame for household and non-farm stakeholder surveys accounting for gender is expected to be completed by May. The Terms of Reference for Dr. Eric Penot mission to support the socio-economic baseline survey was completed.

Objective 3: Technology Networks

Quantify the effectiveness of SANREM-supported farmer groups in Cambodia and the Philippines in training knowledge leaders, in being knowledge transmission points, and in facilitating network connections leading to widespread adoption of CAPS; and find out whether a proposed micro-credit approach and a method to facilitate access to mechanized direct seed drilling and spraying will be successful in promoting adoption of conservation agriculture in Cambodia.

For both countries farmer volunteers have been identified and contacted. Agreements with these volunteers are being finalized. In Cambodia, 27 households with total area of 45 ha agreed to partner with project researchers.

Negotiations and agreements with a bank in Cambodia are being finalized

Objective 4: Soil Quality

Assess soil quality and measure crop yield and biomass from conservation agriculture production systems and compare them with soil quality and crop yield and biomass from conventional plow-based systems in Cambodia and the Philippines

Possible research sites and farmer volunteers in the Philippines have already been identified. Measurement of baseline soil quality and setting-up of experimental designs has been mostly completed in Cambodia, while in the Philippines, it has been moved to a later date due to the delay in the issuance of the subaward and the release of the budget. Cambodia activities have been pre-funded by *Projet d'Appui au Developpement de l'Agriculture du Cambodge* (PADAC) and the Royal University of Agriculture (RUA). The experimental design on a 'demonstration farm' and on the on-farm experimental sites has been completed in Cambodia. In the Philippines, researchers will meet with farmer partners during the kick-off meeting to finalize the experimental design.

In Cambodia, because funds were prefunded by PADAC and RUA, soil sampling has been done as planned at 0-5 cm, 5-10 cm, 10-20 cm, and 20-30 cm on each of the four subplots of the 30 monitored plots. One pit has been dug per subplot and bulk density measured on 0-15 cm and 15 – 30 cm. In the Philippines, no funds were available hence soil sampling has not yet commenced. Contracts are still being finalized and cash advances can be wired by NCA&T to UPLB and LFPI after these contracts have been signed.

Significant Training, Capacity Building, and Networking Activities

A PhD student from Cambodia is being recruited from the Faculty of Agronomy of the Royal University of Cambodia. He completed his M.S, has good English communication skills, and successfully got a French Embassy funded project with Reyes as International supervisor. The project is entitled: “Soil Quality and Crop Productivity under Direct Seeding Mulch-based Cropping Systems” and is complementary to the USAID-funded (SANREM) project and the French-funded (CIRAD-French Agricultural Research Center for International Development) project. The research will be conducted in two experimental sites located in Chamkar Leu District, Kampong Cham Province (Site 1) and Rattanak Mondul District, Battambang Province (Site 2). The soil quality training has been tentatively scheduled for January 2011.

Cambodian host country coordinator, Stéphane Boulakia, in his visit to NCA&T and VT presented how conservation agriculture can be an excellent tool for economic and territory development in Cambodia.

Due to fund release delays, the visit of Philippine researchers to the Cambodia site has not yet taken place. The visit has been moved to June to correspond with the scheduled visit of Reyes and Yeboah. It was decided that since Dayo will combine the gender studies in Cambodia and the Philippines, it is important that she goes with the team.

The permit to purchase machinery more than \$5000 was prepared and approved by USAID. The order was prepared but funds to pay the machinery order in Brazil are still being processed. The Pesticide Evaluation Review and Safe Use Action Plans (PERSUAP) for both countries were submitted to VT for submission to USAID.

Cross-cutting Research Activities (CCRAs)

Economic Impact Analysis

Lead PIs: Mike Bertelsen and George Norton, Virginia Tech

Research Progress by Objective

Objective 1: Identify field- and farm-level production system(s) and sequencing of CAPS elements that will minimize smallholder costs and risks while maximizing benefits and adoption.

A draft general CAPS baseline questionnaire has been prepared and circulated to interested LTRAs.

Current plans call for concentrating detailed analysis efforts on three LTRAs in different regions of the world with a more general sharing of economic information from other LTRA activity areas. The final selection of the three targeted LTRAs will occur after consultations with PIs during and immediately after the annual meeting with preliminary data gathering to begin shortly thereafter. The use of secondary datasets existing in some areas will be explored to lighten the data gathering load.

Objective 2: Estimate the impacts of CAPS systems in targeted LTRA areas.

Only preliminary discussions have occurred to date.

Significant Training, Capacity Building, and Networking Activities

A M.S. student in Virginia Tech's Agriculture and Applied Economics Department, Abigail Nguema, has been selected for this activity. CCRA PIs Mike Bertelsen and George Norton met with her to discuss overall activity strategy and the upcoming SANREM annual meeting. Ms. Nguema is currently reviewing all LTRA proposals as well as relevant literature to prepare for the meeting and subsequent activity kick-off. Major networking and consultations with LTRAs will occur during the annual meeting.

Gendered Knowledge CCRA

Lead PI: Maria Elisa Christie, Virginia Tech

Research Progress by Objective

Objective 1: Identify gendered practices and participation that shape local knowledge related to agricultural production

A working paper on technology networks and gendered knowledge was drafted, revised, and published. It describes the theoretical foundations for analysis of gendered knowledge and social networks in conservation agriculture research and development, and outlines a methodology for identifying all relevant actors and their relationships in the local agricultural setting for each of the LTRAs. The methodology was the subject of extensive debate within the team and went through various revisions before being finalized in the working paper that was posted on the SANREM CRSP Website and circulated to all LTRA PIs.

