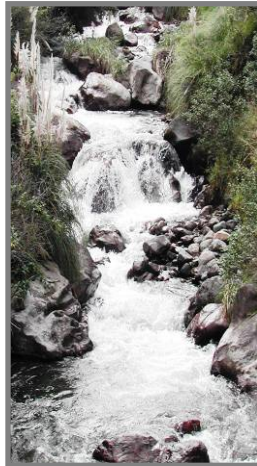


SANREM CRSP 2008 Annual Meeting

May 26-29, Los Baños, Philippines



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



SANREM CRSP

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

Office of International Research, Education, and Development (OIREd)
Virginia Tech
526 Prices Fork Road, Blacksburg, Va. 24061-0378
Phone: (540) 231-1230. Fax: (540) 231-1302. E-mail: sanrem@vt.edu
On the web: <http://www.oired.vt.edu/sanremcrsp/>

MANAGEMENT ENTITY

Name	Position	Phone	E-mail
Theo Dillaha	Program Director	(540) 231-6813	dillaha@vt.edu
Keith M. Moore	Associate Program Director	(540) 231-2009	keithm@vt.edu
S.K. De Datta	Administrative Principal Investigator	(540) 231-9853	dedatta@vt.edu
Michael Bertelsen	Economic Impact Assessment Coordinator	(540) 231-9665	bertel@vt.edu
Maria Elisa Christie	Gender Equity Coordinator	(540) 231-4297	mechristie@vt.edu
Deanne Estrada	Editor, Communications Coordinator	(540) 231-1218	destrada@vt.edu
Jane Lee	Program Coordination Assistant	(540) 231-1230	janelee@vt.edu

This publication was made possible through the United States Agency for International Development (USAID) and the generous support of the American people under terms of USAID Cooperative Agreement EPP-A-00-04-00013-00.

Acknowledgements

The Management Entity of the SANREM CRSP is deeply grateful to the dozens of people involved in the planning, organization, and logistics of the 2008 Annual Meeting. Without their input, support, and tireless work, this international scientific conference would not have been possible.

Thanks go to the Principal Investigators for the SANREM program's five Long-term Research Award (LTRA) activities: Elinor Ostrom, Indiana University, LTRA-1; Alex Travis, Cornell University, LTRA-2; Jeffrey Alwang, Virginia Tech, LTRA-3; Corinne Valdivia, University of Missouri, LTRA-4; and Manuel Reyes, North Carolina A&T State University, LTRA-5. They directed the research teams who prepared the 19 scientific presentations and 36 posters to be included at the meeting; and they, their co-PIs, and staffs managed the countless details involved.

We particularly want to acknowledge and express our gratitude to Manuel Reyes and his TMPEGS partners in the Philippines for their kind offer to host this event and for their diligence to ensure that the annual meeting runs smoothly from start to finish. Thanks go to Liwayway Engle, Manuel Palada, Greg Luther, and Flordeliza C. Faustino of the World Vegetable Center (AVRDC); Suseno Budidarsono, Delia Catacutan, Agustin Mercado Jr., James Roshetko, and Meine van Noordwijk of the World Agroforestry Center (ICRAF); Anthony Penaso, Central Mindanao University; Ma. Ellen Chiong-Javier, De la Salle University; Paul Catalan, Don Bosco Institute of Technology; Victor Ella and Ma. Victoria Espaldon, University of the Philippines-Los Baños; and Jean Saludadez, University of the Philippines-Open University. Special appreciation goes to Carmelita Rebanco, Caroline Duque-Piñon, and Isidra Bagares for directing travel and lodging arrangements for nearly 60 annual meeting participants from around the globe.

Contents

Program at a Glance	1
Introduction	5
Scientific Program	6
Abstracts for Scientific Program	9
SMALLHOLDER LIVELIHOODS	9
08-A-01. Can Forest Sector Governance Reform Achieve Both Favorable Livelihood and Sustainability Outcomes? Searching for Win-win Policy Outcomes in Uganda	
08-A-02. Determinants of Livelihood Strategies and Wellbeing Outcomes in the Chimbo Watershed, Ecuador	
08-A-03. Andean Livelihood Strategies and the Impact of Market and Climate Shocks: Risks, Perceptions, Coping Mechanisms	
CROP DIVERSITY AND CHOICE	11
08-A-04. Determinants of Variety Choice among Potato Planters in the Bolivian Highlands	
08-A-05. Can Vegetables Be More Productive under Tree-based Systems?	
MARKETS.....	12
08-A-06. Economic Opportunities for COMACO to Participate in Global Carbon Markets	
08-A-07. Dairy Markets and Access to Higher Value Chains in Illangama Watershed, Ecuador	
08-A-08. Linking Upland Vegetable Farmers to Lowland Philippine Markets: Critical Factors and Their Program Implications	
SOCIAL DIVERSITY	14
08-A-09. Forest Conservation and Gender Roles: Cases from East Africa and Latin America	
08-A-10. Modernization and Participation in Nghia Trung: Challenges of the Vietnamese Project's Ethnic Diversity	
POLICY AND GOVERNANCE.....	14
08-A-11. Unpacking Decentralization	

08-A-12. Policy Environment of Vegetable Agroforestry Systems in the Philippines and Vietnam: Are There Incentives for Smallholders?

SOIL AND WATER MANAGEMENT 16

08-A-13. Environmental Factors Affecting the Success of Conservation Farming in Zambia

08-A-14. Differences in Cropping Systems and Soil Organic Carbon due to Climate Change and Socioeconomic Factors in Potato-based Cropping Systems in the Bolivian Highlands

08-A-15. Stream Flow Monitoring to Support Watershed Assessment in Bolivia, Ecuador, and Zambia

ANALYZING SYSTEM STRESSORS 18

08-A-16. Vaccination Trials for Newcastle Disease Virus: Evaluation of Impacts on Village Poultry Production and Bushmeat Consumption

08-A-17. Field Evaluation of Endophytic Endospore-forming Bacteria with Cacao Successions for Management of Witches' Broom during the Dry Season, 2007

08-A-18. Projected Changes in Altiplano Climate and Extremes in the 21st Century

08-A-19. The Predicted Impact of Potato Late Blight and Potato Tuber Moth for Climate Change Scenarios

Abstracts for Poster Exhibit..... 21

SOIL AND WATER MANAGEMENT 21

08-P-01. Management of Organic and Inorganic Soil Fertility Inputs in Indigenous Agricultural Communities in the Bolivian Highlands

08-P-02. Characterizing Soil Microbial Communities as Indicators of the Process of Soil Degradation

08-P-03. Development of No-till Equipment for Upland Vegetable Farming

08-P-04. Effect of Hydraulic Head and Slope on Water Distribution Uniformity of the IDE Drip Irrigation System

08-P-05. Assessing and Managing Soil Quality for Sustainable Agricultural Systems

08-P-06. Saving Water for Vegetable Agroforestry (VAF) Systems: An Assessment of Drip Irrigation Trials on Vegetable Cultivation in Nghia Trung Village

PEST MANAGEMENT 24

08-P-07. An Integrated Baseline for Populations, Perceptions, and Management of the Andean Potato Weevil and Potato Tuber Moth under Conditions of Rapid Change in the Bolivian Altiplano

08-P-08. Termite Biocontrol on Cacao Seedlings: Vetiver Grass Application

08-P-09. Crop and Pest Management in the Bolivian Altiplano: Now and in the Future

08-P-10. Pesticide Use and Farmers' Health Costs in Cashew Production Systems in Nghia Trung Village

08-P-11. Evaluations of Cacao Disease Severities for Cacao/Plantain Intercropping Systems under 5 Spatial Arrangements, 2006-2007

CROP DIVERSITY AND CHOICE..... 27

08-P-12. Developing Best Practices for the Integrated Evaluation of Traditional Crop Assessments in Changing Environments: Examples from Andean Crops and Rice

08-P-13. Introduction of Indigenous Vegetables in the Vegetable Agroforestry (VAF) System in Lantapan Watershed, Philippines

08-P-14. Collection and Characterization of Indigenous Vegetables Obtained from Bogor and Pandeglang Districts

08-P-15. Can Vegetables Be Productive under Tree Shade Management in West Java?

08-P-16. Vegetable Agroforestry (VAF) Systems: Understanding Vegetable–tree Interaction Is a Key to Successful Farming Enterprise

08-P-17. Establishing Vegetable Agroforestry System Research at AVRDC – The World Vegetable Center

UNDERSTANDING FARMER BEHAVIOR 31

08-P-18. Understanding the Target Farmers of Agroforestry and Sustainable Vegetable Production Development: The Case of Nanggung Subdistrict, Bogor, Indonesia

08-P-19. Declining Use of Traditional Decision-making Indicators in an Altiplano Community

08-P-20. Measuring Impact on Social Interaction and Natural Resources: Use of KASAP Methodology in the Peruvian Altiplano

GENDER..... 33

08-P-21. Farmer Participation in Agronomic Research: Bolivian Experiences

08-P-22. Economic Gains and Gender Equity: Application of Sen-Robeyns Capability Framework in Understanding Human Wellbeing in Luangwa Valley, Zambia

08-P-23. Roles, Contributions, and Constraints of Women Farmers in Vegetable and Agroforestry Production and Marketing

WATERSHED MODELING AND MANAGEMENT 35

08-P-24. Predicting Effects of Land Use on Runoff and Sediment Yield in Selected Sub-watersheds of the Manupali River Using the ArcSWAT Model

08-P-25. Linking Watershed Protection and Water Consumption: WTP by Domestic Water Users in Ho Chi Minh City

08-P-26. Interpolation of 90m SRTM to Improve Elevation Data for Topographic and Watershed Analysis

08-P-27. Patterns and Trends in Fires in Eastern Zambia

08-P-28. SWAT Implementation in Indonesia for Vegetable Agroforestry (VAF) Systems: A Progress Report

08-P-29. Impact of Cropping on Runoff and Erosion in Upper Jatun Mayu River Watershed, Tiraque, Bolivia

MARKETS..... 38

08-P-30. Market Value Chain Research: Case Study in Nghia Trung Commune, Bu Dang District, Binh Phuoc Province, Vietnam

08-P-31. Understanding Better Market Information to Penetrate the VAF Market for Small-scale Farmers

08-P-32. Valuing Potential Increases in Wildlife Populations Using a Stated-choice Experimental Design in the Luangwa Valley, Zambia

08-P-37. Strategies to Develop Market Access that Contributes to Resilience in the Bolivian Highlands

POLICY AND GOVERNANCE..... 41

08-P-33. Policy Environment of Vegetable Agroforestry (VAF) Systems in the Philippines: Are There Incentives for Smallholders?

08-P-34. Scaling Up Integration of Vegetable and Agroforestry Systems in Asian Watersheds: The SANREM-TMPEGS Philippine Strategy

08-P-35. Developing a Methodology to Enable Community Governance for Market Integration and Adaptation to Climate Changes: Agency and the Advocacy Coalition Approach in the Peruvian Altiplano

08-P-36. Are There Incentives for Smallholders in Vietnam to Adopt Vegetable Agroforestry Systems?

Program at a Glance

FRIDAY, MAY 23-SUNDAY, MAY 25

Tour of Philippine field sites, Lantapan, Bukidnon, Mindanao

SUNDAY, MAY 25, 4-6 P.M.

Registration and poster setup, Splash Mountain Hotel

MONDAY, MAY 26

Progress reports and discussion

- 8:00** Welcome, opening ceremony
S.K. De Datta, SANREM CRSP Administrative PI, Virginia Tech
Jon Lindborg, Mission Director, USAID-Philippines
William Padolina, Deputy Director General for Operations and Support Services,
University of the Philippines
Luis Rey I. Velasco, Chancellor, University of the Philippines-Los Baños
- 9:30** SANREM CRSP program update
Theo Dillaha, Program Director, Virginia Tech
- 10:00** *Coffee break*
- 10:30** LTRA-5, Agroforestry and Sustainable Vegetable Production
Manuel Reyes, North Carolina A&T State University
- 11:00** LTRA-4, Practices and Strategies for Vulnerable Agro-Ecosystems
Corinne Valdivia, University of Missouri
- 11:30** LTRA-3, Watershed-based Natural Resource Management for Small-scale Agriculture
Jeffrey Alwang, Virginia Tech
- Noon** *Lunch*
- 1:00** LTRA-2, An Agricultural Markets Model for Biodiversity Conservation
Alex Travis, Cornell University
- 1:30** LTRA-1, Decentralization Reforms and Property Rights
Elinor Ostrom, Indiana University
- 2:00** Discussion of LTRA activities
- 2:30** Gender cross-cutting activity
Maria Elisa Christie, Virginia Tech
- 3:00** *Coffee break*
- 3:30** Knowledge to action cross-cutting activity
Esther Mwangi, Harvard University
- 4:00** Watershed management cross-cutting activity
Conrad Heatwole, Virginia Tech
- 4:30** Soil quality and metagenomics cross-cutting activity
Karen Garrett, Kansas State University
- 5:00** Host-country partner meeting
Elizabeth Jiménez, Universidad de La Cordillera

- 7:00** Banquet
Ronald P. Cantrell, former Director General, International Rice Research Institute
William Padolina, Deputy Director General for Operations and Support Services,
University of the Philippines

TUESDAY, MAY 27

Scientific program

- 8:00** Welcome, overview of day's activities
8:10 Smallholder Livelihoods
Moderator: Keith M. Moore, Virginia Tech
9:15 Crop Diversity and Choice
Moderator: Elizabeth Jiménez
10:00 Coffee break
10:20 Markets
Moderator: Michael Bertelsen, Virginia Tech
11:20 Social Diversity
Moderator: Maria Elisa Christie
12:15 Lunch
1:30 Policy
Moderator: Keith M. Moore
2:15 Soil and Water Management
Moderator: Shirley Tarawali, International Livestock Research Institute
3:25 Coffee break
3:45 Analyzing System Stressors
Moderator: Harry Shapiro, Mars Inc.
5:15 Discussion
5:45 Adjourn
6:30 Posters and exhibits
8:00 Dinner

WEDNESDAY, MAY 28

Business meetings

- 8:00** Welcome, overview of day's activities
8:15 Individual LTRA meetings
9:40 Coffee break
10:00 Discussion of commonalities
11:00 Technical Committee meeting
12:30 Lunch
1:30 Technical Committee meeting (continued)
2:30 Field trip to International Rice Research Institute
7:00 Gender researchers working dinner

THURSDAY, MAY 29

Gender workshop

- 8:00** Introduction
Maria Elisa Christie
- 8:30** Networks
- 9:30** *Coffee break*
- 9:45** How are networks gendered?
- 10:45** Integrating data and framework: Methodological issues
- 11:30** Next steps: Outcomes
- Noon** *Adjourn*

Introduction

Through its Long-term Research Award (LTRA) program, the SANREM CRSP (Phase III) is generating new sustainable agriculture (SA) and natural resource management (NRM) knowledge and development impacts. The overall SANREM CRSP vision is to develop knowledge pertaining to SA and NRM interventions and strategies, organize that information into an accessible online knowledgebase, place it in its proper development context, and disseminate the knowledge to decision makers.

