

Final Progress Report

Sustainability Science Program
September 1, 2008 – August 31, 2009

Name: Edmundo Barrios Nogueira

Date: 15 July 2009

Field(s): Ecology/Sustainability Science

Your degree program, institution and (expected) graduation date:

Mid-Career Sustainability Science Research Fellow

Faculty host(s) at Harvard name and department:

William C. Clark, KSG; John Holdren, KSG and Woods Hole Research Center.

Description of SSP-related research activity, including a title:

Participatory development of Land Quality Monitoring Systems' to evaluate soil-based ecosystem service provision performance that will allow rural communities, environmental/agricultural institutions and local government to prepare for negotiations associated with emerging schemes and markets of payment for ecosystem services in agricultural landscapes.

Abstract (one paragraph):

The activities described in this report are part of a continuing effort to strengthen local/agricultural institutions and communities with tools that support local decision-making in natural resource management and promote sustainable land use in agricultural landscapes. Important steps in the development of a network of collaborators in agricultural landscape experimental areas for long term interdisciplinary research have been completed to date, including areas already selected by Embrapa in 2 strategic regions of Brazil (e.g. 15 scientists from 9 Embrapa Units in Pantanal and Amazonia), and further development planned still this year in the Cerrado and Semi-Arid regions. This involves further developing existing partnerships and fostering new collaborations among Embrapa, federal/state government, extension services and universities, rural communities and other key stakeholders in each region. Experience during this process had shown that the effectiveness of our capacity building approach is directly related to the ability of stakeholders to assimilate and internalize new information and participatory methodologies. Therefore, addressing sustainable land management issues of increasing complexity require a gradual approach that initially considers more immediate/familiar challenges (e.g. food security) while building a network and community of practice around our participatory methodological approach, and then moves to more long-term/complex issues associated with other ecosystems services. The Participatory Methodological Guide for Brazil is being jointly produced with Embrapa and adapted to the diverse Brazilian context involving Embrapa scientists, federal/state extension services, federal/state universities and local communities and governmental/non-governmental institutions and will be published in October 2009.

Identification of the problem you address (1 sentence to a paragraph):

Land degradation constitutes a major limitation to sustainable development in rural areas of Latin America. Land quality monitoring systems are needed to strengthen local environmental/agricultural institutions and communities with tools that support local decision-making in natural resource management and promote sustainable land use.

Key question asked about the problem (1 sentence to a paragraph):

How to most effectively link relevant knowledge with informed action and guide the transition towards sustainable land use and management?

The methods by which you answered that question (1 sentence to a paragraph):

It involves the development of a participatory monitoring and evaluation approach to assess soil-based ecosystem service provision in agricultural landscapes. The adaptation to the Brazilian context will be initially focused on the Pantanal, Amazon, Cerrado and Semi-Arid regions.

Principle literature upon which the research drew (methodological and substantive, e.g., innovation, incentive-based environmental management, science and technology studies):

Coupled human and natural systems

Linking innovation to sustainable development

Incentive-based strategies to enhance the flow of ecosystem services

Empirical data acquisition description (1 sentence to a paragraph):

Local indicators of soil quality are identified, classified and integrated with technical knowledge during workshops so that empirical data acquisition and capacity building occur simultaneously.

Geographical region studied (if appropriate):

Amazon, Pantanal, Cerrado, Semi-Arid regions of Brazil

Recommendations that might be relevant for your problem (1 sentence to a paragraph):

Highlighting economic valuation of ecosystem services and the lack of markets as key challenges limiting the design of policies that induce land managers to maintain ecosystem services provision levels that are acceptable to society.

A description of the final product(s) you have/are aiming to produce (e.g., article in X journal):

Methodological Guide entitled: "Metodologias Participativas para a Integração de Conhecimento Local e Técnico sobre Indicadores de Qualidade de Solos" as a CIAT – Embrapa Publication (October 2009).