Site level introduction of this work began in Haiti in collaboration with the Technology Networks CCRA but fieldwork was impeded by the earthquake. Our first focus group activity was implemented in two communities in Mali with the LTRA-8 team: outcomes included a listing of potential actors identified for the battery of network actor questionnaire items and initial findings regarding women's and men's perceptions of soil quality based on landscape interpretation. A translated version of the questionnaire was left with the Mali team and shared with the Lead PI. The same focus group activity was initiated at the Ghana site of LTRA-8 as well two weeks later. Arrangements were made for fieldwork activities to take place in Ecuador in April.

Objective 2: Demonstrate how men and women's knowledge, beliefs and perceptions provide constraints and opportunities for CAPS.

The working paper includes a literature review on gendered knowledge and provides a methodology for participatory qualitative research. The LTRA-8 research teams in Ghana and Mali have these questionnaire items for inclusion in their baseline surveys which are expected to be conducted within the next quarter. The LTRA-7 (Andes) team does not currently have plans for a baseline survey; an alternative strategy is being developed. A two-day fieldwork effort targeting gendered knowledge of soils as well as a resource generator (to identify key spaces and actors necessary for agricultural production) was planned for early April in conjunction with a gender workshop for IPM CRSP.

Activities in Mali included one aimed at identifying gendered knowledge of soils using both soil samples and photographs. Separate men's and women's groups discussed soil quality and drew maps of access to key productive assets. Findings included a distinct perceptual difference between men and women concerning how they evaluated the quality of a soil. Presented with pictures of different soils and with two Tupperware boxes of local soils, women identified the 'best' soils with respect to how they performed in the ecology (i.e., with respect to what they produced, particularly distinguishing their two local soils in terms of whether they were millet or sorghum soils; they also judged the photo with the fruit tree to have the best soil). On the other hand, men differentiated soils on the basis of how easy or difficult they were to work under slight rain or heavy rain conditions. The tentative hypothesis suggested by this fieldwork is that women evaluate soil based on its ability to produce food; this will be tested in different sites. It has proved valuable to have a soil expert share his knowledge with the farmers after this exercise and explain scientifically the differences in soil characteristics.

Objective 3: Propose recommendations that build on gender findings for CAPS

Work on this objective will not commence until after the first round of data collection at each of the LTRA sites has been completed and analysis of the gendered practices and knowledge has been initiated.

However, based on preliminary observations in Mali, it was recommended that the team explore working with women in their collective garden space to grow a cover crop that could be used for animal forage. This is important given women's roles raising small animals (goats in particular) and that women's access to forage may enter into direct competition with leaving crop residues on the ground, one of the key principles of CAPS. One idea involved having women test various groundcover crops in their group vegetable gardens, focusing on the importance of women having fodder available to feed their small ruminants.

Significant Training, Capacity Building, and Networking Activities

A Graduate Research Assistant has been recruited and will be working on a Masters' degree in Geography with her thesis focusing on gendered knowledge.

During the visits to Haiti, Mali, and Ghana short-term training was conducted with local partners and participants involving 99 men and 54 women.

Publications, presentations, etc.

One SANREM CRSP Working Paper and three presentations were made.

Research Strategy and Development Objectives

The fieldwork in Mali showed that it will be difficult to obtain consistent, comparable data across sites with qualitative research methods even with closely coordinated efforts. Extra care and time must be taken to train teams to carry out similar exercises.

It is clear that flexibility will be needed for adaptation to the conditions and timing in various host-country research sites. In addition, better coordination with local teams and between local teams and communities is required to schedule activities at a time that is convenient for the community members and when women will be available to participate. In Mali, a last minute change was required based on the day that a regional market took place and that would have made community members very scarce. Also, timing activities to start in the early morning coincided with a time that women are particularly busy with domestic duties, including cooking. The team postponed starting activities until the women were able to join (such that we achieved close to our 50/50 gender balance) but it clearly would have made more sense to either schedule activities to begin later in the day or to ensure that women had been previously informed so that some might have been able to make arrangements to be there early. The importance of having equal numbers of women and men participate in SANREM activities must be made very clear and requires insistence at all levels. Also, the short amount of time allotted to activities in break out groups (one men's, one women's) resulted in a bias against women's participation, given the much lower levels of literacy among the women; basic education skills are lacking and constitute serious gender-based constraints for our project.

Thus, while some events, such as earthquakes and rains, are less predictable and affect our ability to carry out fieldwork, others, like a weekly market or women's chores only require advance planning and consideration for community members and are key to achieving equity and participation.

Soil Quality and Carbon Sequestration CCRA

Lead PI: Michael Mulvaney, Virginia Tech

Research Progress by Objective

Objective 1: To quantify the soil carbon (C) sequestration, infiltration rate, erosion risk, and soil fertility status of conservation agriculture production systems (CAPS) vs. traditional cropping systems.

Biophysical scientists on all LTRAs are interested in the collection of a common minimum dataset to measure soil C sequestration, soil fertility, and soil erosion associated with CAPS in

order to have some continuity among the LTRAs. We are particularly interested in drafting a common minimum dataset in advance of Time 0 data collection.

The ME has facilitated discussion among all the crop and soil scientists associated with the LTRAs in order to agree upon a common minimum dataset to meet the objectives of this research. At this time, the crop and soil scientists have reached a consensus on minimum crop and soil parameters to be measured. Those parameters include soil chemical properties (total soil C and N, plant available P and K, and pH), soil physical properties (infiltration rate, bulk density, soil texture, field length and slope, soil classification, estimation of erosion rates, and soil amendments), crop physical properties (grain yield), crop chemical properties (residue C), biomass data (percent ground cover, total above ground biomass, and biomass removal), and climate data (daily rainfall and daily maximum, minimum, and average air temperature). Exact methodology still requires further elucidation, which will be discussed among the scientists at the May kick-off meeting. Common methodology will likely be utilized for soil chemical properties (as opposed to soil physical properties) in order to ensure that scientifically sound comparisons can be made among those parameters. In most cases, however, it will be left to the discretion of the PIs to determine the methodology most appropriate for their locations.