The focus of the SANREM CRSP 2008 Annual Meeting is scientific results from the program's five LTRA activities and their cross-cutting themes, which engage U.S. and host country researchers, development agents, local officials, and community members in their respective sites. During the meeting, held in Los Baños, Philippines, May 26-29, Principal Investigators (PIs) and researchers for the individual projects will share their key findings in 19 scientific presentations and 36 posters. Following are abstracts for those presentations and posters.

The SANREM CRSP promotes stakeholder empowerment and improved livelihoods through the discovery, organization, and dissemination of SA and NRM knowledge. Our 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 training plans. All activities link sustainable NRM with the economic concerns of local populations and the promotion of good governance.

Scientific Program

TUESDAY, MAY 27

8:00 Welcome, overview of day's activities

8:10 SMALLHOLDER LIVELIHOODS

Moderator: Keith M. Moore

- *Can Forest Sector Governance Reform Achieve Both Favorable Livelihood and Sustainability Outcomes? Searching for Win-win Policy Outcomes in Uganda.* Authors: Pamela Jagger, Indiana University; Arthur Arinaitwe, environmental consultant, Uganda. Presenter: Arthur Arinaitwe
- *Determinants of Livelihood Strategies and Well-being Outcomes in the Chimbo Watershed, Ecuador.* Authors: Robert Andrade, Jeffrey Alwang, George W. Norton, Virginia Tech; Victor Barrera, Instituto Nacional de Investigaciones Agropecuarias (INIAP), Ecuador. Presenter: Jeffrey Alwang
- *Andean Livelihood Strategies and the Impact of Market and Climate Shocks: Risks, Perceptions, Coping Mechanisms.* Authors: Corinne Valdivia, Leonie Marks, Jere L. Gilles, University of Missouri; Elizabeth Jiménez, Alejandro Romero, Universidad de La Cordillera, Bolivia. Presenter: Corinne Valdivia

9:15 CROP DIVERSITY AND CHOICE

Moderator: Elizabeth Jiménez

- *Determinants of Variety Choice among Potato Planters in the Bolivian Highlands.* Authors: Michael Castelhana, Jeffrey Alwang, Nick Kuminoff, Virginia Tech; Ruben Botello, PROINPA, Ecuador. Presenter: Jeffrey Alwang
- *Can Vegetables Be More Productive under Tree-based Systems?* Authors: Agustin Mercado Jr., Caroline Duque-Piñon, Manuel Reyes, Gerhard Manurung, World Agroforestry Center (ICRAF); Manuel Palada, Deng-lin Wu, Gregory C. Luther, Liwayway M. Engle, Flordeliza C. Faustino, World Vegetable Center (AVRDC); Anas Susila, Bogor Agricultural University, Indonesia; James M. Roshetko, Winrock International; Le Van Du, Nong Lam University, Vietnam. Presenter: Agustin Mercado Jr.

10:00 Coffee break

10:20 MARKETS

Moderator: Michael Bertelsen

- *Economic Opportunities for COMACO to Participate in Global Carbon Markets.* Author and presenter: John Fay, Emerging Markets Group Ltd., Arlington, Va.
- *Dairy Markets and Access to Higher Value Chains in Illangama Watershed, Ecuador.* Authors: Victor Barrera, Instituto Nacional de Investigaciones Agropecuarias (INIAP), Ecuador; Jeffrey Alwang, Heather Weeks, George W. Norton, Virginia Tech. Presenter: Jeffrey Alwang
- *Linking Upland Vegetable Farmers to Lowland Philippine Markets: Critical Factors and Their Program Implications.* Author and presenter: Ma. Elena Chiong-Javier, De La Salle University, Manila, Philippines

11:20 SOCIAL DIVERSITY

Moderator: Maria Elisa Christie

- *Forest Conservation and Gender Roles: Cases from East Africa and Latin America.* Authors: Esther Mwangi, Harvard University; Ruth Meinzen-Dick, International Food Policy Research Institute (IFPRI), Washington. Presenter: Esther Mwangi
- *Modernization and Participation in Nghia-Trung: Challenges of the Vietnamese Project's Ethnic Diversity.* Author and presenter: Rasmus Lybæk, Aarhus University, Denmark

12:15 Lunch

1:30 POLICY

Moderator: Keith M. Moore

- *Unpacking Decentralization.* Authors: Elinor Ostrom, Jacqueline Bauer, Pamela Jagger, Indiana University; Krister P. Andersson, University of Colorado; Marty Luckert, Centre for International Forestry Research (CIFOR), Bogor, Indonesia; Ruth Meinzen-Dick, International Food Policy Research Institute (IFPRI), Washington; Esther Mwangi, Harvard University. Presenter: Elinor Ostrom
- *Policy Environment of Vegetable Agroforestry (VAF) Systems in the Philippines and Vietnam: Are There Incentives for Smallholders?* Authors: Delia C. Catacutan, Caroline Duque-Piñon, World Agroforestry Centre (ICRAF), Philippines; Dang Thanh Ha, Le Thanh Loan, Nong Lam University, Vietnam. Presenter: Delia C. Catacutan

2:15 SOIL AND WATER MANAGEMENT

Moderator: Shirley Tarawali

- *Environmental Factors Affecting the Success of Conservation Farming in Zambia.* Authors: Lydiah Gatere, Rob Delve, Peter Hobbs, Steve DeGloria, Johannes Lehmann, Cornell University. Presenter: Lydiah Gatere
- *Differences in Cropping Systems and Soil Organic Carbon due to Climate Change and Socioeconomic Factors in Potato-based Cropping Systems in the Bolivian Highlands.* Authors: Peter Motavalli, Corinne Valdivia, University of Missouri; Jorge Cusicanqui, Magali Garcia, Roberto Miranda, Universidad Mayor de San Andrés, Bolivia; Javier Aguilera, PROINPA, Bolivia; Elizabeth Jiménez, Universidad de La Cordillera, Bolivia. Presenter: Jorge Cusicanqui
- *Stream Flow Monitoring to Support Watershed Assessment in Bolivia, Ecuador, and Zambia.* Authors: Conrad Heatwole, Virginia Tech; Mirco Peñaranda, UMSA, Bolivia; Ana Karina Saavedra, PROMIC, Bolivia; Carlos Montúfar, SIGAGRO/ INIAP, Ecuador; White Lunga, WCS/COMACO, Zambia. Presenter: Conrad Heatwole

3:25 Coffee break

3:45 ANALYZING SYSTEM STRESSORS

Moderator: Harry Shapiro

- *Vaccination Trials for Newcastle Disease Virus: Evaluation of Impacts on Village Poultry Production and Bushmeat Consumption.* Authors: Robyn Alders, International Rural Poultry Centre/KYEEMA Foundation, Australia; Dale Lewis, Wildlife Conservation Society (WCS), Zambia; Alex Travis, Cornell University. Presenter: Alex Travis
- *Field Evaluation of Endophytic Endospore-forming Bacteria with Cacao Successions for Management of Witches' Broom during the Dry Season, 2007.* Authors: R.L. Melnick, P.A. Backman, Penn State University; K.S. Hidalgo, C. Suárez, INIAP, Ecuador. Presenter: Anissa Poleatewich
- *Projected Changes in Altiplano Climate and Extremes in the 21st Century.* Authors: Anji Seth, Jeanne Thibeault, University of Connecticut; Magali Garcia, Universidad Mayor de San Andrés, Bolivia. Presenter: Anji Seth
- *The Predicted Impact of Potato Late Blight and Tuber Moth for Climatic Change Scenarios.* Authors: Greg Forbes, Centro Internacional de la Papa; Karen Garrett, Adam Sparks, Kansas State University; Rubí Raymundo. Presenter: Karen Garrett

5:15 Discussion

5:45 Adjourn

Abstracts for Scientific Program

SMALLHOLDER LIVELIHOODS

08-A-01. Can Forest Sector Governance Reform Achieve Both Favorable Livelihood and Sustainability Outcomes? Searching for Win-win Policy Outcomes in Uganda

Authors: Pamela Jagger, Indiana University; Arthur Arinaitwe, environmental consultant, Uganda

Abstract: Governance reforms are promoted as policy tools for achieving favorable livelihood and sustainable forest management outcomes. However, there is a dearth of empirical evidence to support this supposition or to identify conditions under which either or both are achieved. Drawing on the case of a major forest-sector governance reform in Uganda in 2003, this research seeks to fill that gap. The research employs a quasi-experimental research design comparing pre- and post-reform data for a large sample of households adjacent to three major forests in western Uganda. The design includes a control group. Household income portfolio data collected in 2007 are compared with baseline data collected immediately before the reform. Changes in forest sustainability are assessed using data on household perceptions of change in forest cover and quality, and household participation in activities that contribute to deforestation.

There are few cases where both favorable livelihood and sustainable forest management outcomes have been achieved. On private forest land overseen by the decentralized District Forestry Service, there has been no significant change in average annual household income from forests, the share of total income from forests has declined, and forest cover and quality have significantly declined. In Budongo Central Forest Reserve, overseen by the parastatal National Forestry Authority, there have been significant gains in average annual household income from forests, as well as in share of total income from forests. However, increases in income are limited to households in the highest income quartile and are primarily attributed to sale of illegally harvested timber. Forest cover in Budongo has decreased only slightly, but reduction in tree diversity, water quality, and presence of large trees indicates diminishing forest quality. These findings challenge the view that governance reforms will result in favorable livelihood and sustainable forest management outcomes. Policymakers should carefully consider the incentives facing both forestry officials and local resource users, with particular attention to increasing awareness of the value of trees and forests, and facilitating opportunities for rural smallholders across all income categories to engage in sustainable forest product harvesting and value addition.

Keywords: decentralization, forests, livelihoods, poverty

08-A-02. Determinants of Livelihood Strategies and Wellbeing Outcomes in the Chimbo Watershed, Ecuador

Authors: Robert Andrade, Jeffrey Alwang, George W. Norton, Virginia Tech; Victor Barrera, Instituto Nacional de Investigaciones Agropecuarias (INIAP), Ecuador

Abstract: Outcomes of any process to manage watersheds depend on human decisions about land use, labor allocations, and investment and savings decisions. This paper examines the determinants of household livelihood strategies in the Chimbo watershed of Ecuador. The objective is to provide information about how households will respond to changes in policies and programs to promote more sustainable watershed management in the area. We examine the roles of human, physical, financial, and social capital; and how conditions such as risk and access to markets affect human decisions. We then explore the relationship between this choice of livelihood and well-being outcomes.

Keywords: livelihood strategies, capital and assets, econometrics, multinomial logit selection model, watershed management

08-A-03. Andean Livelihood Strategies and the Impact of Market and Climate Shocks: Risks, Perceptions, Coping Mechanisms

Authors: Corinne Valdivia, Leonie Marks, Jere L. Gilles, University of Missouri; Elizabeth Jiménez, Alejandro Romero, Universidad de La Cordillera, Bolivia

Abstract: Andean families pursue their livelihood strategies in an environment of uncertainty shaped by market and climate risks. Production and consumption decisions remain interlinked due to limited, shallow, or imperfect markets, especially for credit to protect against negative shocks. Risk perceptions inform decisions, as do insurance mechanisms. Risks are assessed from the viewpoints of women and men heads of household connecting perceptions and management or coping mechanisms. Perceptions are predicted by the dread that the risk produces, the degree of control, knowledge of the risk, and the coping mechanisms. The latter includes the capitals invested – social, economic, cultural, natural – in providing a buffer or in adaptation strategies. Trusted sources of information and networks are also evaluated to develop a framework for communication of changes in the Altiplano to improve adaptation.

Community participatory assessments identified environmental, production, market, and human welfare risks. These were evaluated for dread, degree of control, and coping through a household survey of 330 families, eliciting systematically from male and female heads of household their perceptions and feelings about various risks, and sense of control of the risk. The survey also recorded information on shocks, coping mechanisms, capitals, and activities in 2006. Three clusters were identified with significant differences in total income and cash income in each region, Umala and Ancoraimes. Higher livestock assets and access to alfalfa and overall higher income were found in Umala. Higher crop diversification, fewer fallow fields, and lower overall income were characteristic of Ancoraimes. Accordingly, clusters in the latter region experienced more climate shocks on crop production. Consistent with theory, higher income and coping mechanisms that do not deplete assets are consistent with lower sense of dread for both men and women.

Keywords: rural livelihood, coping, assets, risks, perceptions, climate hazard, market risk

08-A-04. Determinants of Variety Choice among Potato Planters in the Bolivian Highlands

Authors: Michael Castelhana, Jeffrey Alwang, Nick Kuminoff, Virginia Tech; Ruben Botello, PROINPA, Ecuador

Abstract: Potato producers in the Bolivian highlands adopt many varieties of potatoes. Variety selection depends on attributes of the potato, including yield, tastes, disease and pest resistance, and resistance to frost and drought. Selection also depends on producer attributes, but access to and performance of markets may be critically important. When markets are not available, the farmers would be more likely to select varieties for taste and storage characteristics; remote farmers may plant highly diversified variety profiles due to individual tastes and preference, and exposure to different types of risk. SANREM CRSP researchers are engaged in research to promote higher-returning livelihoods. Variety selection can be a key element of a program to enhance incomes. SANREM staff and scientists at PROINPA need better information about demand for potato attributes to tailor interventions.

This study uses data collected in Tiraque and other highland areas of Bolivia to examine how farmers demand different attribute varieties. The data set includes information on farmer characteristics, potato attributes, and local conditions to estimate the demand for variety attributes.

Keywords: potato variety, on-farm diversification, attribute demands

08-A-05. Can Vegetables Be More Productive under Tree-based Systems?