"Managing ecosystem functions for sustainable agriculture in Latin America, Asia and Africa" (tentative title). This paper presents a holistic framework for examining how ecosystem functions and benefits to society are influenced by land use change and

management decisions at multiple scales. It is a collaborative product of co-fellows Delia Catacutan and Esther Mwangi and is intended for the PNAS journal (in preparation).

“Fostering knowledge sharing in resource management and adaptation to global change”. This paper presents insights from the process of development and adaptation of our evolving participatory monitoring and evaluation approach and methodological guide to the Pantanal and Amazon regions of Brazil. It is a collaborative product developed with Embrapa collaborators and is intended for the Agriculture, Ecosystems and Environment journal (in preparation).

Description of major other intellectual or professional advancement activity(ies) over the past academic year, including working title(s) (e.g., PhD qualifying paper, dissertation, non-SSP research project paper, job search):

+Preparation of proposal in collaboration with Prof. Calestous Juma (Director of the Science, Technology, and Globalization Project, Belfer Center for Science and International Affairs) and Dr. Heitor Coutinho (Embrapa Soils) for the Harvard University Center for the Environment (HUCE) faculty grants entitled: “Bringing positive change to Natural Resource Management in Africa through South-South collaboration with Latin America” with a focus on Brazil-Lusophone Africa collaboration.

+Coordination of the Ecosystem Services working group of Fellows: Working group activities included discussing and identifying key research questions in ecosystem services research, getting to know each others work by reading and discussing a key publication every two weeks from each working group member, exploring the opportunity and interest in writing a joint publication, facilitating the working group consensus about the invitation of World Leader in Ecosystem Services to give a presentation at Harvard and organizing the visit and logistics. Prof. Diana Wall was the invited speaker for the Ecosystem Services working group. Prof. Wall is a former president of the Ecological Society of America, past Director of the National Resource Ecology Lab (NREL) and Founding Director of the School of Global Environmental Sustainability at Colorado State University. She chaired the DIVERSITAS-International Biodiversity Year 2001-2002, and co-chaired the Millennium Development Goals Committee of the Millennium Ecosystem Assessment as well as the Steering Committee of the Aldo Leopold Leadership Program. She is also a leading senior scientist in biodiversity and ecosystem services relationships as affected by global change. The title of her presentation to the Sustainability Science Program was “Soil Biodiversity, Ecosystem Services and Climate Change”.

+Job search:

- i) Short-listed and offered research faculty opposition at the Complex Systems Research Center (CSRC) of University of New Hampshire (UNH).
- ii) Short-listed for research position at ICRAF, the World Agroforestry System.

Please list citations for reports, papers, publications and presentations that built on your fellowship research (please list full citations here, paragraph length abstracts, and attach copies of URLs if possible):

+Fellows Seminar Series Presentation entitled “Developing linkages between relevant knowledge and informed action to guide land use management decision making”, 30 September 2008, CID-Harvard University.

+Coordinator and instructor of the Amazon region workshop entitled “Participatory Methodologies to Integrate Local and Technical Knowledge about Indicators of Soil Quality”, 24-28 November 2008, Igarapé Açu, Pará State, Brazil.

+Participation in the User Forum for Sustainability Impact Assessment Tools of the SENSOR EU project entitled “Land Use Policy: Risk, Transparency and Integration”, 21-23 April 2009. University Foundation, Brussels, Belgium.

+Oral Presentation at the Seventh International Human Dimensions Program (IHDP) Open Meeting, 26-30 April 2009, Bonn, Germany.

Title: “Land Quality Monitoring Systems that Integrate Local and Technical Knowledge Facilitate Adaptation to Global Change in Agricultural Landscapes” by Barrios E., Coutinho H. and Kato O.