Objective 2: Identify cropping systems or elements that improve soil fertility, reduce erosion, and increase C sequestration.

This objective will be accomplished after the quantification of soil chemical and physical parameters are elucidated. Under this objective, we will identify those systems or elements of systems that improve soil quality while maintaining or improving grain yield. Ideally, we will be able to identify common parameters that improve soil quality across all sites worldwide.

Objective 3: Relate successful CAPS components to site specific environmental conditions, including the socioeconomic and biophysical environments to determine what combinations of environmental conditions enable success of CAPS.

This objective will relate those components of CAPS that improved soil quality to social, economic, physical, climatic, and gender parameters in order to determine which of these are the most important for successful implementation of CAPS and those CAPS elements that had the greatest impact on soil quality. We are interested in assessing which combinations of environmental conditions enable successful CAPS.

Significant Training, Capacity Building, and Networking Activities

The coordinating agronomist at the ME has facilitated a dialogue among all the crop and soil scientists on the LTRAs. This has led to a consensus on the biophysical parameters to be measured as part of the common minimum dataset in advance of Time 0 data collection. Final agreement on the dataset will be accomplished during the May kick-off meeting.

Degree training of students will occur after the ME agronomist gains adjunct status with Virginia Tech. This will allow disbursement of funds to support a degree seeking student.

Research Strategy and Development Objectives

Due to the intrinsically slow nature of soil morphology and genesis, five years may not be long enough to determine which CAPS elements improved soil quality. For example, conservation tillage, which is used as an experimental treatment in all of the LTRAs, is known to sequester C at a rate of approximately 0.1% per year after conversion from conventional tillage practices.

After four years, we may expect an increase in soil C in surface horizons to increase by about 0.4%, which may be too small of a change to detect in these experiments, given normal variation in soil C across fields and landscapes. However, some regions may have greater C sequestration potential, depending upon the amount of biomass applied to the soil surface, slope, rainfall patterns, relief, temperature, and biota. After careful deliberation among the biophysical scientists, we are attempting to circumvent this potential problem by sampling soils, in part, at shallow depths. This will give us every chance to identify significant differences in C sequestration among experimental treatments, although the outcome is uncertain.

The proposed minimum dataset for the biophysical scientists marks a milestone in the determination of quantifiable research objectives related to the LTRAs. Although the development of this dataset is strategically important, it represents only a beginning to our research objectives. In the future, we will coordinate with social scientists and gender specialists to determine perceptions of and adoption potential for those CAPS that improve soil quality.

Technology Networks CCRA

Lead PI: Keith M. Moore, Virginia Tech

Research Progress by Objective

Objective 1: Reveal local agricultural network structures.

A working paper on technology networks was drafted describing the theoretical foundations for social network analysis in conservation agriculture research and development and outlining a methodology for identifying all relevant actors and their relationships in the local agricultural setting for each of the Long-Term Research Awards (LTRAs). The methodology was the subject of extensive debate within the team and went through various revisions before being finalized in the working paper that was posted on the SANREM Website and circulated to all LTRA PIs.

The methodological work resulted in draft questionnaire items to be included in LTRA baseline surveys. Site level introduction of this work began in Haiti in collaboration with the gendered knowledge CCRA but was cut short by the earthquake. Socio-economic research has been put on hold at the Haiti site until stable social conditions are restored. We implemented our first focus group activity in Mali with the LTRA-8 team where a listing of potential actors was identified for the battery of network actor questionnaire items. A French translation of the questionnaire items was shared with the Lead PI and the Mali team. The same focus group activity was initiated at the Ghana site of LTRA-8 as well two weeks later.

Objective 2: Identify technological frameworks shaping production relations.

The same initial progress was made for work on the technological (knowledge) frameworks shaping production relations as for Objective 1. The working paper includes a section on the theoretical foundations for technological frameworks and provides a methodology (including a battery of questionnaire items) to elicit this information through the baseline surveys of each LTRA. The LTRA-8 research teams in Ghana and Mali have these questionnaire items for inclusion in their baseline surveys which are expected to be conducted within the next quarter. The LTRA-7 (Andes) team does not currently have plans for a baseline survey so an alternative strategy is being developed.

Objective 3: Determine knowledge pathways and key actors to facilitate technological change.

Work on this objective will not commence until after the first round of data collection at each of the LTRA sites has been completed and analysis of the local networks and technological frameworks has been initiated.

Significant Training, Capacity Building, and Networking Activities

A Graduate Research Assistant, Jennifer Lamb, has been recruited and will be working on a Masters' degree in Agricultural and Applied Economics with her thesis focusing on technology networks.

During the visits to Haiti, Mali, and Ghana short-term training was conducted with local partners and participants involving 99 men and 54 women.

Publications, presentations, etc.

One SANREM CRSP Working Paper and six presentations were made.

Research Strategy and Development Objectives

Contacts have been made with all LTRA PIs, although in-depth discussions have been initiated with only four of them. This has allowed us to begin introducing the concepts and methodology into two LTRA socio-economic baseline surveys. Given the late start on the LTRAs this provides us with preliminary insight to better adapt the research to the remaining LTRA sites during the Kick-Off meeting in May 2010. It is clear that flexibility will be needed for adaptation to the conditions and timing in various host-country research sites.

Management Entity Activities

The SANREM CRSP Management Entity established the foundation for the Phase IV program with a new set of Long-Term Research Awards (LTRAs) and Cross Cutting Research Activities (CCRAs) during the first half of Fiscal Year 2010. Phase III LTRAs were given no-cost and education supplementary extensions to complete educational programs, culminate research and training activities, and disseminate their findings. Although this was a transition period between Phases III and IV, sustainable agricultural and natural resource management innovations, policies, and practices continued to be tested and the results disseminated through professional publications, extension documents, and various reports to partner organizations. Highlights of these supportive activities include the following.