Authors: Agustin Mercado Jr., Caroline Duque-Piñon, Manuel Reyes, Gerhard Manurung, World Agroforestry Center (ICRAF); Manuel Palada, Deng-lin Wu, Gregory C. Luther, Liwayway M. Engle, Flordeliza C. Faustino, World Vegetable Center (AVRDC); Anas Susila, Bogor Agricultural University, Indonesia; James M. Roshetko, Winrock International; Le Van Du, Nong Lam University, Vietnam

Abstract: Intensive commercial vegetable production under monoculture systems is not sustainable. However, integration of trees compatible with vegetable crops offers potential for enhanced sustainability. Our objective is to integrate trees on intensive vegetable systems or incorporate vegetables into tree-based systems. Specifically, our objective is to evaluate and improve production of commercial and indigenous vegetables under tree-based systems. Assessments and experiments with vegetable agro-forestry systems (VAF) were conducted in the Philippines, Taiwan, Indonesia, and Vietnam using cashew, timber, and fruit trees in combination with commercial and indigenous vegetable species. Farmer perceptions and experiences, light transmission, tree growth, crop growth and yield were collected to determine productivity, adaptability, competition, complementarity, and profitability.

In the Philippines, suitable trees were *Eucalyptus robusta*, *Eucalyptus torillana*, and *Acacia mangium* with tree line spacing of 25 to 30 meters. Commercial vegetables were cabbage, cauliflower, carrot and bell pepper; indigenous vegetables were amaranth, jute, and Malabar

spinach; fruit vegetables were yardlong bean and eggplant, with *Moringa oleifera* as a tree vegetable. Positive complementarity was observed between tree height and amount of canopy after tree pruning, but negative on canopy width. In Taiwan, outstanding species were *Anona reticulata*, *Artocarpus heterophyllus*, *Chrysophyllum caimito*, and *Tamarindus indica*. All vegetable crops produced average yields with minimum competition from tree crops, suggesting that integration of high-value vegetable crops provides quick economic returns at early establishment in agro-forestry systems. In Indonesia, vegetables (amaranth, kangkong, eggplant, chili, and tomato) grown under trees with medium shade resulted in yield increases of 5 percent to 180 percent over full sunlight. Heavy shade reduced yields of fruit vegetables (eggplant, chili, and tomato) but had no negative effect on leafy vegetables (amaranth and kangkong).

Keywords: agroforestry, vegetable, fruit, tree

MARKETS

08-A-06. Economic Opportunities for COMACO to Participate in Global Carbon Markets

Author: John Fay, Emerging Markets Group Ltd., Arlington, Va.

Abstract: COMACO employs a triple bottom line approach designed ultimately to conserve wildlife and habitats by reducing poverty and securing food for those who would otherwise resort to poaching and destructive land use. COMACO has developed the infrastructure and network to significantly impact land-use practices across much of Zambia's Luangwa Valley. More than 25,000 smallholder farmers have adopted conservation farming, are using solar fencing and lighting, and have planted tens of thousand of trees, all activities with significant carbon reduction implications. While performing yearly business analyses and plans, SANREM CRSP researchers identified that carbon emission reduction is a natural outcome of COMACO's activities, positioning the organization to benefit from burgeoning carbon markets. With SANREM research and capacity-building, COMACO is now exploring carbon credit potential both in mandatory (e.g., Kyoto Protocol driven) and voluntary markets (e.g., Chicago Climate Exchange). Reforestation/agro-forestry and soil carbon capture through conservation farming provide the most immediate opportunities, with avoided deforestation markets being somewhat less well developed.

To date, carbon finance opportunities have largely bypassed underserved markets in Africa. However, there has been increasing interest in generating projects across Africa. This has been encouraged by a renewed emphasis on land-based credits such as reforestation and afforestation projects from the United Nations Climate Change Summit in Bali. While the challenges are significant, developing carbon offset projects is a priority of the Zambian government. The Designated National Authority, the governmental body in Zambia that approves potential Kyoto projects, is focused on developing its capacity to acquire carbon credits through projects that generate Certified Emissions Reductions. Additional research in the form of modeling soil carbon sequestration and carbon storage in both miombo and mopane woodlands is needed to quantify the scope of carbon offsets that COMACO can provide. These activities could have a significant impact on COMACO's ability to meet the requirement for economic self-sufficiency.

Keywords: carbon markets, greenhouse gas, emissions, reforestation, afforestation

08-A-07. Dairy Markets and Access to Higher Value Chains in Illangama Watershed, Ecuador

Authors: Victor Barrera, Instituto Nacional de Investigaciones Agropecuarias (INIAP), Ecuador; Jeffrey Alwang, Heather Weeks, George W. Norton, Virginia Tech

Abstract: Farmers in the upper Chimbo watershed in Bolivar, Ecuador, depend on potato and milk production for income and food security. Incomes in the area, however, are very low and constrained by declining environmental quality, limited access to appropriate technologies, low local capture of value added, and poorly functioning marketing systems. As a part of the SANREM CRSP project, a study was undertaken of the dairy market chain in the Illangama watershed to identify obstacles to participation in higher-value portions of the chain and to examine overall efficiency. This paper reports the findings of this study, which can be used to formulate policies and programs for enhanced dairy-based livelihoods. Findings show a marketing system where rents are captured by intermediaries, but higher-valued production is constrained by on-farm factors, low density of producers, and long travel distances to final markets. Recommendations are made for improvements in the system.

Keywords: dairy markets, milk and cheese production, livelihoods

08-A-08. Linking Upland Vegetable Farmers to Lowland Philippine Markets: Critical Factors and Their Program Implications

Author: Ma. Elena Chiong-Javier, De La Salle University, Manila, Philippines

Abstract: Development efforts aimed at poverty alleviation among the poorest farming populations found largely in Philippine upland watersheds may not prosper unless they are linked to lowland markets and consumers of their products. Responding to this challenge, market value chain research was undertaken in Songco, an upland village in Lantapan Municipality, Bukidnon Province, where traditional agro-forestry systems have been transformed by the introduction of commercially viable vegetable crops. The study sought to understand local marketing channels, practices or strategies; and constraints, particularly concerning vegetables, in order to recommend appropriate program interventions. Data were gathered through observation, key informant interviews, focus group discussions, and gender surveys.

Findings from the study revealed that small-scale vegetable farmers are connected to the urban markets by multi-tiered channels characterized by many intermediaries who are bound by personal and informal transactions. While most farmers sell through intermediaries, the desire for greater profits has pushed many to actively market their own produce and/or become *biyahidors* engaged in buying and selling of vegetables, heightening competition as the number of small market players expands. Market roles are gender-differentiated. More men are engaged in large marketing endeavors, while women figure prominently in small vegetable-trading enterprises. The major marketing constraints for both farmers and *biyahidors* are lack of access to organized market information, which affects farm production and marketing decisions; inability to maintain product quality and control market pricing, which increases their vulnerability to unscrupulous practices; high cost of farm-to-market delivery; and poor transport facilities. Any program intervention should, among other factors, enhance farmers' knowledge about the demand-driven side of the market such as consumer preferences, build marketing collectives that take into account the existing web of functional individual and personal

transactions among the different market stakeholders, create direct linkages between marketing collectives and institutional buyers, and provide adequate market infrastructure support.

Keywords: market value chain, vegetable marketing, market constraints

SOCIAL DIVERSITY

08-A-09. Forest Conservation and Gender Roles: Cases from East Africa and Latin America

Authors: Esther Mwangi, Harvard University; Ruth Meinzen-Dick, International Food Policy Research Institute (IFPRI), Washington

Abstract: Many studies have demonstrated that understanding gender relations (in particular, women's access and decision-making) is crucial for the sustainable management of forests. This paper examines whether the composition of forest user groups in East Africa (Kenya and Uganda) and Latin America (Bolivia and Mexico) influences forest condition as perceived by the users themselves as well as forestry officials. The paper asks a fundamental question: whether forest condition indicators vary under predominantly female forest user groups compared with predominantly male or mixed forest groups, how, and why. In attempting to answer this question, the authors explore differences in types and levels of conflict, forest improvement activities, harvesting restrictions and technologies, and rule making and compliance across the three types of groups. The paper also reflects on the effects of decentralized forest management on user group function and performance.

Keywords: gender, users, forest management, decentralized

08-A-10. Modernization and Participation in Nghia Trung: Challenges of the Vietnamese Project's Ethnic Diversity

Author: Rasmus Lybæk, Aarhus University, Denmark

Abstract: not available

POLICY AND GOVERNANCE

08-A-11. Unpacking Decentralization

Authors: Elinor Ostrom, Jacqueline Bauer, Pamela Jagger, Indiana University; Krister P. Andersson, University of Colorado- Boulder; Marty Luckert, Centre for International Forestry Research (CIFOR), Bogor, Indonesia; Ruth Meinzen-Dick, International Food Policy Research Institute (IFPRI), Washington; Esther Mwangi, Harvard University

Abstract: The term "decentralization" is applied to a wide diversity of governance arrangements around the world and has achieved positive, negative, and no results in its application to natural resource management. Part of the reason that the results have been so mixed is that decentralization is used as the name of widely diverse policies, including de-

concentration of national administrative authority to regional or local offices, shifting authority from national agencies to local agencies with varying degrees of autonomy, and privatization of the ownership and/or management of natural resource systems. Thus, the resulting formal governance arrangements may vary substantially from one decentralization effort to another, depending on both the policies that are adopted and many other factors, including the broader economy of a country and the region where decentralization is occurring, the set of legal rights that had been in existence before the new policy, and multiple economic processes. Consequently, the behavior of resource users, private firms, and government officials at multiple levels will differ substantially. Livelihood and sustainability outcomes also will tend to differ substantially from one location to another.

High-level changes in decentralization trickle down to local people through complex paths. Our primary interest is to understand how benefits to local people change in the face of these complexities. Decentralization comes in numerous variants. Therefore, we need a framework that is sufficiently flexible and robust to encompass many empirical situations. If the concepts and processes of decentralization are not unpacked into meaningful and coherent theories, empirical studies of impact can only conclude that the outcomes are different. In our paper we will analyze a framework in which we can then present the findings from our studies of decentralization in Bolivia, Kenya, Mexico, and Uganda.

Keywords: decentralization, natural resource management, forests, local governance, incentives, property rights, finance

08-A-12. Policy Environment of Vegetable Agroforestry Systems in the Philippines and Vietnam: Are There Incentives for Smallholders?

Authors: Delia C. Catacutan, Caroline Duque-Piñon, World Agroforestry Centre (ICRAF), Philippines; Dang Thanh Ha, Le Thanh Loan, Nong Lam University, Vietnam

Abstract: In transition economies like the Philippines and Vietnam, using agriculture as a basis for economic growth requires innovative policies and a productivity revolution in smallholder farming. An important aspect is to expand technical options adapted to the ecological potential and changing economic patterns of the area, drawing on existing technologies in the short term and introducing new practices and technologies in the long term. Vegetable agroforestry (VAF) is a viable farming system in the uplands; however, its viability is constrained by such factors as farmers' inability to invest in the system, inadequate institutional structures for facilitating information flow, and lack of market incentives. Policy incentives are thus needed to stimulate smallholder investments in VAF systems.

In the Philippines, the study found that the policy environment is supportive of VAF system but is insufficient in stimulating smallholder investments. Incentives for smallholders, albeit limited, do exist; however, disincentives persist. Large landholders tend to benefit more from national-level policies than do smallholders, for the former have more access to policy information and can leverage the associated costs of policy implementation. In Vietnam, forest policies shifted from centrally dominated forest exploitation to social forestry, promoting sustainable forest management with emphasis on agroforestry. The fruit and vegetable sector is experiencing rapid growth, but only commercial fruit and vegetable producers are involved in this process – smallholders are still lagging the industry. At the local level, policy implementation is still slow.

In both countries, it is recognized that some issues are better resolved through national-level policies, while a number of them could be better addressed by locally formulated policies. Where national-level policies do not effectively address the needs of smallholders, locally crafted policies are needed to offset this gap. Policy linkages between national and local levels need to be established. The viability of VAF system depends on a whole set of policy environment that government can provide. It is therefore a political imperative.

Keywords: agroforestry, incentives, smallholders, policy instruments

SOIL AND WATER MANAGEMENT

08-A-13. Environmental Factors Affecting the Success of Conservation Farming in Zambia

Authors: Lydiah Gatere, Rob Delve, Peter Hobbs, Steve DeGloria, Johannes Lehmann, Cornell University

Abstract: Despite agriculture being a fundamental activity required to feed the world's population, it often has negative environmental impact when practiced without consideration of the state of the soils on which it depends. Our experiments investigate the environmental conditions under which conservation farming (CF) works best, the types of organic amendments that are best for improving production potential, and the time required to achieve greatest yield potential under on-farm conditions. A transect across the three major agro-ecological zones was chosen to study soil and crop management practices where variability in environmental conditions, soil types, and landscape position are major determinants of soil water and nutrient availability. More than 500 small-scale farmers practicing conservation on a rainfall gradient of 500 to 1,500 millimeters annually were selected. The field experiment involves traditional farming, CF as managed by farmers, CF supervised by researchers, and CF supervised by researchers with full commercial fertilization. Within the researcher-supervised treatment, we investigate the potential to improve nutrient availability by organic matter additions of contrasting quality ($6t\ C\ ha^{-1}$), especially the C/N ratio and carbon stability. A chronosequence study is used to understand the effects of time on yield increases by CF. Fields with different lengths of continual practice of CF were identified on the same soil type and under the same climate.

Results obtained for above-ground biomass yield indicated that a combination of organic and inorganic nutrient sources gave higher maize biomass yield than when each is applied separately. In general, above-ground biomass yield production in maize ($t\ ha^{-1}$) from organic and inorganic amendments was in order of fertilizer + manure > fertilizer + biochar > gliricidia > manure > compost > control. On average, clay soils across the environmental gradient produced higher yields compared with loam and sandy soils. However, with timeliness in application of organic manure and harvesting, the above results are bound to change. Results from these experiments can inform farmers about the best amendment strategies to use under different conditions, which reflect those seen across southern Africa.