Abstract: Coupled human-environment systems can greatly benefit from integrative approaches that combine formal and informal knowledge to address current sustainability problems associated with global change. The increasing attention paid to local knowledge in recent years results from the recognition that the knowledge of people who have been closely interacting with their environment for a long time can offer many insights about the sustainable management of natural resources. The generation of a “hybrid” knowledge base, combining local and scientific knowledge, reflects an effort to understand the complexity of the land management decision making to promote and protect multifunctional land uses. Increased concern about soil management as a key determinant of sustainability in agricultural landscapes has led to the identification of early warning indicators to monitor changes in soil quality, and their impact in the provision of ecosystem services, as affected by land use change and agricultural intensification. This is part of a continuing effort to develop land quality monitoring systems that strengthen local environmental/agricultural institutions and communities with tools that support local decision-making in natural resource management and promote sustainable land use in agricultural landscapes. This effort was initiated in Central America, later adapted and further developed in East Africa through South-South collaboration, and it is currently being adapted and further developed in the Pantanal and Amazon regions of Brazil as part of a CIAT/Embrapa collaborative project with financial support from CNPq and Embrapa.

+Fellows Seminar Series Presentation entitled “Fostering Knowledge Sharing in Resource Management and Adaptation to Global Change”, 19 May 2009, CID-Harvard University.

+Paper accepted to the Second DIVERSITAS Open Science Conference ‘Biodiversity and society: understanding connections, adapting to change’, 13-16 October 2009, Cape Town, South Africa.

Title: “The role of Biological Indicators of Soil Quality in the participatory Development of Land Quality Monitoring Systems”. Barrios E. and Coutinho H.

Abstract The majority of ecosystem processes have the soil as the critical and dynamic regulatory center and soil organisms contribute to a wide range of ecosystem services that are essential to the sustainable function of natural and managed ecosystems. Our goal is to develop soil quality monitoring systems that inform decision makers at all

levels about ecosystem service provision status of different land use and management options. This continuing South-South collaboration effort between Latin America and Africa, now with a focus in the Pantanal and Amazon regions of Brazil, is part of a collaborative project between Embrapa and CIAT with financial support from Embrapa and CNPq. Participatory methodologies used to develop a “hybrid” knowledge base, combining local and scientific knowledge, reflect an effort to understand the complexity of land management decision-making to promote and protect multifunctional land uses. Increased concern about soil management as a key determinant of sustainability in agricultural landscapes demands the identification of early warning indicators to monitor changes in soil quality, and their linkage to the provision of ecosystem services. Native plants and soil macrofauna were consistently used by local land managers as biological indicators of soil quality. Modification in plant communities as a result of changes in land use and agricultural systems can have profound impacts on biologically mediated soil processes and thus ecosystem services. This interaction is explored at the landscape scale as part of evolving land quality monitoring systems. Participatory development of land quality monitoring systems to evaluate ecosystem service provision performance will allow rural communities, environmental/agricultural institutions and local governments to prepare for negotiations associated with emerging schemes and markets of payment for ecosystem services.

Principal collaborators outside Harvard (list name and institution):

- +Heitor Coutinho (Embrapa-Solos)
- +Osvaldo Kato (Embrapa-CPATU)
- +Tatiana Sa (Embrapa, Executive Director)
- +I.M. Rao (CIAT)
- +Diana Wall (NREL-Colorado State University)
- +Steven Fonte (UC Davis)
- +Johan Six (U.C.Davis)
- +Natasha Pauli (University of Western Australia)
- +Arthur Conacher (University of Western Australia)
- +Thomas Oberthur (ACIAR-Australia)
- +Aracely Castro (CIAT-Honduras)
- +Luis A. Welchez (FAO-Honduras)

Comments on the Fellowship Program:

The Sustainability Science Seminars at the beginning rather than during the whole semester was a good way to get early access to key concepts, approaches and readings. Given the considerable wealth and diversity of information it may be recommended to give access to key readings to new fellows before arrival at the beginning rather than at the end of August. The Fellows seminar series was very useful to get a first glance at what other fellows are researching and thus permit identifying promising collaboration opportunities to be further explored. Nevertheless, mechanisms to foster further fellow interactions (e.g. thematic working groups) should be further explored and promoted. The interaction with other fellows from different disciplines has been fruitful and will be further strengthened with the joint efforts towards a common product (e.g. joint publication). The interdisciplinary community being developed through the Sustainability Science Program is an excellent way to build a network of colleagues from different disciplines, experiences and nationalities working together for the great transition towards sustainability.