- The External Evaluation Panel reviewed twenty-one applications for Phase IV LTRAs. Five of the seven ultimately selected were subject to a revise and re-submit competition before they were awarded.
- All but one of the seven LTRAs was fully contracted by the end of the first half of the fiscal year.
- Phase III LTRAs submitted applications for no-cost extensions to complete activities and for extended financing for student degree completion. After some adjustment, most applications were accepted.
- An agronomist was recruited and hired as the Assistant Program Director and PI for the Soil Quality and Carbon Sequestration CCRA.
- Three Graduate Research Assistants (GRAs) were and hired for the Economic Impact Analysis, Gendered Knowledge, and Technology Networks CCRAs.
- The *SANREM CRSP 2009 Annual Report* was prepared for submission to USAID.
- The SANREM CRSP website was routinely updated with newly released reports and information.
- Two hundred twenty-nine new information resources were entered into the SANREM Knowledgebase (SKB).
- Version 5 of the SANREM Knowledgebase Metadata Guide updating the guidelines for entering information resources in the SKB was published.
- Gendered Knowledge and Technology Networks CCRAs conducted an aborted mission to Haiti and a successful mission to Mali to initiate the CCRA activities. LTRAs in Ghana (Technology Networks) and Ecuador (Gendered Knowledge) were also introduced to the CCRAs.
- SANREM CRSP co-sponsored the 21st Century Watershed Technology: Improving Water Quality and the Environment Conference at Earth University, Costa Rica (February 2010).
- One SANREM newsletter was published (October 2009).
- Two working papers on conservation agriculture were published.
- The SANREM systems book, *The Sciences and Art of Adaptive Management*, was published by the Soil and Water Conservation Society.
- At the end of the period, the Communications Coordinator resigned.

Appendices

List of Acronyms and Abbreviations

ACT	African Conservation Tillage network
APLTV	Adjustable pressure lateral take-off valves (LTRA-5)
BENRO	Bukidnon Environment and Natural Resource Office (LTRA-5)
CCRA	Cross-cutting Research Activity
CF	Conservation farming
CIDES	Ciencias del Desarrollo (LTRA-4)
CIMMYT	International Maize and Wheat Improvement Center
CIRAD	French Agricultural Research Center for International Development (LTRA-12)
COMACO	Community Markets for Conservation (LTRA-2)
CONAFOR	National Forest Commission of Mexico (LTRA-1)
DABAR	Dept. of Agriculture-Bureau of Agricultural Research, the Philippines (LTRA-5)
GAIA	Grupo Autónomo para la Investigación Ambiental (LTRA-1)
GEA	Grupo de Estudios Ambientales (LTRA-1)
GRA	Graduate Research Assistant
IDE	International Development Enterprise (LTRA5)
IPPS	Instituto de la Pequeña Producción Sustentable (de UNALM) (LTRA-4)
IRRI	International Rice Research Institute (LTRA-4)
KACOFA	Kapchorwa Commercial Farmers Association (LTRA-10)
KENDAT	Kenyan Network for Dissemination of Appropriate Technology (LTRA-10)
LFPI	Landcare Foundation of the Philippines, Incorporated (LTRA-12)
LTRA	Long-Term Research Award
MRV	Measurement, reporting and verification (LTRA-2)
NAC	National Advisory Council (LTRA-1)
NGO	Non-governmental Organization
OUAT	Orissa University of Agriculture and Technology (LTRA-11)
PADAC	<i>Projet d'Appui au Developpement de l'Agriculture du Cambodge</i> (LTRA-12)
PAR	Participatory Action Research (LTRA-11)
PES	Payments for environmental services (PES)
PRA	Participatory Rural Appraisal (LTRA-11)
PROINPA	Promoción e Investigación de Productos Andinos (LTRA-3; LTRA-4)
RUA	Royal University of Agriculture (Cambodia) (LTRA-12)
RUPES	Rewarding Upland Poor for Environmental Services project (LTRA-5)
SENACYT	Secretaría Nacional de Ciencia y Tecnología (Ecuador) (LTRA-7)
SKB	SANREM Knowledgebase
TULSEA	Tree on multi-Use Landscape in Southeast Asia project (LTRA-5)
UMSA	Universidad Mayor de San Andrés (LTRA-4)
UNALM -	La Molina National Agrarian University (LTRA-4)
UNAM	Universidad Nacional Autónoma de México (LTRA-1)
UPLB	University of the Philippines Los Baños (LTRA-12)
USDA	United States Department of Agriculture
VAF	Vegetable agroforestry (LTRA-5)
WASWAC	World Association of Soil and Water Conservation (LTRA-5)