Keywords: conservation farming, biochar, environmental variables, organic, inorganic, chronosequence

08-A-14. Differences in Cropping Systems and Soil Organic Carbon due to Climate Change and Socioeconomic Factors in Potato-based Cropping Systems in the Bolivian Highlands

Authors: Peter Motavalli, Corinne Valdivia, University of Missouri-Columbia; Jorge Cusicanqui, Magali Garcia, Roberto Miranda, Universidad Mayor de San Andrés, Bolivia; Javier Aguilera, PROINPA, Bolivia; Elizabeth Jiménez, Universidad de La Cordillera, Bolivia

Abstract: Global climate change and changes in migration and market conditions in the Bolivian Highlands (Altiplano) have reduced the use of traditional cropping practices and increased the risk of crop failure and food insecurity. The objectives of this research were to survey indigenous farming communities in the northern Altiplano of Bolivia to determine the actual and perceived changes in cropping practices in potato-based cropping systems and to assess the effects of these changes on cropping systems, soil total organic carbon (C) levels, and the availability and composition of soil amendments. Village-level surveys were conducted using questionnaires and participatory techniques in 2006-2007 in four communities that were selected to represent communities situated at relatively low and high altitudes in the region. Samples of soil amendments, primarily animal manures, were obtained from each community to determine the range of composition of the materials. In addition, soil samples were collected to a 20 centimeter depth from agricultural fields that represented different stages of the common agricultural rotation practiced in the region and that had different lengths of fallow periods.

Among the findings of this research were that soil organic C generally increased with increasing fallow length or was higher in the uncropped compared with the recently fallowed fields. Soil pH levels also generally increased and neutralizable acidity decreased with increasing fallow. The results of the analysis of the soil amendments and soils will be compared with community perceptions of changes in soil quality and management, and any differences among the communities will be discussed. The findings of this research will help to determine whether appropriate management practices need to be identified to improve soil organic matter, possibly to mitigate negative effects of climate change in the area.

Keywords: global climate change, soil organic carbon, Altiplano, animal manure, potato

08-A-15. Stream Flow Monitoring to Support Watershed Assessment in Bolivia, Ecuador, and Zambia

Authors: Conrad Heatwole, Virginia Tech; Mirco Peñaranda, UMSA, Bolivia; Ana Karina Saavedra, PROMIC, Bolivia; Carlos Montúfar, SIGAGRO/ INIAP, Ecuador; White Lunga, WCS/COMACO, Zambia

Abstract: Basic hydrologic data characterizing watershed response provide important information for quantifying water resources of a community. Identifying, defining, and quantifying community resources are important steps in being able to “manage” those resources. Hydrologic data is also critical for the calibration and evaluation of models that can be used to assess the long-term impact of climate and practice changes on the watershed. Flow monitoring has been implemented at 21 stations in eight watersheds in Bolivia, Ecuador, and Zambia. Design and selection of the monitoring system components focused on simplicity, reliability, and low cost. Non-vented in-stream pressure sensors offer a variety of installation options and provide a high frequency (10 minute) observation of water depth. The sensor data must be complemented by local observations of stage and discharge. Three techniques for flow

measurement are used depending on conditions: flow-meter and cross-section measurements, cross-section and timed float, and tracer dilution study using salt.

Preliminary data from the first rainy season (2007-2008) show good potential for reliable long-term records. Ensuring quality in the collection of flow data used to develop a stage-discharge curve for each of the monitoring sites will be a challenge of this approach. Appropriate training, consistency in cooperators, and follow-up visits for quality assurance and training will be important for ensuring the validity and usefulness of the data collected.

Keywords: hydrology, runoff, water balance, stream gauge, stage-discharge

ANALYZING SYSTEM STRESSORS

08-A-16. Vaccination Trials for Newcastle Disease Virus: Evaluation of Impacts on Village Poultry Production and Bushmeat Consumption

Authors: Robyn Alders, International Rural Poultry Centre/KYEEMA Foundation, Australia; Dale Lewis, Wildlife Conservation Society (WCS), Zambia; Alex Travis, Cornell University

Abstract: Newcastle disease (ND) is a severe viral infection that has high morbidity and mortality in poultry flocks. Endemic in the Luangwa Valley of Zambia, it can wipe out poultry production in entire villages, which often rely specifically on poultry to cope with periods of food insecurity. SANREM CRSP research identified that 85 percent of all village poultry were lost before sale or consumption. Surveys and observation identified suboptimal husbandry practices and were used to generate training materials to increase village knowledge of improved methods. Unfortunately, even ideal husbandry cannot protect against ND. Therefore, a second phase has been implemented with COMACO, IRPC, and WCS-AHEAD in which teams of community vaccinators are taught how to administer a thermostable ND vaccine. Data are being collected from both villages receiving the vaccination and from control, unvaccinated villages.

In our first two vaccination cycles (June and November 2007), more than 11,000 birds were vaccinated in five chiefdoms, and 13,200 birds were counted in four control chiefdoms. We anticipate that at least six to eight vaccination cycles will be needed before data become meaningful, due to seasonal variations in disease incidence and household food security. In November, for example, some farmers in test villages declined vaccination because they were about to sell their birds. Vaccination was not economically practical under those conditions. However, preliminary data suggest that in the test villages (those receiving vaccinations), there was an increase in the number of birds per household (from 13 to 17), whereas there was a decrease in the number of chickens in the control (unvaccinated) villages (from 15 to 10). Data must be interpreted cautiously until factors of sale and consumption can be integrated into both poultry management and economic analyses, but these data are consistent with other trials in neighboring countries. Ongoing surveys have also begun to evaluate potential links between reliability of livestock resources and bushmeat harvesting.

Keywords: poultry, Newcastle disease, vaccine, bushmeat

08-A-17. Field Evaluation of Endophytic Endospore-forming Bacteria with Cacao Successions for Management of Witches' Broom during the Dry Season, 2007

Authors: R.L. Melnick, P.A. Backman, A.M. Poleatewich, Penn State University; K.S. Hidalgo, C. Suárez, INIAP, Ecuador

Abstract: Witches' broom is a fungal disease affecting cacao production across Ecuador. Effective treatments are needed to ensure the viability of small-scale cacao production. This paper presents results from a study of means of controlling the disease through application of endophytic bacteria. This trial was conducted using clones of four varieties of cacao at the Tropical Experimental Research Station of INIAP in Pichilingue, Ecuador. The four varieties were the susceptible clone (EET-19), moderately resistant clones (A2162 and A2634), and resistant clone (CCN-51). In May, five bacterial treatments consisting of endophytic endospore-forming bacteria previously isolated from trees on the INIAP station were applied to 6-month-old greenhouse-grown plants. The bacterial treatments applied to each variety were: no bacteria, Silwet control; A2076 5.1.7; CCAT1858 2.1.2; CUR3 3.1.1; and EETht103 2.1.1. Bacterial suspensions were applied at log 8.0 CFU/ml in water with 0.20 percent Silwet L-77 using hand-held aerosol sprayers. In June, all inoculated plants were placed in the field three weeks after treatment in a randomized nested block design with four replicates. To best standardize natural infection, potted trees were placed under larger trees with high levels of witches' broom infection. Incidence was determined in September and November. Mean separation was conducted using Tukey's (HSD) ($\alpha=0.05$).

Cacao variety had a significant effect on disease severity, with reduced disease observed on susceptible and resistant cacao successions. There were no significant differences in disease severity between varieties treated with bacterial endophytes and the Silwet treated control plants at either rating date. Visual observations suggest bacterial treatments did not decrease disease due to low levels of infection at the trial site during the dry season. However, none of the plants colonized by endospore-forming bacterium CCAT1858 2.1.2 were diseased in any of the cacao lines, indicating a likely trend towards disease suppression. There was no significant interaction between cacao variety and bacterial treatment. Data will be presented on evaluations taken during late March during the rainy season.

Keywords: witches' broom, cacao disease, biological control

08-A-18. Projected Changes in Altiplano Climate and Extremes in the 21st Century

Authors: Anji Seth, Jeanne Thibeault, University of Connecticut; Magali Garcia, Universidad Mayor de San Andrés, Bolivia

Abstract: Coupled climate model datasets employed in the Fourth Assessment of the Intergovernmental Panel on Climate Change (IPCC AR4) are analyzed for projected changes in Altiplano climate through the 21st century. The models simulate well the timing of the annual cycles of both precipitation and temperature; however, the reduced elevation of the Altiplano in the models yields a warmer and wetter climate than is observed currently. Projections of 21st century climate are evaluated for indices of climatic extremes. They demonstrate trends in decreasing frost days, increasing heat-wave duration and intensity of precipitation, as well as increasing numbers of consecutive dry days.

The evolution during the 21st century suggests that moderate changes will be experienced by mid-century, with potentially much larger responses in mean and extreme climate by late century. These projections are consistent with the large-scale circulation changes projected for the tropics and for the South American Monsoon. The projected trends in frost days and heat-wave duration disagree with the recent observed trends in the region. Further research is in progress to examine this issue. The results for projected frost days and heat waves should be taken with caution.

Keywords: climate change, climatic extremes, Altiplano, Andean highlands

08-A-19. The Predicted Impact of Potato Late Blight and Potato Tuber Moth for Climate Change Scenarios

Authors: Greg Forbes, Centro Internacional de la Papa; Karen Garrett, Adam Sparks, Kansas State University; Rubí Raymundo

Abstract: Knowledge about the future geographic distribution of important disease and pest pressures is important input for formulating strategies. For some pathogens and insect pests, there is sufficient information to predict the severity of impact using models based on climatic variables such as temperature and precipitation patterns. Potato late blight is one of the best-studied plant pathogens, and models are available to predict its impact based on hourly temperature and moisture data.

Weather stations often provide only daily data, so we have developed methods for interpolating hourly data for use in the model. We have developed preliminary maps of late blight severity and the pesticide use needed for successful management of both resistant and susceptible potato varieties in the Andean highlands, currently and under climate change scenarios. Potato tuber moth is another major constraint to potato production, but its response to climate has not been studied as much as that of late blight. Using available models, we are mapping potato tuber moth impacts and predicted shifts due to climate change.

Keywords: potato late blight, potato tuber moth, climate change

Abstracts for Poster Exhibit

SOIL AND WATER MANAGEMENT

08-P-01. Management of Organic and Inorganic Soil Fertility Inputs in Indigenous Agricultural Communities in the Bolivian Highlands

Authors: Javier Aguilera, Eliceo Tangara, PROINPA, Bolivia; Roberto Miranda, Elvio Herrera, Universidad Mayor de San Andrés, Bolivia; Peter Motavalli, University of Missouri-Columbia

Abstract: The Bolivian Altiplano is a mountainous, semi-arid region characterized by periodic frost and hail, and high drought risk during the growing season. Due to global climate and socioeconomic changes, risks of crop failure and food insecurity have increased. Also, use of organic and inorganic soil amendments varies among communities and is restricted by several factors, including the relatively high cost of fertilizers and limited availability of transport. The objectives of this research were to 1) develop alternative fertilization practices that would improve long-term soil fertility and increase soil organic matter content to buffer against the effects of climate change, and 2) to engage community members in ongoing evaluation of the practices and their potential for adoption. Field experiments with potato were established in 2006 in several communities in Umala and Ancoraimes that provided a contrast in rainfall and elevations. Treatments included a control, sheep and cow manures, compost, peat moss, Biofert (a commercial microbial activator soil amendment), urea and diammonium phosphate, and combinations of these treatments.

Soils samples were taken before planting, at blooming time, and after harvest to assess changes in soil chemical and physical properties due to treatments. Also, leaf petioles and samples of organic amendments were collected for total N and nitrate analysis. Mixtures of animal manures and chemical fertilizers resulted in the highest potato tuber yields, an average of 12 and 16 t ha⁻¹ for Umala and Ancoraimes, respectively. Those treatments were also selected by the community farmers at blooming and harvesting time based on relative plant growth and tuber yields and quality. In Ancoraimes, organic soil amendments also resulted in relatively higher soil water content during the growing season compared with the control and inorganic soil amendments. This experiment will be repeated in 2007 with potato, and another study will examine residual effects of treatments on subsequent growth of a local grain crop such as quinoa or barley.

Keywords: Altiplano, soil organic matter, climate change, organic amendments, potato

08-P-02. Characterizing Soil Microbial Communities as Indicators of the Process of Soil Degradation

Authors: Jeffrey Alwang, Virginia Tech; Karen Garrett, Kansas State University; Lydiah Gatere, Alex Travis, Johannes Lehman, Cornell University; Peter Motavalli, Corinne Valdivia, University of Missouri-Columbia; Lorena Gomez, Mike Herman, Ari Jumpponen

Abstract: Soil degradation is one of the most important problems for sustainable agriculture worldwide. Because tropical soils have been studied less than temperate soils, understanding and developing methods to halt degradation of tropical soils is an important topic for SANREM CRSP, and SANREM provides a unique social science context for studying human impacts on soil degradation. One of the most exciting outcomes of the biotechnology revolution in genomics is our ability to characterize soil microbial communities with much greater coverage. New high-throughput technologies such as 454 sequencing allow us to evaluate DNA simultaneously from millions of microbes in soil samples, including species that have previously been overlooked because they could not be cultured using standard techniques. While the first studies in soil metagenomics have emphasized extensive analysis of a small number of samples, our research group at Kansas State University has developed techniques to add molecular tags and simultaneously process many tagged replicate soil samples. This allows us to compare soil microbial communities in carefully designed replicated experiments.

Studies of soil metagenomics will begin in concert with the soils and social science projects so that samples are selected in the appropriate biophysical and human context. Because soil communities differ greatly among soil types, even in the absence of any human activity, comparisons of management impacts on soil communities will be made within particular soil types. Soil communities also differ greatly across very small distances, even within the same soil type and management practice, so many subsamples will be combined into each replicate sample. We will identify fields that represent different levels of soil degradation to characterize how soil communities change. Soil DNA extraction will be performed by students and collaborators in the host countries. Tagging of DNA will be performed at Kansas State before 454 sequencing. One of our most important activities is the development of training materials for students in the different countries, and we will present a summary of those materials.

Keywords: soil degradation, microbial communities, soil communities, 454 sequencing, metagenomics

08-P-03. Development of No-till Equipment for Upland Vegetable Farming

Author: Paul M. Catalan, Don Bosco Technical College, Philippines

Abstract: The no-till farming system has been proved by many scientists around the globe to be beneficial to farmers and the environment. However, in the Philippines, especially in the uplands, many farmers still practice tillage farming, a reliable method but one that causes soil erosion and degradation, especially on slopes. Among the identified reasons why no-till is not practiced is the lack of no-till equipment, especially for small-scale farmers. The objective of this research is to develop practical equipment and/or tools that can be used to facilitate no-till vegetable farming among small-scale farmers of the uplands in Barangay Songco, Lantapan, Bukidnon, Mindanao, Philippines.

