Global Food Security:
Biophysical and Social Limits and Opportunities

Monday, November 7, 2011
10:00-17:00
The Royal Swedish Academy of Sciences
Beijer Hall, Lilla Frescativägen 4A, Stockholm

Organizers: The Swedish National Committee for Geography (within the Royal Swedish Academy of Sciences, KVA), Lund University Centre for Sustainability Studies (LUCSUS) and the Swedish International Agricultural Network Initiative (SIANI). SIANI is hosted by the Stockholm Environment Institute and funded by Sida.

Colloquium Goals:
This one-day conference will bring together international leaders in their field with early-career researchers in Sweden working on global food security from both biophysical and socioeconomic perspectives. The keynote speaker will articulate the key challenges to global food security and highlight the latest trends and projections, as well as innovative solutions, while the early-career researchers will present empirical work addressing these challenges from global to local scales. The goal is to strengthen connections between academic researchers, government policymakers, and practitioners in working towards a shared agenda of a more sustainable and equitable global food system.

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Colloquium Programme

10:00-10:05	**Colloquium Introduction and Goals** ***Kimberly Nicholas*, Lund University**
10:05-10:15	Presentation of the Swedish Secretariat for Environmental Earth Systems Science *Dan Wilhelmsson*, SSEESS/KVA
10:15-11:15	**Invited Keynote:** "Solutions for a Cultivated Planet" *Jonathan Foley*, University of Minnesota
11:15-11:30	Fika
	Global Perspectives on Food Security
11:30-12:00	"Global Livestock Production and Food Security Through the Water Lens" *Mats Lannerstad*, Stockholm Environment Institute
12:00-12:30	**"**Opportunities and tradeoffs for global cropland intensification" *Nathan Mueller*, Swedish Research Council Fellow, Stockholm Resilience Centre
12:30-13:00	"Challenging the food vs. fuel dilemma: genealogical analysis of the biofuel discourse pursued by international organizations" *Magdalena Kuchler*, Centre for Climate Science and Policy Research (CSPR), Linköping University
13:00-14:00	Lunch provided for registered conference attendees
	Empirical Cases in Food Security in Africa
14:00-14:30	"'Because of Poverty, We Had to Come Together' -Collective Action for Improved Food Security in Rural Kenya and Uganda" *Elina Andersson and Sara Gabrielsson*, Lund University Centre of Excellence for Integration of Social and Natural Dimensions of Sustainability
14:30-15:00	"Impact of Illness and Death on Household Food Consumption – a Longitudinal Study" *Jovita Amurwon*, Department of Urban and Rural Development, Swedish University of Agricultural Sciences
15:00-15:30	"Dispute, Conflict or living together in harmony? Bean Theft and Cultivation in Rural Ethiopia" *Tesfanesh Zekiwos Gichamo*, Rural Development and Natural Resource Management, Swedish University of Agricultural Sciences
15:30-15:45	Fika
15:45-16:15	"Agricultural Water Management for Improved Food Security: A Social Network Approach " *Christian Stein*, Stockholm Resilience Centre, Stockholm University
16:15-17:00	Panel Discussion with All Presenters and Conclusion

Speaker Biographies

Kimberly Nicholas is an Assistant Professor of Sustainability Science at the Lund University Centre for Sustainability Studies in Lund, Sweden. Kim's research motivation is to understand what human changes to the Earth's climate and land surface will mean for the future of the ecosystems on which we depend, and how we can better balance human needs with sustaining the planet's life support systems. She uses observational, experimental, modeling and synthesis approaches to study how climate variability and change affect crop development, yields and quality, with particular emphasis on the wine industry; climate adaptation and food security; land use, biodiversity, and ecosystem services; and the theory, practice, and pedagogy of sustainability science. Her interest in agriculture is rooted in five generations of family farming in her hometown of Sonoma, California. She holds a PhD in the Interdisciplinary Program in Environment and Resources from Stanford University and an MS in Viticulture (Horticulture and Agronomy) from the University of California, Davis.