Degree Training Participants, FY 2009

Student Name	Sex (M/F)	Nationality	Discipline	SANREM Thesis/Research	Country(s)	Supported	Sandwich Program (Y/N)	Start Date	End Date	Degree	SANREM CRSP (Y/N)	Non-SANREM CRSP (Y/N)	LTRA	SANREM CRSP Advisor/PI	University(s) Degree Granting Institution First
Amanda Tai McClellan	F	USA	Soil Science	Crop productivity and soil quality	India	N	Apr 2010			Y	N	11	Travis Idol	University of Hawaii-Manoa	
Anissa Polatewich	F	USA	Plant Pathology	Fruit Disease Mgmt	Bolivia	N	Sep 2007	Aug 2010	PhD	Y	Y	3	Backman	Penn State	
Carlos Montúfar	M	Ecuadorian	Environmental sciences	Water quality	Ecuador	N	Apr 2008	Mar 2010	MS	Y	Y	3	Barrera	Universidad Internacional SEK	
Carolla Chambilla	F	Bolivian	Agroecology	Resource utilization	Bolivia	Y	Jun 2008	Jun 2010	MS	Y	N	4	Peter Motavalli	Universidad Mayor de San Simon	
Catherine LaRochelle	F	Canadian	Economics	Health and Natural Resource Management	Ecuador/ Bolivia	N	Aug 2006	Aug 2010	PhD	Y	Y	3	Alwang	Virginia Tech	
Cecilia Turin Canchaya	F	Peruvian	Rural Sociology	Pasture Management	USA	N	Aug 07	Dec 2010	PhD	Y	Y	4	Jere Gilles	Universidad Nacional Agraria La Molina (BS, Animal Science, MS Rural Extension- Larenstein)	
Danielle Buttke	F	USA	Biomedical Sciences	Biomedical Sciences	Zambia	N	Aug 2004	May 2010	DVM	N	Y	2	Alexander Travis	Cornell University	
Edwin Yucra	M	Bolivian	GIS Climate	Local Clamete Indicators	USA	N	Sep 2007	Dec 2009	MS	Y	N	4	Jere Gilles	Universidad Mayor de San Andrés	
Edy Setywan	M	Indonesian	Plant Protection	Plant Protection	SE Asia	N	Aug 2005	Dec 2009	PhD	Y	Y	5	Rauf/ Anas D. Susila	Bogor Agricultural University	
Forrest Fleischmann	M	USA	Public Policy	Forest Decentralization (tentative)	Global	N	Sep 2007	May 2012	PhD	Y	Y	1	E. Ostrom	Indiana University	
Freddy Navia	M	Bolivian	GIS Landscape	GIS Production Systems	USA	N	Sep 2007	Dec 2009	MSc	Y	N	4	Jere Gilles	Universidad Mayor de San Andrés	
Geoffrey Bolton	M	USA	Natural Resources & Environmental Management	Crop productivity and soil quality	India	N	Feb 2010			Y	N	11	Travis Idol	University of Hawaii-Manoa	
Gustavo Garcia Lopez	M	USA (Puerto Rican)	Political Science	Forest institutions and livelihoods	Mexico	N	Aug 2005	May 2010	PhD	Y	Y	1	E. Ostrom	Indiana University	
Jacqueline Marie Halbrendt	F	USA	Horticulture	Crop productivity and soil quality	India	N	Apr 2010			Y	N	11	Theodore Radovich	University of Hawaii-Manoa	
Javier Aguilera Alcón	M	Bolivian	Soil Science	Soil organic matter	Bolivia	N	Aug 2006	Sep 2010	PhD	Y	Y	4	Peter Motavalli	University of Missouri Columbia	
Javier Osorio	M	Bolivian	BSE	Watershed modeling	Ecuador/ Bolivia	N	Jan 2007	Dec 2009	PhD	N	Y	Watershed	Wolfe	Virginia Tech	

Student Name	Sex (M/F)	Nationality	Discipline	SANREM Thesis/Research	Country(s) Supported		Sandwich Program (Y/N)	Start Date	End Date	Degree	SANREM CRSP (Y/N)		LTRA	SANREM CRSP Advisor/PI	University(s) Degree Granting Institution First
Jennifer Lamb	F	USA	Agricultural Economics	Technology Networks for Conservation Agriculture	Global	N	May 2010	May 2012	MS	Y	N	CCRA-8	K.M. Moore	Virginia Tech	
Justina Condori	F	Bolivian	Agronomy	Landscape research Ancoraimes	Bolivia	N	Oct 2008	Jun 2010	MS	Y	N	4	Jorge Cusicanqui	Universidad Mayor de San Andrés	
Keri Agriesti	F	USA	Geography	Gendered Knowledge	Global	N	Aug 2010	May 2012	MSc	Y	N	CCRA-7	Marie Elisa Christie	Virginia Tech	
Kim Bothi	F	Canadian	Sociology	Natural Resources	Zambia	N	Aug-05	Dec-10	PhD	Y	Y	2	Buck/Travis	Cornell	
Luis Escudero	M	Ecuador	Agronomy	Project evaluation	Ecuador	N	Aug 2008	Jul 2010	MS	Y	N	3	Barrera	Universidad Cotopaxi	
Lydia Gatere	F	Kenyan	Soil & Crop Science	Nutrient Management	Zambia	N	May 2006	May 2010	PhD	Y	Y	2	Lehmann	Cornell	
Marissa Duff	F	USA	Biological Systems Engineering	Watershed Modeling	Zambia	N	Jan-10	May-10	MS	Y	Y	Watershed	Heatwole	Virginia Tech	
Matt Bruns	M	USA	Soil Science	N Fertility	Lesotho		Jan 2010	Dec 2011	MS	Y	N	9	Eash/Walker	University of Tennessee	
Mirco Peñaranda	M	Bolivian	Water Resources	Watershed Ancoraimes	Bolivia	N	Jul 2008	Jun 2010	MS	Y	N	4	Jorge Cusicanqui	Universidad Mayor de San Andrés	
Nadezda Amaya	F	Bolivian	Economics	Marketing in Tiraque, Bolivia	Bolivia	Y	Aug 2007	Dec 2009	MS	Y	N	3	Alwang	Virginia Tech	
Neshmi Salaues	F	Bolivian	Soils Science		Bolivia	N	Apr 2009	Nov 2009	BS	Y	N	Soils	Castillo	UMSS	
Rachel Melnick	F	USA	Plant Pathology	Cacao disease management	Ecuador/Bolivia	N	Jun 2006	Dec 2009	PhD	Y	Y	3	Backman	Penn State	
Sally Walker	F	USA	Biological Systems Engineering	Nutrient Management	Bolivia	N	Jan-08	Sep-09	MS	Y	Y	Watershed	Heatwole	Virginia Tech	
Samuel Bell	M	Australian	Applied Economics	Project evaluation	Zambia	N	Sep 2005	May 2010	PhD	Y	Y	2	Schulze	Cornell	
Tin Herawati	F	Indonesian	Family and Consumer Science		Indonesia	N	Aug 2008	May 2011	PhD	Y	Y	5	Trikoesoemaningtyas	Bogor Agricultural University	
Tisna Prasetyo	M	Indonesian	Horticulture	Soil Quality	Indonesia	N	2008	2010	MS	Y	N	5	Anas D. Susila	Bogor Agricultural University	
Wendy Jones	F	USA	Soil Science	Carbon Sequestration	Lesotho		Jan 2010	Dec 2011	MS	Y	N	9	Eash/Walker	University of Tennessee	