This paper will present the activities done in the design, fabrication, testing, and operation of a human-powered no-till drill, an animal-powered no-till drill, a seeder with vertical metering plate, a star-wheeled fertilizer dispenser, a seed dibbler, a transplanter, and a cover crop roller. Performances of plain- wave- toothed coulters will be compared. A similar comparison will be made among an inverted T-opener, a tined opener, and a double-disc opener. The preparation of the test bed and the proposed design for the motorized no-till drill also will be presented.

Keywords: no-till, drill, vertical metering plate, star-wheeled fertilizer dispenser, seed dibbler, cover crop roller, motorized no-till drill, toothed coulters

08-P-04. Effect of Hydraulic Head and Slope on Water Distribution Uniformity of the IDE Drip Irrigation System

Authors: Victor B. Ella, University of the Philippines-Los Baños; Manuel R. Reyes, North Carolina Agricultural and Technical State University; Robert Yoder, International Development Enterprises

Abstract: Assessment of the effect of topography and operating heads on the emission uniformity distribution in drip irrigation systems is important in water management and could serve as the basis for optimizing water-use efficiency and crop productivity. This study was carried out to evaluate the effect of slope and hydraulic head on the water distribution uniformity of a low-cost drip irrigation system developed by International Development Enterprises (IDE). The drip system was tested for water distribution uniformity under varying system heads and slope conditions. The experiments were conducted at the hydraulic laboratory facilities of the College of Engineering and Agro-industrial Technology, University of the Philippines-Los Baños. A drum reservoir served as water supply for the IDE drip system. A sub-main of 10 m and lateral-sub holder of 20 m with adjustable slope was fabricated to enable slope variations during laboratory experiments. The drip system was operated at pre-specified operating heads of 1 m, 2 m, and 3 m from the reservoir outlet for slopes of 0 percent, 10 percent, 20 percent, 30 percent, 40 percent, and 50 percent for the sub-main; and 0 percent slope for the laterals. The discharges in selected emitters were monitored under each chosen slope through direct volumetric measurements. The uniformity coefficient was then estimated using Christiansen's method. Mathematical relationships were then developed to characterize the effect of slope and heads on uniformity coefficient. On the basis of the results, appropriate recommendations were formulated to minimize non-uniformity of water distribution under field conditions in sloping drip-irrigated lands.

Keywords: drip irrigation, uniformity distribution, emission uniformity, low-cost drip system

08-P-05. Assessing and Managing Soil Quality for Sustainable Agricultural Systems

Authors: Peter Motavalli, Bunjirtluk Jintaridith, Keith Goynes, Jere Gilles, University of Missouri-Columbia

Abstract: Identifying and developing appropriate methods to quantify and assess changes in soil quality are essential for evaluating the extent of soil degradation and the effectiveness of improved management practices. Also, the use of soil quality measurements that have meaning to farmers and land managers is important for linking science with practice in the assessment of sustainable management practices. The objectives of this cross-cutting research, which will use the wide range of practices and environments among SANREM CRSP projects, are to assess community perceptions and indicators of soil quality, and to determine the efficacy of spectroscopic-based (*i.e.*, near-infrared, mid-infrared, and visible range) analytical methods to evaluate soil organic matter fractions and soil quality in degraded and non-degraded soils.

Initial activities of the project are to develop appropriate soil quality surveys, collect soil samples from representative degraded and non-degraded soils at ongoing SANREM field sites, establish in-field and laboratory capacity to test soil quality, and develop analytical methodologies for the spectroscopic-based procedures. Initial results of the development of the analytical methodologies will be presented, including a testing of extraction procedures, scanning results from diffuse reflectance infrared Fourier-transformed (DRIFT) mid-infrared spectroscopy, use of an in-field potassium permanganate-based test, and establishment of criteria to evaluate the results. Collaboration with the CGIAR system (*i.e.*, ICRAF), USDA-ARS, and USDA-NRCS are also important goals of this project due to the ongoing efforts and resources being invested at these institutions in developing low-cost methods for soil quality evaluation.

Keywords: soil quality, spectroscopy, indicators, soil organic matter, soil degradation

08-P-06. Saving Water for Vegetable Agroforestry (VAF) Systems: An Assessment of Drip Irrigation Trials on Vegetable Cultivation in Nghia Trung Village

Author: Tran Van My, Nong Lam University, Vietnam

Abstract: Growing vegetables for home consumption and for sale in the cashew-producing area of Bu Dang District, Binh Phuoc province, Vietnam, can help farmers to increase their income. However, water and labor are two limiting constraints faced by farmers in that area in the dry season. Low-cost drip irrigation is a promising tool in vegetable cultivation for increasing water-use efficiency, reducing labor requirements, and improving harvest quantity and quality. This study therefore aims not only to introduce a new small-scale irrigation tool to the farmers but also to compare it with the farmers' existing irrigation practice. An experiment with two vegetable species with and without drip irrigation was conducted in the dry season. The experimental setup consisted of on-farm trials with plots laid out in a randomized, complete block design with four treatments and three replications. This report presents the main results of the study, focusing on the relationship between irrigation methods and vegetable yield, water, and labor productivity.

Keywords: low-cost drip irrigation, water productivity, vegetables

PEST MANAGEMENT

08-P-07. An Integrated Baseline for Populations, Perceptions, and Management of the Andean Potato Weevil and Potato Tuber Moth under Conditions of Rapid Change in the Bolivian Altiplano

Authors: Bernardo Baltazar, Nelly Calle Kantuta, Jorge Cusicanqui, Miriam Gomez, Miguel Angel Gonzales, Universidad Mayor de San Andrés, Bolivia; Karen Garrett, Kansas State University; Claudia Jarandilla, Gladys Jiménez, PROINPA; Soroush Parsa, University of California-Davis; Antonio Paz Arcani, Mirco Peñarando, Anji Seth, University of Connecticut; Corinne Valdivia, University of Missouri-Columbia

Abstract: To determine strategies for future pest management in the Bolivian Altiplano, it will be important to estimate how pest pressures will change in response to climate and economic changes. But understanding these changes requires knowledge of current conditions. In farmer surveys, the Andean potato weevil and the potato tuber moth have been identified as two of the most important pest problems in the area. We have quantified their abundance in farmers' fields as part of our baseline estimation. We have also analyzed preexisting datasets for information about the abundance of these pests as a function of climatic conditions. Combining information about pest abundance with farmer perceptions and management practices provides an integrated baseline for evaluating change in the future.

Keywords: Altiplano, Andean potato weevil, potato tuber moth, climate change

08-P-08. Termite Biocontrol on Cacao Seedlings: Vetiver Grass Application

Authors: Le van Du, Nguyen Huu Truc, Nong Lam University, Vietnam

Abstract: In some upland provinces of southern Vietnam in the past decade, cacao (*Theobroma cacao*) has been introduced to agroforestry systems, especially cashew plantations, to improve incomes of local farmers. However, termite attacks on cacao seedlings have constrained development of this crop. Application of chemicals had been the only method available to protect cacao, and there had been no study of non-chemical termite control. An experiment on natural termite control using vetiver grass was established by a Nong Lam University team from August to December 2007 in Nghia Trung (Site 1) and Nghia Binh (Site 2) communes of Bu Dang district, Binh Phuoc province. The experiment tested the hypothesis that natural oil compounds and other constituents in composted vetiver grass biomass can repel termites, and that its organic matter can enhance the growth of cacao seedlings.

In each site, the trial was carried out with 6-month-old cacao seedlings in a randomized complete block design with four treatments and three replications. The four treatments were T1 (treatment with manure only, no chemicals, no vetiver compost), T2 (farmers' practice with chemical termite control), T3 (mixture of manure and lime), and T4 (mixture of manure and vetiver grass compost, and planting six vetiver clumps surrounding each cacao seedling). Manure, lime, and vetiver compost were spread in the holes one week before planting. A total of 72 cacao seedlings were used in each site. Two months after planting, rates of seedling damage in Site 1 were 50 percent, 11 percent, 17 percent, and 17 percent, but the rates of seedling deaths due to termites were only 39 percent, 0 percent, 17 percent, and 0 percent for the treatments T1, T2, T3, and T4, respectively. No cacao seedlings were damaged by termites in T2 (chemical) and T4 (vetiver compost). In Site 2, the rate of seedling death by termites in the treatment T1, T2, and T3 were 70 percent, while only 33 percent were recorded for the treatment T4, indicating that damage due to termite attack was lowest when applying vetiver compost. The initial findings suggest that vetiver grass can be used not only as a tool for soil erosion control, but its biomass also can be used instead of chemicals for termite control in cacao.

Keywords: termite, biocontrol, vetiver, cacao

08-P-09. Crop and Pest Management in the Bolivian Altiplano: Now and in the Future

Authors: Jorge Cusicanqui, Universidad Mayor de San Andrés, Bolivia; Karen Garrett, Kansas State University

Abstract: We present an overview of biological research results from the LTRA-4 project. One project is focused on predicting future pest and disease pressures based on climate change predictions. We have developed preliminary maps of late blight severity and the pesticide use needed for successful management of both resistant and susceptible potato varieties in the Andean highlands, currently and under climate change scenarios. Using available models, we are also mapping potato tuber moth impacts and predicted shifts due to climate change.

Another project is to establish an integrated baseline for the Andean potato weevil and the potato tuber moth. We are combining new experimental data and preexisting datasets with farmer perceptions and management practices to provide an integrated baseline for evaluating change in the future. A third project addresses use of traditional crop varieties. New projects include a study of the microbial community response to soil degradation and a study of landscape-level land use and land-use change.

Keywords: plant disease, pests, climate change, crop varieties, soil degradation

08-P-10. Pesticide Use and Farmers' Health Costs in Cashew Production Systems in Nghia Trung Village

Authors: Pham Thi Kieu Trang, Dang Thanh Ha, Nong Lam University, Vietnam

Abstract: Agricultural production in the study area of Nghia Trung village is characterized by perennial production systems with cashew as the main cash crop. The cultivation of cashew has been intensified over time with increasing input applications, particularly inorganic fertilizer and pesticides, to improve the yield of cashew and raise incomes for farmers. Increased use of pesticides poses threats to the environment, including adverse health effects on farmers and others, and pollution of the watershed. In light of those adverse effects, it is vital to know how current pesticide use endangers farmers' health and labor productivity, and whether the marginal gain from reduced pesticide use through sustainable pest management practices could surpass the marginal loss in cashew productivity and farmers' benefits.

This paper reports the main results of a study conducted by a Nong Lam University team on pesticide use and farmers' health costs in cashew-based production systems. The study examined pesticide productivity and types of health impairments and health costs caused by pesticide use, and estimated farmers' willingness to pay to avoid health impairment brought about by pesticide exposure. The Cobb-Douglas function analysis was employed to examine pesticides' effects on cashew production using data collected in a survey of 80 farmers in Nghia Trung village. To quantify the health impairment of farmers and their use of pesticides, a health cost model was also employed. Information generated from the study provides an important basis for the identification of policies and measures to promote sustainable pest management practices in a cashew-based vegetable agroforestry production system.

Keywords: pesticide productivity, health cost, cashew farmers

08-P-11. Evaluations of Cacao Disease Severities for Cacao/Plantain Intercropping Systems under 5 Spatial Arrangements, 2006-2007

Authors: D.I. Vera, C. Suárez, Instituto Nacional de Investigaciones Agropecuarias, Ecuador; P.A. Backman, Penn State University

Abstract: Witches' broom is a fungal disease affecting cacao production across Ecuador. Effective treatments are needed to ensure the viability of small-scale cacao production in the SANREM CRSP watershed. This paper presents results from a study of cropping patterns and disease incidence. Findings indicate that disease incidence is strongly associated with cropping patterns, and an intercropped (with plantain) system is the most effective means of controlling the disease. Five intercropping systems were developed, and the amount of witches' broom disease affecting cacao intercropped with plantain was reported under three spatial arrangements plus monocrops (five treatments with four replications). The treatments were planted in a randomized complete block design. Each plot/replication had an area of 864 m², with an average of 75 plants per crop/plot. For cacao, an Ecuadorian clone of the national type (EET-103) was planted to the field as a 4-month-old clonally rooted plantlet on April 6. Rooted plantain suckers of cultivar barraganete were planted at the same time. Integrated pest management practices were developed for each crop (mechanical control of weeds, nutrition based on previous soil analysis and requirements of the plants, phytosanitary pruning). The treatments compared were (CDR+PDR) = cacao double row + plantain double row with a density of 833 and 1,111 plants/ha, respectively; (CSR+PSR) = cacao single row + plantain single row (954 plants/crop/ha); (CD + PD) = cacao diamond (943 plants/ha) + plantain diamond (1,095 plants/ha); (SC) = single cacao in square (1,111 plants/ha) and (SP) = single plantain in square (1,111 plants/ha.).

Evaluations were made in the middle of the following rainy season (March 7) by reporting percentage of symptomatic axillary shoots, terminal shoots, or flower cushions borne on the stems. Cacao plants were between 1 and 1.5m tall, and plantain were 4 to 5m tall at evaluation and provided a strong overstory to the much smaller cacao during the rainy season. Disease incidence indicated that in young plantings, monoculture planting of cacao produces highest witches' broom disease severity, while intercropping resulted in lower levels of disease.

Keywords: cacao, plantain, intercropping, disease control, witches' broom

CROP DIVERSITY AND CHOICE

08-P-12. Developing Best Practices for the Integrated Evaluation of Traditional Crop Assessments in Changing Environments: Examples from Andean Crops and Rice

Authors: Dora Aguilar Endara, Jorge Cusicanqui, Karen Garrett, Miguel Angel Gonzales, Elizabeth Jiménez, Corinne Valdivia, *et al.*

Abstract: Not available

08-P-13. Introduction of Indigenous Vegetables in the Vegetable Agroforestry (VAF) System in Lantapan Watershed, Philippines

Authors: Liwayway M. Engle, Flordeliza C. Faustino, World Vegetable Center (AVRDC), Taiwan; Agustin Mercado, World Agroforestry Center (ICRAF), Philippines

Abstract: The collaborative project between AVRDC and TMPEGS-Philippines under the sponsorship of USAID-SANREM CRSP aims to introduce indigenous vegetable (Iv) germplasm to the agroforestry system in Lantapan watershed, identifying vegetable varieties suitable for cultivation with trees. Introduction of Ivs could enhance plant biodiversity in the area, leading to diversification of farmers' production systems and raising household incomes. Using different kinds of Ivs also could improve family nutrition.