Short-Term Training: FY 2010 (October 2009 – March 2010)

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						
Workshop for knowledge sharing	Nov-2010	Farmer group from Vinto Coopani	19	18	UC and UMSA	Linking knowledge systems and climate
Workshop for knowledge sharing	Nov-2010	Farmer group from San Juan Circa	8	5	UC and UMSA	Linking knowledge systems and climate
Workshop for gender and markets findings	Nov-2010	Farmer group from Vinto Coopani	7	8	UC and UMSA	Market strategies
Workshop for gender and markets findings	Nov-2010	Farmer group San Juan Circa	14	13	UC and UMSA	Market strategies
Workshop for knowledge sharing	Dec-2010	Farmers in Chojnapata	6	5	UMSA	Dynamics of pests knowledge sharing
Workshop for knowledge sharing	Jan-2010	Cohani Farmers	8	4	UMSA	Dynamics of pests knowledge sharing
Workshop for knowledge sharing	Jan-2010	Chinchaya farmer groups	25	5	UMSA	Production systems knowledge sharing
Workshop for knowledge sharing	Jan-2010	Calahuancani farmer groups	10	9	UMSA	Production systems knowledge sharing
Workshop for knowledge sharing	Jan-2010	Chojnapata farmer groups	3	4	UMSA	Production systems knowledge sharing

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		
Ghana						
Focus Group	30-Mar-2010	Men and women villagers in New Nyoli, Ghana	6	11	SANREM ME in collaboration with SARI researchers and Lassia Tuolo agents	Introduce and investigate the concepts of conservation agriculture, technology networks, and gendered knowledge and practices.
Haiti						
Workshop	11-12 January 2010	University of Haiti agriculture faculty and students	58	4	CSES Dept and SANREM ME Virginia Tech	Introduction to CAPS project and research design and implementation issues in the Central Plateau
Research Site Selection, Corporant	15-Mar-2010	Zanmi Agrikol Agronomists and technicians	7	3	Virginia Tech	Train agronomists to square, GPS, and stake out the experiments, take soil samples, do soil percolation test, and take soil bulk densities
Workshop at Wozo Plaza Hotel, Mirebalais	16-Mar-2010	Gillaine Warne, Director of Zanmi Agrikol and Zanmi Agrikol Agronomists	5	3	Virginia Tech	To explain the research protocol (randomization, replication, seeding, data collection, and harvest techniques) for black bean, maize, and conservation agriculture research plots
Research Site Selection, Maïssade	17-Mar-2010	Caritas Agronomists	4	2	Virginia Tech	Train agronomists to square, GPS, and stake out the experiments, take soil samples, do soil percolation test, and take soil bulk density.
Workshop at Caritas Office, Hinche.	18-Mar-2010	Caritas Agronomists	4	2	Virginia Tech	To explain the research protocol (randomization, replication, seeding, data collection, and harvest techniques) for black bean, maize, and conservation agriculture research plots

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		
Lesotho						
Seminar	22-Jan-2010	University faculty and students	7	4	University of Tennessee	Explanation of CAPS in subsistence agriculture
Mali						
Focus Group	14-Mar-2010	Men and women villagers in Fambougou, Mali	13	22	SANREM ME in collaboration with IER researchers and PRECAD agent	Introduce and investigate the concepts of conservation agriculture , technology networks, and gendered knowledge and practices
Focus Group	15-Mar-2010	Men and women villagers in Bouaware, Mali	22	17	SANREM ME in collaboration with IER researchers and PRECAD agent	Introduce and investigate the concepts of conservation agriculture , technology networks, and gendered knowledge and practices
Peru						
Workshop for knowledge sharing	Feb-2010	Farmer from Apopata Community	21	18	UNALM	Share 2009 survey information with community
Workshop for knowledge sharing	Feb-2010	Farmer from Santa María Community	16	16	UNALM	Share 2009 survey information with community
Uganda						
Community follow-up meeting	Oct 2009 – Jan 2010	Residents and officials from Wakisi	22	12	UFRIC	Follow up on previous trainings to encourage ongoing participation in local forest management

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		
Community follow-up meeting	Oct 2009 – Jan 2010	Residents and officials from Malamaganbo	18	11	UFRIC	Follow up on previous trainings to encourage ongoing participation in local forest management
Community follow-up meeting	Oct 2009 – Jan 2010	Residents and officials from Kakindo	20	14	UFRIC	Follow up on previous trainings to encourage ongoing participation in local forest management
Community exchange meeting	Oct 2009 – Jan 2010	Community leaders from Kyarukooka and Malamaganbo	6	4	UFRIC	Kyarukooka leaders learned about successes in collaborative forest management
Total Number of Participants			329	214		

SANREM CRSP Publications, Presentations and Other Products Produced Since 9/1/2009

<i>Categories</i>	<i>Bibliographic Citations*</i>
<p>Articles Published in Refereed Publications</p>	<p>Cheatham, M.R., M.N. Rouse, P.D. Esker, S. Ignacio, W. Pradel, R. Raymundo, A.H. Sparks, G.A. Forbes, T.R. Gordon and K.A. Garrett. 2009. Beyond Yield: Plant disease in the context of ecosystem services. <i>Phytopathology</i> 99(11): 1228-1236.</p> <p>Garrett, K.A., L.N. Zuñiga, E. Roncal, G.A. Forbes, C.C. Mundt, Z. Su, and R.J. Nelson. 2009. Intraspecific functional diversity in hosts and its effect on disease risk across a climatic gradient. <i>Ecological Applications</i> 19(7): 1868-1883.</p> <p>Perez, C., C. Nicklin, O. Dangles, S. Vanek, S. Sherwood, S. Halloy, K. Garrett and G. Forbes. 2010. Climate change in the high Andes: Implications and adaptation strategies for small-scale farmers.. <i>The International Journal of Environmental, Cultural, Economic, and Social Sustainability</i> 6. (<i>Publication pending</i>)</p> <p>Seth, A., J. Thibeault, M. Garcia, C. Valdivia, 2010: Making sense of 21st century climate change in the Altiplano: Observed trends and projections, <i>Annals Amer. Assoc. Geog.</i> In press.</p> <p>Seth, A., M. Rojas, S. A. Rauscher, 2010: CMIP3 projected changes in the annual cycle of the South American Monsoon, <i>Climatic Change</i>, 98:331-357. DOI 10.1007/s10584-009-9736-6</p> <p>Thibeault, J. M., A. Seth, and M. Garcia, 2010: Changing climate in the Bolivian Altiplano: CMIP3 projections for precipitation and temperature extremes, <i>J. Geophys. Res.</i>, doi: 10.1029/2009JD012718, In press.</p> <p>Thibeault, J. M., A. Seth, and G. Wang, 2010: Precipitation Variability in the Bolivian Altiplano: CMIP3 Projections, in preparation.</p>

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	<p>Valdivia, C., A. Seth, J. Gilles, M. García, E. Jiménez, E. Yucra, J. Cusicanqui and F. Navia. Adapting to Climate Change in Andean Ecosystems: Landscapes, Capitals and Perceptions Linking Rural Livelihood Strategies and Linking Knowledge Systems. Submitted to <i>Annals of the American Association of Geographers</i>. Accepted January 31, 2010.</p>
Books/Book Chapters	<p>Alwang, J. and A. Sowell. 2010. Soil and Water Conservation in the South American Highlands: Social and Economic Considerations. Forthcoming in <i>Socioeconomic Dimensions of Soil and Water Conservation</i>. Ted Napier (ed.) Ames: Soil and Water Conservation Society. (<i>Publication pending</i>)</p> <p>Amaya, N. and J. Alwang. 2010. Are potato markets gendered? An analysis of the potato marketing chain in the Jatun Mayu watershed of Tiraque, Bolivia. Forthcoming in collected publication on Gendered access to markets (SANREM publication). (<i>Publication pending</i>)</p> <p>Jimenez Elizabeth y Alejandro Romero . 2010 Los Impactos del Cambio Climático en la Biodiversidad <u>In</u> E. Jimenez, and J. Albarracin (eds.) <i>Adaptación y Cambio Climático en el Altiplano Boliviano, El Postgrado en Ciencias del Desarrollo (CIDES)</i>, Universidad Mayor de San Andrés, La Paz, Bolivia. In press.</p> <p>Jimenez Elizabeth y Apolinar Contreras . 2010 Mercados y Cambio Climático <u>In</u> E. Jimenez, and J. Albarracin (eds.) <i>Adaptación y Cambio Climático en el Altiplano Boliviano, El Postgrado en Ciencias del Desarrollo (CIDES)</i>, Universidad Mayor de San Andrés, La Paz, Bolivia, In press.</p> <p>K. A. Garrett, A. Jumpponen, and L. Gomez. 2010. Emerging plant diseases: What are our best strategies for management? In: D. L. Kleinman, J. Delborne, K. A. Cloud-Hansen, and J. Handelsman (eds.). <i>Controversies in Science and Technology Vol 3</i>, In press.</p> <p>Moore, K.M. (ed.). 2009. <i>The Sciences and Art of Adaptive Management: Innovating for Sustainable Agriculture and Natural Resource Management..</i> Ankeny, IA: Soil and Water Conservation Society.</p> <p>Motavalli, P.P., J. Aguilera, H. Blanco-Canqui, C. Valdivia, A. Seth, and M. Garcia. In press. Soils and</p>

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	climate change: Consequences and potential adaptation in the Andean Highlands (in Spanish). In E. Jimenez, and J. Albarracin (eds.) <i>Adaptación y Cambio Climático en el Altiplano Boliviano</i> , El Postgrado en Ciencias del Desarrollo (CIDES), Universidad Mayor de San Andrés, La Paz, Bolivia
Theses and Dissertations	<p>Amaya, N. 2009. Effects of access to information on farmer's market channel choice: The Case of Potato in Tiraque Sub-watershed (Cochabamba-Bolivia). Unpublished MS Thesis. Blacksburg, VA: Virginia Polytechnic Institute and State University. 104 pp.</p> <p>Walker, S.M. 2009. Nitrogen modeling of potato fields in the Bolivian Andes using GLEAMS.. MS thesis. Blacksburg, VA: Biological Systems Engineering, Virginia Tech.</p>
SANREM CRSP Annual Reports and Highlights	SANREM CRSP Management Entity. 2010. SANREM annual report 2009. Blacksburg, VA: SANREM CRSP (<i>In the editing stage—publication pending</i>)
Extension Publications (large)	Heatwole, C.D., J.N. Lamb., and L. Moore. 2009. SANREM knowledgebase metadata guide: Version 5. Blacksburg, VA: SANREM CRSP, OIRED, Virginia Tech.
Conference Proceedings	LTRA-4. 2009. Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. Seminario Internacional, La Paz, Bolivia: SANREM CRSP [Digital format] (Spanish)
SANREM CRSP Working Papers	<p>Lamb, J., K.M. Moore, and M.E. Christie. 2010. Research framework for technology network and gendered knowledge analyses.. SANREM CRSP Working Paper Series No. 01-10</p> <p>Swenson, S. and K.M. Moore. 2009. Developing conservation agriculture production systems: An analysis of local networks.. SANREM CRSP Working Paper Series No. 10-09</p>