A field day was conducted Sept. 22, 2007, in Barangay Kibangay, Lantapan, Bukidnon, to meet these objectives. Other goals were to teach villagers the philosophy of conservation and utilization of plants, and to document local knowledge of indigenous vegetables' medicinal values. The Ivs introduced were 20 accessions from the Genetic Resources and Seed Unit, AVRDC, and five species of tree vegetables native to the Philippines. Five popularly grown exotic vegetables were also included. More than 60 people participated, 35 percent of them women. At least 28 percent of participants raise and sell their own produce. When participants evaluated the vegetables for adaptability and general acceptability, more than 60 percent identified the following with potential for adoption in their locality: spineless white TOT5474 and purple TOT7278 amaranths, roselle, and local tree vegetables malunggay, bago, katuray, and alikway. Among the exotic vegetables, bell pepper, carrot, and an improved tomato line were preferred. Villagers generally preferred Ivs that were relatively new to them and preferred them in cooked form rather than raw. Constraints to growing Ivs were unfamiliarity with the crop, unavailability of seeds and potential markets, and lack of knowledge about cultivation and utilization. In selecting desirable Ivs, more than 60 percent of participants considered overall appearance, leaf/fruit color, taste, nutritional value, shelf life, availability of seeds, marketability, non-seasonality, and tolerance/resistance to pests, insects, and diseases as their bases.

The activity also gave the team an opportunity to document knowledge of indigenous vegetables' medicinal values.

Keywords: indigenous vegetables, amaranth, roselle, malunggay, bago, katuray, alikway, vegetable agroforestry system

08-P-14. Collection and Characterization of Indigenous Vegetables Obtained from Bogor and Pandeglang Districts

Authors: Agung Laksana, Bambang S. Purwoko, Muhamad Syukur, A.D. Susila, Bogor Agricultural University, Taiwan; Manuel Palada, World Vegetable Center (AVRDC), Taiwan

Abstract: Research was conducted to collect and characterize several indigenous vegetable species obtained from Bogor and Pandeglang districts. Differences among accessions and their lineage were also studied. A randomized block design with three replicates was used during planting of each species. Accessions were collected from Nanggung, Parung, Tamansari, Cibinong (Bogor District), and Pandeglang, Mandalawangi, Cadasari, and Cimanuk (Pandeglang District). They consisted of nine kemangi (*Ocimum americanum* L.) accessions, 11

katuk (*Sauropus androgynus* (L.) Merrill) accessions, 10 honje (*Etlingera giseke*) accessions, and eight kucai (*Allium tuberosum* Rottler ex Sprengel) accessions.

Morphological growth as well as agronomical characteristics were observed. Results showed that there were morphological and yield differences. The highest yield per plant (128 g) of kemangi was achieved by *Cadasari* accession, while for katuk it was by *Mandalawangi* accession (43.75 g/plant), and for kucai it was by *Parung* accession (16.62 g/plant). Honje flowered after 12 months, and the yield will be presented. The lineage among accessions and morphological differences of each species will be discussed.

Keywords: indigenous vegetables, morphological characters, lineage

08-P-15. Can Vegetables Be Productive under Tree Shade Management in West Java?

Authors: Gerhard Manurung, World Agroforestry Center (ICRAF), Indonesia; Anas Susila, Bogor Agricultural University, Indonesia; James M. Roshetko, Winrock International and ICRAF

Abstract: Farmers in Nanggung, West Java, have historically cultivated vegetables under full sunlight. There is an opportunity to expand vegetable production in tree gardens, but farmers have limited experience with such practices. An on-farm trial was implemented to evaluate the production of 11 priority vegetable species under three levels of tree shading in a nested design, replicated three times. The vegetables in the trial were honje, terubuk, katuk, kenikir, kangkong, amaranth, chili, eggplant, long bean, green bean, and tomato. Eleven variables were analyzed for their effect on vegetable survival, growth, and yield. Average light levels for each treatment were 482–540 *1000 lux (open area, control), 43–540 *1000 lux (medium light), and 32–174 *1000 lux (low light).

Preliminary results for five of the vegetable species (amaranth, kangkong, egg plant, chili and tomato) are reported here. Medium light level increased average amaranth yields to 15.3 gram per plant (a 180.5 percent increase over the no-shade control); average kangkong yields to 30.3 gram per plant (a 89.6 percent increase); average eggplant yields to 833.3 gram per fruit (a 70.8 percent increase); average chili yields to 1.46 kgs per plant (a 9.4 percent increase); and average tomato yields to 458 gram of fruit per plant (a 5.2 percent increase). In the case of amaranth and kangkong, low light levels had no effect on vegetable yields compared with the control, but heavy shade had a negative impact on yields of eggplant, chili, and tomato. The effect of independent variables on the production of priority vegetable species is discussed in the paper. Preliminary results indicate that vegetable production under tree garden shade is a viable option for smallholder farmers, though intensive species-specific and site-specific management is required. A program of training and extension support would help smallholders develop such practices.

Keywords: vegetable production, tree shade management, amaranth, kangkong, eggplant, chili, tomato, vegetable agroforestry systems

08-P-16. Vegetable Agroforestry (VAF) Systems: Understanding Vegetable–tree Interaction Is a Key to Successful Farming Enterprise

Authors: Agustin Mercado Jr., Caroline Duque-Piñon, World Agroforestry Center (ICRAF); Manuel Reyes, North Carolina Agriculture and Technology State University; Manuel Palada, Flordeliza Faustino, Liwayway Engle, World Vegetable Center (AVRDC), Taiwan

Abstract: Our hypothesis is that, in intensive commercial vegetable production systems in the uplands, monoculture systems are not sustainable, but integrating trees is feasible and offers better prospects. Our overall objective is to integrate trees on intensive vegetable farming systems with minimal negative interaction, thus increasing productivity, profitability, nutrient use efficiency, and environmental services. Specifically, our research objectives are to assess existing vegetable agroforestry (VAF) systems and understand their potential and constraints; improve VAF systems by employing appropriate agro-silvocultural practices; and evaluate indigenous and commercial vegetables under tree-based systems for better tree-vegetable matching.

We assessed VAF systems at the SANREM CRSP site at Lantapan, Bukidnon, Philippines, covering 21 farms, two AF systems, six tree species, eight vegetables, and four aspects. Data collected were tree parameters, spatial performance of vegetables, and spatial light transmission. Focus group discussion was also conducted with VAF farmers on ways of integrating trees on vegetable farms. We also evaluated 36 indigenous and commercial tree, fruit, leafy, root, and climbing vegetables perpendicular to 6-year old *Eucalyptus torillana* hedgerows. Crop growth and yield data were collected spatially relative to tree distance to determine productivity, adaptability, competition, and complementarity. Net complementarity index (NCI) was used as a tool for assessing tree-vegetable integration.

We found that optimum tree hedgerow spacing was 25-30 meters. Tree species suitable for VAF systems were *Eucalyptus robusta*, *Eucalyptus torillana* and *Acacia mangium*; commercial vegetables were cabbage, cauliflower, carrot, and bell pepper. Indigenous vegetables were amaranth, jute, and alugbati. Fruit vegetables were yardlong bean and eggplant, and malunggay for tree vegetables. There was a positive relationship between tree height and amount of canopy after pruning, but a negative relationship on canopy width. Vegetables grown on the east or south side yielded better than plantings west or north of the tree line.

Keywords: agroforestry, integration, complementarity, indigenous vegetables

08-P-17. Establishing Vegetable Agroforestry System Research at AVRDC – The World Vegetable Center

Authors: Manuel C. Palada, Deng-lin Wu, Gregory C. Luther, World Vegetable Center (AVRDC), Taiwan

Abstract: Tree-crop interactions in agroforestry systems involving vegetable crops have not been studied extensively, for previous research in agroforestry focused on agronomic arable field crops. A vegetable agroforestry system was established at the World Vegetable Center (AVRDC) to study tree-crop interactions in alley cropping vegetables with tropical fruit trees in terms of competition and/or complementarity; to investigate the influence of tree crops on natural habitat and insect pest population in vegetable alley cropping systems; and to evaluate

total productivity and economic return from high-value horticultural crops in an agroforestry system. In December 2005, seedlings of 12 tropical fruit tree species were planted: *Anona reticulata*, *Artocarpus heterophyllus*, *Chrysophyllum caimito*, *Coffea arabica*, *Eugenia brasiliensis*, *Eugenia uniflora*, *Pouteria caimito*, *Pouteria campechiana*, *Psidium littorale*, *Rollinia mucosa*, *Syzygium samarangense* and *Tamarindus indica*. The trees were on raised beds 50 cm high and 1 m wide with hedgerow spacing of 8.0 m. Tree spacing within beds varied from 1.5 to 3.0 m. Vegetable crops were sequentially grown in alley beds between tree hedgerows starting in October 2006, 10 months after tree establishment, until April 2007. Three sources of organic fertilizer (compost) were compared and evaluated for effects on growth and yield of vegetable crops. The trial used a randomized complete block design with four replications.

Establishment and initial growth of trees varied according to species. Outstanding species were *A. heterophyllus*, *C. caimito*, *T. indicus* and *A. reticulata*. All vegetable crops produced average yields with minimum competition from tree crops. Yield response of vegetable species to compost application varied significantly with planting season. Tree-crop competition for water, nutrients, and light was insignificant as observed during early establishment. Results suggest that integration of high-value vegetable crops can provide quick economic returns in agroforestry systems.

Keywords: alley cropping, tree-crop interaction, tropical fruit trees, vegetable crops

UNDERSTANDING FARMER BEHAVIOR

08-P-18. Understanding the Target Farmers of Agroforestry and Sustainable Vegetable Production Development: The Case of Nanggung Subdistrict, Bogor, Indonesia

Authors: Suseno Budidarsono, Arif Rahmanulloh, James M. Roshetko, World Agroforestry Center (ICRAF), Indonesia

Abstract: Agroforestry systems constitute promising livelihood options for rural poor in the uplands and also represent a strategic management approach for degraded land (watershed) that balances both economic and environmental issues. In Indonesia, the SANREM CRSP program “Agroforestry and Sustainable Vegetable Production in Southeast Asia Watersheds” aims to improve both technological options and ecological potential of integrated vegetable agroforestry (VAF) to benefit farmer livelihoods. This socioeconomic baseline study is a farm/household assessment focusing on vegetable-producing farm and household budget analyses in the target area. It provides an analytical basis for socioeconomic impact assessment of integrated VAF systems. The socioeconomic data collected comprises demographics, farm characteristics, households’ incomes and expenditures, gender roles, and labor availability.

Nanggung Subdistrict enjoys relatively good access to the potentially lucrative urban centers of Bogor and Jakarta, as well as rich forest and mineral resources, and an ideal climate for agricultural development. Those assets have the potential to support market-based agricultural development through VAF innovation. Farmers in this subdistrict are primarily smallholders on or below the poverty line and with access to less than one hectare of land. They have limited access to technical assistance and poor market linkage, particularly to urban and regional markets. Of particular notes in the findings are the inequality in both land and income distribution and the relatively low percentage of income derived from agricultural production: 9

percent, 22 percent, and 14 percent for the three sample villages. Average farm size is less than 0.2 hectare. This may justify targeting SANREM interventions and training to the subset of farmers who derive at least 25 percent of their income from agriculture.

Keywords: agroforestry, access to land, income distribution, poverty

08-P-19. Declining Use of Traditional Decision-making Indicators in an Altiplano Community

Authors: Jere Gilles, Corinne Valdivia, Justin Thomas, University of Missouri-Columbia; Olga Yana, Universidad de la Cordillera, Bolivia; Edwin Yucra, Universidad Mayor de San Andrés, Bolivia

Abstract: The Altiplano presents severe challenges to crop production besides the problems posed by high altitude. Droughts and flooding are serious problems. Summertime temperatures rarely exceed the 60s, and hailstorms and killing frosts can occur throughout the growing season. Despite these challenges, agriculture based on the cultivation of potatoes and other Andean crops has existed for millennia. The people of the Altiplano have developed strategies to deal with an unstable climate.

At a time when Western scientific research is validating these practices, some of this knowledge is disappearing. This paper reports the results of surveys conducted in 1999 and 2005 documenting the declines in use of these traditional resource management techniques in Bolivia's central Altiplano. The paper examines the factors leading to this change. Among these factors are climate change, migration, and the introduction of new cash crops.

Keywords: climate change, indigenous knowledge, decision-making, weather forecasting

08-P-20. Measuring Impact on Social Interaction and Natural Resources: Use of KASAP Methodology in the Peruvian Altiplano

Authors: Cecilia Turin, University of Missouri; Pedro Condor, Silvana Vargas, Universidad Nacional Agraria, Peru

Abstract: Measuring impact is often one of the greatest concerns of development practitioners and project managers. Thus, based on the perspective of Knowledge, Attitudes and Behavior Studies, as well as on the Community Capitals Framework, a methodological approach focused on Knowledge, Attitudes, Skills, Aspirations, and Practices (KASAP) was designed and carried out in the Aymara communities of Santa Maria and Apopata in the Peruvian Altiplano. The approach aimed at describing the interaction among natural, social, human, and cultural capitals and understanding how these capitals influence the development of livelihood strategies at the household and community levels within a context of climate change and market vulnerability.

Data were collected through 119 household questionnaires using a mixed-method approach involving quantitative and qualitative techniques. Participatory workshops, key-informant interviews, and field days complemented the information on household demographics, natural resource use and management, social organization, market and food security. Both selected communities belong to the same watershed but to different agro-ecological regions. Research results indicate that both communities' populations combine modern technical knowledge with indigenous knowledge for agricultural purposes. However, small household land size affects

decision-making on sustainable soil and grassland management practices. Changes in market and climate have forced small producers to change their livelihood strategies. Findings also suggest that women have less access than men to secondary and post-secondary education. This is associated with less-developed skills in the use of Spanish as a second language. Women also occupy few political positions within the community and have limited access to outside training. In addition, women have increasingly acquired additional labor responsibilities and decision-making concerning soil and grasslands use and agricultural production due to male and youth seasonal migration.

Keywords: local knowledge, livelihood strategies, Community Capitals Framework, KASAP, Altiplano

GENDER

08-P-21. Farmer Participation in Agronomic Research: Bolivian Experiences

Authors: Jere Gilles, Corinne Valdivia, University of Missouri-Columbia; Olga Yana, Universidad de la Cordillera, Bolivia; Edwin Yucra, Universidad Mayor de San Andrés, Bolivia

Abstract: Farmer participation is an important component of agronomic research in Bolivia in the areas of soil fertility, pests, and biodiversity. This paper describes farmer participation in the SANREM CRSP project, beginning with a discussion of the role of participation in research, then examining the cases of farmers in the Ancoraimes and Umala municipalities of Bolivia. Participation occurred at two levels. First, community meetings of farmers identified key concerns and problems that could be addressed by agronomic research. This information was used by agricultural scientists to help design their research. Second, at the level of field research itself, farmers were asked to evaluate research results in the areas of variety selection (quinoa), soil fertility, pests, and biodiversity (potato varieties). Participation at this level relied on different methods in Ancoraimes and Umala. Evaluations were conducted at community meetings in Ancoraimes and by self-selected farmer research groups in Umala.

This paper examines the results of the participatory process in terms of the agronomic and biological research itself and in terms of the farmers' experiences in the research process. Farmers helped identify key research issues and then evaluated field participation in trials organized at the community level in Ancoraimes and through smaller self-selected farmer research groups in Umala. This paper examines the results of this experience in terms of the agronomic trials and of the experiences of the farmers involved.

Keywords: agronomic research, farmer participation, soil fertility, biodiversity, pests

08-P-22. Economic Gains and Gender Equity: Application of Sen-Robeyns Capability Framework in Understanding Human Wellbeing in Luangwa Valley, Zambia

Authors: Vongai Kandiwa, Cornell University; Chisha Chungu, University of Zambia-Lusaka

Abstract: Evidence suggests that the COMACO model is associated with improved economic outcomes for communities in Luangwa Valley. Previous impact studies found modest

improvements in grain yields, commodity prices, and natural resource conservation. Yet it is not clear how this economic dividend is shared equitably within communities or translated into substantive improvements in human wellbeing. We argue that a focus on economic gains alone limits understanding of structures that reinforce gender and other forms of inequality in rural communities. Therefore, we complement earlier studies by combining assessments of material wellbeing with critical evaluations of actual freedoms that enable people to live lives that they have a reason to value.

We use the Amartya Sen-Ingrid Robeyns Framework to evaluate human wellbeing. This framework encompasses capabilities such as political empowerment, education and knowledge, participation in domestic and market activities, mobility, time-autonomy, leisure, religion, shelter, bodily integrity and safety, and being respected and treated with dignity. First, we evaluate the appropriateness of this tool for the study of social change in Zambia's low-income rural communities. Then we estimate trends in the nature and scope of human capabilities between genders; examine factors that determine divergence or convergence in human capabilities among women; evaluate patterns of distribution of income and their relationship to observed human capabilities; and develop a framework for examining the nature and extent of social inequalities within and across similar agricultural communities in Luangwa Valley. We use ethnographic and survey methods to gather data in COMACO as well as adjacent non-COMACO areas. We expect to find complex patterns of access to various sets of capabilities both between men and women and among women. Results of this study will inform our understanding of changes in human capabilities associated with rapid improvements in economic opportunities.

Keywords: gender inequality, Amartya Sen-Ingrid Robeyns Capability Framework, human wellbeing, freedoms; political empowerment

08-P-23. Roles, Contributions, and Constraints of Women Farmers in Vegetable and Agroforestry Production and Marketing

Author: Cristina A. Rodriguez, De La Salle University-Manila, Philippines

Abstract: This study aims to profile the livelihood status and roles of women farmers of Bukidnon, Philippines, in vegetable and agroforestry production. These women are part of the Talaandig tribal group who live and engage in vegetable farming in an upland community called Songco in the municipality of Lantapan, Bukidnon. The data for profiling the women farmers are taken from a gender baseline survey conducted in the final quarter of 2006.

The average age of the women farmers is 40 years. Most have been or are currently married, and on average they have five children. Most have been educated only through elementary school. A typical household is relatively large, composed of seven members. Most of them do not own a farm. They cultivate a piece of land assigned by the tribal chief or use other people's land by sharecropping. The average farm is 2.81 hectares, typically planted with seven varieties of vegetables. Although they have a variety of trees on farm and/or home lots, only a few are raising trees to be sold as timber.

As farmers, they are actively involved in farm production, working side by side with their husbands. They also perform reproductive and community-related roles. While they contribute greatly to the economic security of their families, the norms that apply in performing their gender roles are still traditional. Because of this, they have difficulty gaining access to resources such as land and credit, training, and production inputs and services. They have very little

participation in farm decision-making or in organization of or involvement in farmer and marketing associations.

Keywords: agroforestry, vegetable production, women farmers

WATERSHED MODELING AND MANAGEMENT

08-P-24. Predicting Effects of Land Use on Runoff and Sediment Yield in Selected Sub-watersheds of the Manupali River Using the ArcSWAT Model

Authors: Victor B. Ella, Nathaniel Alibuyog, University of the Philippines-Los Baños; Manuel R. Reyes, North Carolina A&T State University; Conrad Heatwole, Virginia Tech

Abstract: The quantitative prediction of environmental impacts of land-use changes in watersheds could serve as a basis for developing sound watershed management schemes, especially for Philippine watersheds with agroforestry systems. This study was conducted to determine the effects of various land-use patterns on runoff, and sediment yield in selected sub-watersheds of the Manupali River using the ArcSWAT model. ArcSWAT is a river basin scale model developed to quantify the impact of land management practices on water, sediment, and agricultural chemical yields in large, complex watersheds with varying soils, land use, and management conditions over long periods of time. In this study, the model was parameterized and calibrated in selected Manupali River sub-watersheds with an aggregate area of 2,177 ha to simulate the hydrologic effects of land use. Initial simulation results showed that conversion of forest to agricultural lands causes serious erosion and sediment yield in the area. Agricultural lands planted with corn, potato, and tomato, which make up 22.38 percent of the sub-watershed area, resulted in an average annual sediment yield of 110.1 t/ha, with the areas planted with potato producing the largest sediment yield of 205 t/ha. Forest and pasture and/or grassland produced a sediment yield of 0.7 t/ha and 2.15 t/ha, respectively. On average, simulation results showed an annual sediment yield of 12.86 t/ha for the whole area. It is evident from these initial results that conversion of forest to agricultural lands coupled with poor agricultural management practices could lead to serious erosion problems. Further simulation work will be done to generate results that could serve as sound basis for policy formulation geared toward sustainable watershed and agroforestry management.

Keywords: ArcSWAT, hydrologic simulation, watershed modeling, land use change, erosion, sediment yield

08-P-25. Linking Watershed Protection and Water Consumption: WTP by Domestic Water Users in Ho Chi Minh City

Authors: Dang Thanh Ha, Nong Lam University, Vietnam

Abstract: In many watersheds of Asia, the demand for water is increasing while the supply is challenged by ongoing deforestation and watershed degradation. To ensure a stable supply of water to satisfy growing demand, the protection of watersheds is critical. Vietnam faces this situation, particularly in the Dong Nai watershed, where high population growth, rapid industrialization, agricultural production, and economic growth are exerting tremendous

pressure. Policymakers have explored various mechanisms to address sustainable watershed management and poverty alleviation. Payments for environmental services (PES) are being considered as a promising mechanism to address both of these goals. One of the challenges in PES is how to ensure sustainable financing for watershed protection services. In response to this challenge, a new study from Vietnam has looked into the potential for sustainable financing for a sustainable management of the Dong Nai watershed. It found that the majority of residents in Ho Chi Minh City would be willing to pay more for water in return for a protection service that would help to ensure a reliable water supply for their households. Payments in the form of a watershed protection fee added to their monthly water bill would generate a significant fund to support upstream communities and to protect the watershed supplying the city's drinking water.

Keywords: Watershed management, water users, willingness to pay, PES

08-P-26. Interpolation of 90m SRTM to Improve Elevation Data for Topographic and Watershed Analysis

Authors: Younggu Her, Conrad Heatwole, Javier Osorio, Guido Yactayo, Virginia Tech

Abstract: Elevation data from the Shuttle Radar Topography Mission (SRTM) of 2000 is the best resolution global digital elevation data publically available, so since its release in 2006, it is being widely used in GIS and topographic analysis. The SRTM data are available for the United States at a 30m resolution but were resampled to a 90m resolution for the rest of the world. Unfortunately, the 90m resolution is coarser than desired for some applications. For hydrologic analysis in upland watersheds, a 90m resolution grid results in a rough stream network that can produce poor quality results in watershed assessment and modeling studies. Likewise, slope is a common and important derivative of elevation data, and resolution effects on slope accuracy are well documented. While interpolation can never recover the surface information lost in the aggregation from 30m to 90m, this study evaluates the potential and performance of different processing and interpolation techniques as a means of refining the 90m SRTM data.

The selected study area in New Mexico consists of a wide range of topographic features: flatlands, hills, and mountains. The 30m SRTM data was resampled to 90m using a mean value, and from this 90m grid (representative of the worldwide data), different interpolation methods were used to generate 30m grids that were then compared with the original 30m grid to assess accuracy. Inverse distance weighting (IDW), regularized and tension splines, Kriging, and Natural Neighbor interpolation were evaluated the using ArcGIS 9.1 Spatial Analyst. The derived elevation, slope, aspect, curvature, sink, and stream networks from the interpolated 30m DEMs were compared quantitatively with those derived from the original 30m SRTM DEM and with stream lines digitized from high resolution imagery.

Keywords: elevation, DEM, SRTM, watershed analysis, terrain, topography, slope

08-P-27. Patterns and Trends in Fires in Eastern Zambia

Authors: Younggu Her, Conrad Heatwole, Virginia Tech; Dale Lewis, Wildlife Conservation Society, Zambia; Alex Travis, Cornell University

Abstract: Efforts to improve resource management, sustainability, and wildlife habitat in the Luangwa River Valley of Zambia include community education to change the common

practices of setting fires throughout the long dry season. Fires are set for many reasons: to clear fields of last year's crop residue, to clear new land, to remove undergrowth for safety along roads and paths, accidentally, and sometimes apparently with little reason. MODIS satellite data have been used to derive likely locations as a means of mapping fires from space. A combination of heat signature and smoke plumes is used to define the likelihood of a fire.

Fire point data from 2003-2007 for a regional area surrounding and including the Luangwa Valley were analyzed looking for spatial and temporal patterns in fire occurrence. A 3km cell was used as a basic spatial element for aggregating and analyzing fire occurrence. Monthly and yearly variation can be seen regionally that may reflect differences in rainfall and climate between months and years. Ratios between years were used as a basis for examining different rates of change spatially. Fire occurrence in community areas with a conservation program and those without were compared. Relative differences are evident, providing evidence of the impact of the conservation effort in changing behaviors.

Keywords: Luangwa, COMACO, conservation farming, fires, residue, MODIS, satellite imagery

08-P-28. SWAT Implementation in Indonesia for Vegetable Agroforestry (VAF) Systems: A Progress Report

Authors: Mahmud Raimadoya, Bogor Agricultural University, Indonesia; Manuel Reyes, North Carolina Agricultural and Technical State University; Raghavan Srinivasan, Texas A&M University; Conrad Heatwole, Virginia Tech

Abstract: The overall goal is to convert degrading Southeast Asia watersheds into vibrant, sustainable basins enhancing quality of life for their inhabitants. To achieve this, the research has established as its first objective to develop an economically viable and ecologically sound integrated vegetable agroforestry (VAF) system to increase farm productivity and income through reliable supply of products and to reduce vulnerability and risks. The Soil and Water Assessment Tool (SWAT) has been selected as a basin scale model to assess the short- and long-term environmental impacts of the integrated VAF system.

This paper updates first-year progress of SWAT implementation in the selected test site of Indonesia's watershed. The first step is to harmonize the available digital elevation model (DEM) with land-use categories. Under the Digital Terrain Elevation Data/High Resolution Terrain Information (DTED/HRTI) definition of the U.S. National Geospatial-Intelligence Agency (NGA), the existing DEM is categorized into Level 1, suitable only for 1:250,000 map scale. Because the target of this year is a first attempt to complete the SWAT processing chain, the approach has to be divided into two options: to continue processing with existing DEM by using medium resolution satellite image; and to prepare new DEM (Level 2 DTED/HRTI suitable for 1:50,000 map scale) appropriate for high resolution satellite imagery.

To avoid delay and reduce cost, three new medium resolution L-Band synthetic-aperture radar (SAR) imageries were acquired from ALOS/PALSAR through networking with JAXA (Japan). The Level 1.5 PALSAR image (ALPSRP083667050-H1.5GUA of 2007/08/20) is used to derive land use for the first option. The other two images are Level 1.1 PALSAR single look complex interferometric repeat pass pairs (ALPSRP050117050-H1.1_A of 2007/01/02 and ALPSRP056827050-H1.1_A of 2007/02/17) to derive new DEM (DTED/HRTI Level 2) by using SAR Interferometry (InSAR) for the future second option. This paper reports the progress

of the first option of SWAT process to the level of hydrological response unit (HRU) derivation.

Keywords: Vegetable agroforestry system, environment, SWAT

08-P-29. Impact of Cropping on Runoff and Erosion in Upper Jatun Mayu River Watershed, Tiraque, Bolivia

Authors: Ana Karina Saavedra, Programa Manajo Integral de Cuencas (PROMIC), Bolivia; Conrad Heatwole, Javier Osorio, Virginia Tech

Abstract: One of the problems affecting the Jatun Mayu River is the increasing expansion of farm plots into the upper zone of the watershed at elevations above 3800m. The change from native paramo vegetation to tilled fields on steep slopes is resulting in increased erosion and sedimentation. To assess the impact of cropping on runoff and erosion, and to examine the basic question of the sustainability of cropping on the soils in this upper zone, a plot study is being used to compare differences among native vegetation, active fields, and abandoned fields. Plots are 3m wide and 5m along the slope, with 0.5m between plots and 2m between treatments. Borders of sheet metal are inserted 15cm in the ground with approximately 15cm above ground. A metal gutter system collects surface runoff and directs it through a trough to a collection barrel. Runoff is measured each day, and a water sample is collected for laboratory filtration and measurement of TSS. At the primary plot site there are three replicates of four land-use treatments: native vegetation, potato with rows along the slope, potato with rows across the slope, abandoned/fallow plot. For the 2007/8 season, two replicates of each of the potato treatments were lost due to washout of the plots. For a second study, plots are in three places (near the primary plot site) where previously cultivated fields have been abandoned for two or more years, allowing time for regeneration of vegetative cover. An adjacent plot of undisturbed native vegetation at each of three locations provides a paired comparison of native and fallow with three replicates.