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World Wide Web Sites and Documents	Bell, S. 2009. AFOLU Emission Offsets on a Landscape Scale: Monitoring, Reporting and Verification. Ithaca, NY: Cornell University. Available at: http://www.agricultureday.org/presentations/Cornell-University.pdf
Germplasm Releases	N/A
Papers/Seminars Presented	<p>Barrera, V., E. Cruz, J. Alwang, L. Escudero, C. Monar. 2010. Experiences in integrated management of natural resources in the sub-watershed of the Chimbo River, Ecuador. Presented at ASABE Meeting, Earth University, Costa Rica. 21 pp. To be published in the proceedings of the ASABE Meeting.</p> <p>Walker, S.M., C.D. Heatwole and J. Cossio. 2010. GLEAMS evaluation in potato fields for agricultural nutrient management in central Bolivian highlands.</p>
Electronic Presentations	<p>Baca-Fernández, E. “Experiencias en Coaliciones de Persuasión Frente a Cambio Climatic.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Barrera, Victor. Experiences in integrated management of natural resources in the sub-watershed of the Chimbo River, Ecuador Presented at ASABE meeting on Watershed Management, Earth University, Costa Rica, February 2010.</p> <p>Bell, S. 2010 Conservation Agriculture and Carbon Markets in Zambia. Presentation made to Ministry of Tourism, Environment and Natural Resources, Republic of Zambia, Lusaka Zambia, 29 March 2010.</p> <p>Benancio, G.R. and J.S. Quispe. “Cambio Climatic en el Peru.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y</p>

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	<p>de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Boulakia, S. 2010. DMC development in Cambodia: A tool for economic and territory development.. Presented to the Office of International Research Education and Development, Blacksburg, VA 19 March 2010.</p> <p>Contreras, A. and O. Yana. “Participación e Investigación Participative.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Flora, C. “Cambio Climático y Coaliciones de Persuasión.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Garcia, M. and E. Yucra. “Tendencias del Balance Hídrico Como Indicador del Cambio Climatic en el Altiplano Boliviano.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Garrett, K. “Anticipating and Responding to Biological Complexity in the Effects of Climate Change on Agriculture. “Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Gilles, J. “Conocimientos Científicos y Locales.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p>

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	<p>Gonzales, M.A. “El Comportamiento de Plagas y Clima.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Jiménez, E. “Género y Estrategias de Comercialización en Comunidades del Altiplano.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>LaRochelle, Catherine. 2010. “Market Participation and Marketing Performance: A Case Study of Bolivian Potato Farmers.” Agricultural and Applied Economics Association Annual Meeting in Denver Colorado, 25-27 July 2010.</p> <p>LaRochelle, Catherine. 2010. “The role of risk mitigation in production efficiency: A case study of Bolivian potatoes producers.” Northeastern Agricultural and Resource Economics Association Annual Meeting in Atlantic City, NJ, 13-15 June 2010.</p> <p>Melnick, Rachel. Impact of application of endophytic <i>Bacillus</i> spp. For biocontrol of cacao diseases on native microbial communities. Presented at USDA/ARS Perennial Crops Laboratory, Beltsville, MD. 10 November 2009.</p> <p>Moore, K.M. 2010. SANREM CRSP overview.. Presented at the LTRA-8/ME Kickoff Workshop, Wa, Ghana, 29 March 2010.</p> <p>Moore, K.M. 2010. Reconstructing agricultural production for food security in Haiti.. Presented at the Phi Beta Delta International Honor Society’s panel presentation: Lessons from the past, challenges ahead for the new Haiti, Virginia Tech, 10 February 2010.</p> <p>Moore, K.M. 2010. Developing approaches for smallholder adaptation of conservation</p>

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	<p>agriculture..Presented at the LTRA-8/ME Kickoff Workshop, Wa, Ghana, 29 March 2010.</p> <p>Moore, K.M. 2010. Desarrollo de enfoques para la adaptación de pequeños productores a la agricultura de conservación.. Presentó a la taller de LTRA-7, ME y manejo integrado de plagas, Bolivar, Ecuador 7 Abril 2010. (Spanish)</p> <p>Morante, M.P. “Evaluación del Balance Hidrico y la Disponibilidad Climatologica en la Cuenca Chojñapata- Chinchaya.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Morante, M.P. “Fluctuación Poblacional del Gorgojo de los Andes.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Motavalli, P. “The Role of Soil Organic Matter in Mitigation and Adaptation in the Bolivian Highlands,” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Quispe, J.S. “Impacto del Cambio Climatic sobre el Cultivo para en el Altiplano Peruano.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Seth, A. “Altiplano Climate.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p>

<i>Categories</i>	<i>Bibliographic Citations*</i>
	<p>Valdivia, C. “Adaptándose a los Cambios Climáticos y de Mercado: Construyendo Capacidad Adaptativa en Sistemas Complejos.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Yucra, E. “La Evaluación Particpativa Como Herramienta de Investigacion y Desarrollo Participativo.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p> <p>Yucra, E. “Gestion de Alerta Temprana para Riesgos Agricolas Basado en el Uso de Unicadores Naturals.” Presentation in: LTRA-4 CD-ROM produced for the SANREM CRSP, Proyecto Practicas y Estrategias en Respuesta al Riesgo Climatico y de Mercado en Agroecosistemas Vulnerables de la Region Andina. La Paz, Bolivia. 2009. (Spanish)</p>
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* See Formatting Scheme for SANREM Docs in the attached file for citation formats.