Keywords: erosion, plot study, potato

MARKETS

08-P-30. Market Value Chain Research: Case Study in Nghia Trung Commune, Bu Dang District, Binh Phuoc Province, Vietnam

Authors: Le Thanh Loan, Duong Thi Kim Lan, Dang Thanh Ha, Nong Lam University, Vietnam

Abstract: Using a participatory approach in focus groups, in-depth interviews, and weighted scoring methods, this study aims to identify the most profitable crops for market-driven development from existing farming systems and marketing constraints with strategies and interventions to improve market access in Nghia Trung. Perennial crops are more highly valued than annuals. The most valued perennials are cashew, rubber, and durian; pepper and coffee are in the second rank. Appraisal of cacao, a newly cultivated plant, is vague. Concerning market accessibility and income growth potential, cashew, rubber, cassava, and durian are highly valued, whereas rambutan, coffee, and vegetables are perceived as difficult to market. Surveys show that Nghia Trung has a comparative advantage with cashew, rubber, pepper, durian, and

cassava. In addition to cashew, the target group favored cassava and vegetables. Among the existing five diversified crops, durian and bamboo shoots appear to be most profitable and to have rising market demand. With durian, however, low technology and water shortage are a concern, and heavy investment is required. Though showing stable growth in local-market demand, cassava has low financial incentive and gradually decreasing comparative advantages in terms of land availability. Rambutan and vegetables are ranked behind durian, bamboo shoots, and cassava. Thanks to safe, high-quality production, vegetables promise to show gains in local demand, given a stable and sufficient supply.

Low use of technology, weak extension activities, inadequate supply of production inputs, poor marketing infrastructure, and weakness in market linkage and post-harvest performance are all detriments to the development of agricultural markets in Nghia Trung. More strategic and supportive operations from the government, input and output companies, would be conducive to farmers' participation and would result in benefits. Most households need support on techniques and market price information. More efficient supply of input factors, extension activities, irrigation, and marketing infrastructure are all recommended. To enhance market efficiency, efficient linkage is needed among government support, processing enterprises, and farmers' production investment.

Keywords: market value chain, marketing performance, diversified crop, vegetables, perennial crops, market constraints

08-P-31. Understanding Better Market Information to Penetrate the VAF Market for Small-scale Farmers

Authors: Iwan Kurniawan, James M. Roshetko, Denta Anggakusuma, Suseno Budidarsono, World Agroforestry Center (ICRAF), Indonesia

Abstract: Nanggung Subdistrict, Bogor, has relatively good accessibility and is close to markets. However, its unique landscape has placed the production area in an unfavorable condition affected by transportation costs and deterioration in post-harvest handling. Based on focus group discussion results, most small-scale farmers were not well informed about the vegetables market or market-oriented in making agricultural decisions. Developing vegetable agroforestry (VAF) production in this area is still at pilot-project level, with farmers lacking sufficient experience to grow vegetables in an agroforestry system. To compete effectively, farmers need reliable market information about selected vegetables, the first step toward developing VAF in Nanggung. Farmers have always had to make decisions about what and when to plant, and where and how to sell. Helping farmers to obtain and use the market information are the project's main focus this year. Other purposes of the action-research are to facilitate the farmers group in selecting and producing the most marketable VAF and to link the farmers with potential traders.

Improved Rapid Market Appraisal (RMA) is used as a method to obtain market information. Field visits to successful vegetable farmers are also a way to teach and motivate other farmers. Based on survey on VAF marketing in several local markets, leaves of katuk (*Sauropus androgynus*) and kucai (*Allium odorum*) have good market demand and relatively stable prices, higher per unit than vegetables now being planted. Initial cooperation between farmer group and local traders to market these vegetables has been established, with facilitation by ICRAF. The cost-benefit analysis indicated that these farming systems will contribute to household incomes about \$945/ha/year from katuk and \$2,287/ha/year from kucai.

Keywords: VAF, agroforestry, small-scale farmer, market information, RMA

08-P-32. Valuing Potential Increases in Wildlife Populations Using a Stated-choice Experimental Design in the Luangwa Valley, Zambia

Authors: Samuel D. Bell, William Schulze, Gregory L. Poe, David Just, Cornell University

Abstract: Wildlife populations in the Luangwa Valley of Zambia are threatened by land-use practices that reduce habitat and degrade ecosystem services, and by continued poaching. Community Markets for Conservation (COMACO) is addressing these threats through myriad activities including conservation farming, market creation and alternative livelihoods. As part of a larger benefit-cost analysis of COMACO, this research examines the potential impact of increased wildlife populations on tourists' willingness to pay (WTP) higher entrance fees in the South Luangwa National Park (SLNP) in Zambia. A stated preference survey was administered to tourists at the SLNP in October and November 2007. This survey used a series of choices to elicit tourists' WTP values for potential wildlife increases, based on three notional groups of wildlife: small to medium animals, large mammals, and prominent species. A rhinoceros repopulation program comprising 10 breeding pairs was added to examine the potential for raising revenue to institute such a venture. Also included were questions designed to facilitate estimation of park visitation demand using the travel cost method, along with a section on park management issues and demographic questions.

Preliminary multinomial logit estimation of the stated-choice responses, based on a linear utility model, shows that visitors to the park have positive and statistically significant values for increases in each wildlife group. Current results indicate that tourists' WTP higher entry fees for a 10 percent increase in any one population (*ceteris parabis*) range from \$0.50 to \$0.90 for small to medium animals, \$1.60 to \$2 for medium mammals, and \$2.10 to \$2.80 for prominent species. These figures increase proportionally with larger population increases. The rhinoceros repopulation program warranted an increased WTP of \$1.30 to \$5.50 in addition to current park entry fees. These figures are of a consistent magnitude when compared with the current entrance fee of \$25, suggesting significant potential value to tourists in protecting wildlife in the Luangwa Valley.

Keywords: contingent valuation, stated choice experiments, wildlife, tourism, recreation

08-P-37. Strategies to Develop Market Access that Contributes to Resilience in the Bolivian Highlands

Authors: María Figueroa, Corinne Valdivia, University of Missouri

Abstract: This study evaluates how the Bolivian Andean Platform (BAP), under the philosophy of the Participatory Market Chain Approach (PMCA), reduces transaction costs for native products chuño and tunta by small-scale farmers in three communities in Umala, Bolivia. At its first stage, the study identifies how local native potato varieties programs (NPVP) developed by the International Potato Center (CIP)-ALTAGRO development project empower farmers to participate in the BAP. It also identifies the barriers foreseen by those who do not participate in NPVP. At a second stage, it analyzes which transaction costs are reduced for participating farmers. It also identifies incentives within the platform that motivate market chain actors' participation.

To accomplish the objectives, the authors use qualitative methods to develop a multiple embedded case study and an empirical study under the pattern-matching logic (Yin, 1994). For the case study, personal interviews are conducted with all stakeholders of the BAP. For the empirical study, the qualitative analyses consist of the selection of families that produce chuño and tunta commercially in three communities participating in the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP) and ALTAGRO baseline surveys. Selected chuño and tunta marketers are grouped by those who participate in NPVP and those who do not. On the one hand, the results indicate that NPVP benefits producers' participation in the BAP by promoting collective action, sustainable livelihoods, and resilience. The main barrier to participation is emigration and the resulting reduction available labor at the household level. On the other hand, the BAP reduces transaction costs in the market chain and promotes agency capacity and market involvement for small-scale producers. However, the BAP lacks incentives to motivate farmer participation and offers a price that does not pay off producers' efforts for higher quality of chuño and tunta.

Keywords: participatory market access, native potatoes, chuño, tunta, livelihoods, Altiplano

POLICY AND GOVERNANCE

08-P-33. Policy Environment of Vegetable Agroforestry (VAF) Systems in the Philippines: Are There Incentives for Smallholders?

Authors: Delia C. Catacutan, Caroline Duque-Piñon, World Agroforestry Centre (ICRAF), Philippines

Abstract: In the Philippines, using agriculture as a basis for rapid economic growth requires both a productivity revolution in smallholder farming, and innovative policies and political commitment. An important aspect of this development has to do with expanding technical options adapted to the ecological potential of the area and changing economic patterns, drawing on existing technologies in the short term, and introducing new practices and technologies in the longer term. Vegetable agroforestry (VAF) is a viable system in the uplands; however, its viability is constrained by various factors, including farmers' inability to invest, inadequate institutional structures for facilitating information flow, and lack of market incentives. Policy incentives are thus needed to stimulate smallholder investments in VAF systems.

This paper reports on the scoping study of the policy environment of VAF systems. The study found that, at least in theory, the policy environment supports VAF but is insufficient in stimulating smallholder investments. Incentives for smallholders, albeit limited, do exist, but disincentives persist. Large stakeholders tend to benefit more from national level policies than smallholders because the former have more access to information and can leverage the associated costs of implementation. It is recognized that some issues are better resolved through national-level policies, while others are better addressed locally. For the vegetable sector, issues of price regulation and control, commodity protection, reducing costs across the market value chain, non-tariff barriers, and global trade require national-level interventions. For the tree sector, issues regarding restrictive policies, transaction costs, land tenure and resource rights, and domestic and international market incentives also must be addressed through national-level policies. At the local level, promoting smallholder investments in VAF requires decisive policy action to improve the effectiveness of the extension system, with emphasis on improved

technology provision and support for market linkages and infrastructure. Where national-level policies do not effectively address the needs of smallholders, locally crafted policies are needed to close the gap. The viability of VAF depends on a whole set of policies that government can provide. It is therefore a political imperative.

Keywords: vegetable agroforestry, incentives, smallholders, policy instruments, national policy, local policy

08-P-34. Scaling Up Integration of Vegetable and Agroforestry Systems in Asian Watersheds: The SANREM-TMPEGS Philippine Strategy

Authors: Victoria O. Espaldon, Isidra Bagares, Sofia Alaira, University of the Philippines-Los Baños

Abstract: This paper presents the initial output of the scaling-up component of the SANREM CRSP- TMPEGS Philippines. The primary objective of this component is to test and employ different methods of scaling up to disseminate the benefits that can be generated from research on the integration of vegetables and agroforestry systems in Philippine watersheds. The study area is Barangay Songco, Lantapan, Bukidnon, Philippines.

The scaling-up process involves training needs assessment, analysis of research outputs that are ready for dissemination to different users and stakeholders, development of training modules, and implementation of training courses. Techno-guides based on the field research will be printed for distribution to promote the results to the wider public. After the training, an evaluation is to be conducted based on the KAP framework. The work plan, in addition to the ongoing research projects, will draw materials from existing farms that can serve as models of sustainable agriculture. In this context, the team documented the case of the Binahon Agroforestry Farm, which will serve as a model and an inspiration in the scaling-up activities. Copies of a documentary film, together with a pamphlet, will be distributed to targeted stakeholders.

Keywords: vegetables, agroforestry, scaling up, sustainable agriculture

08-P-35. Developing a Methodology to Enable Community Governance for Market Integration and Adaptation to Climate Changes: Agency and the Advocacy Coalition Approach in the Peruvian Altiplano

Authors: Edith Fernandez-Baca, Pedro Condor, Universidad Nacional Agraria-La Molina, Peru; Cecilia Turin, University of Missouri-Columbia

Abstract: The Advocacy Coalition Framework (ACF), proposed by Jenkins-Smith and Sabatier (1993), builds on stakeholder analysis (SA) to understand positions of different social actors over time. ACF allows analysis of the intricacy of decision-making and policymaking, identification of the different groups that form around relevant issues, and examination of the interaction that occurs between them when they try to influence decisions. Previous AC study has involved research on coalitions, rather than research conducted by, in this case, communities to better build advocacy coalitions that satisfy community goals. Recent research in Peru (Fernández-Baca 2006) has shifted from looking at coalitions from the outside to participation of communities in coalition formation. Introducing the AC approach enables

governance to move from protests and demands or begging from a deficit position to multi-actor, multi-level negotiations based on shared interests.

An advocacy coalition process was initiated in two Aymara communities from the Peruvian Altiplano aimed at building on their ability to negotiate and form working alliances with key external institutions to achieve future community goals. Based on the previous research done in Peru, the communities of Santa Maria and Apopata engaged in participatory processes of needs assessment, historical analysis of existing stakeholder networks, and identification of desired futures and goals. Santa Maria identified increased soil fertility as its goal, while Apopata found that an improved market access for alpaca wool would enhance its quality of life.

As the process has evolved, Apopata has shown more willingness to engage in coalition building. Santa Maria has shown some reticence in engaging in AC, apparently partly as a result of the change in local authorities. This has made reevaluation of work strategies necessary. Thus we have increased activities in Santa Maria that link soil studies to AC research, processes that were less overtly related at field level.

Keywords: political capital, advocacy coalitions, participatory methodologies, stakeholder analysis, Altiplano

08-P-36. Are There Incentives for Smallholders in Vietnam to Adopt Vegetable Agroforestry Systems?

Authors: Dang Thanh Ha, Le Thanh Loan, Nong Lam University, Vietnam

Abstract: This paper reports on the scoping study of the policy environment of VAF systems in Vietnam. The study has found that national-level policy in the forestry sector is encouraging the adoption of VAF systems. The forestry sector is shifting from resource exploitation to social forestry, from monoculture or extensive forestry to intensive forestry with agroforestry methods, integrated management and multi-purpose forest utilization with special emphasis on poverty alleviation. Major policy incentives include increasing land tenure security, allocating forest land to individual households for development, protection and practicing agroforestry models, investment and credit policy, benefit-sharing policy, extension and technology transfer, and promoting the processing and marketing of timber and non-timber forest products.

A pilot policy on payment for forest environmental services is being drafted. The fruit and vegetable sector of the country has experienced rapid growth over the last decade, reflecting the response of this sector to rising incomes and demand for greater diversity in the diet. The expansion is also a reflection of export opportunities related to regional income growth and trade liberalization, and incentive policies regarding land use, credit, and investment. However, incentives are more favorable for commercial vegetable and fruit producers. At the local level, the process of policy implementation is still slow, particularly with regard to forest land allocation. In addition, poor market linkages and infrastructure, inadequate extension and technical support are also constraints that need to be addressed to encourage small-scale farmer to adopt VAF systems.

Keywords: agroforestry, incentives, smallholders, policy



Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program
Office of International Research, Education, and Development (OIREd), Virginia Tech
526 Prices Fork Road, Blacksburg, Va. 24061-0378
Phone: (540) 231-1230. Fax: (540) 231-1302. E-mail: sanrem@vt.edu. On the web: <http://www.oired.vt.edu/sanremcrsp/>