Dan Wilhelmsson is Scientific Coordinator at the Swedish Secretariat for Environmental Earth System Sciences (SSEESS), dealing with a broad set of global environmental change issues, including research capacity building and collaboration with decision makers. SSEESS is a collaboration between the four major research councils in Sweden, The Royal Swedish Academy of Sciences, and the Swedish International Development Agency. Dan is also Vice Chair of European Alliance of National Global Change Research Committee. Being marine ecologist by training, Dan has also been working with issues around sustainable resource use (e.g. fisheries, alternative livelihoods for fisher families), conservation, and monitoring of coastal natural resources, including policy advice, for more than a decade. He is also working on the environmental risks and opportunities of offshore wind and wave energy, including both field surveys and scientific reviews. He was regional coordinator for the Coastal Ocean Research and Development program in South Asia and assistant coordinator for the intergovernmental organization ICRI for a number of years. Dan has also been Scientific Coordinator at IUCN Global Marine Programme and a consultant.

Jonathan Foley is the director of the Institute on the Environment (IonE) at the University of the Minnesota, where he is a professor and McKnight Presidential Chair in the Department of Ecology, Evolution and Behavior. He also leads the IonE's Global Landscapes Initiative.

Foley's work focuses on complex global environmental systems and their interactions with human societies. He and his students have contributed to our understanding of global-scale ecological processes, global patterns of land use, the behavior of the planet's climate and water cycles, and the sustainability of our biosphere. This

work has led him to be a regular advisor to large corporations, NGOs and governments around the world.

Foley joined the University of Minnesota in 2008, after spending 15 years on the faculty of the University of Wisconsin, where he founded the Center for Sustainability and the Global Environment. He and his colleagues have published over 100 articles in the scientific literature, including highly cited work in Science, Nature and the Proceedings of the National Academy of Sciences. He has also written many popular articles and essays, including pieces in the New York Times, Scientific American, SEED, E360, the Guardian, and elsewhere.

Mats Lannerstad holds a Ph.D. in Water and Environmental Studies from the Department of Water and Environmental Studies at Linköping University, where he was partly stationed at the International Water Management Institute-HQ in Colombo, Sri Lanka from 2003-2007. He also holds a M.Sc. in Environmental Engineering and Sustainable Infrastructure, and a M.Sc. in Biology/ Limnology. Since September 2009 he has been employed as Research Fellow at SEI Stockholm. Mats participates in research projects both within SEI and with outside partners, like analyzing linkages between the MDGs and ecosystem services, and how international biofuel policies locally impact water resources and livelihoods in Indonesia and Tanzania. In a joint larger research study together with the International Livestock Research Institute in Nairobi (ILRI) and The Potsdam Institute for Climate Impact Research (PIK), a global analysis of global livestock water productivity has been carried out. Mats is the project leader and one of ten co-authors of the book "*Confronting the water challenge in a turbulent world: A green blue resilience approach for global sustainability*" that attempts at advancing our understanding of integrated water resource governance and management in the context of cross-scale dynamics and feedbacks, global change processes, social-ecological resilience and green-blue water resource management in agricultural landscapes.

Nathan Mueller is a visiting researcher at the Stockholm Resilience Centre and a PhD student at the University of Minnesota. His research analyzes the complex feedbacks between agricultural intensification and global environmental change using spatial data analysis and modeling. Nathan received his bachelor's degree in biology and environmental studies from St. Olaf College, and was a research assistant with the U.S. EPA before starting graduate school.

Magdalena Kuchler is a PhD candidate at the Department of Thematic Studies - Water and Environmental Studies and the Centre for Climate Science and Policy Research, Linköping University. Her research focuses on the international politics of bioenergy, as well as food production, energy security and climate change. Drawing from two theoretical traditions of post-structuralism and neo-Marxism she uses discourse analysis and text deconstruction as her main research methods. The primary aim of here analytical work is to unravel and compare how international organizations in relation to their specific goals and tasks discuss and frame bioenergy as a potential solution to energy insecurity, agricultural crisis, and climate change mitigation.

Björn-Ola Linnér is professor in Water and Environmental Studies and at the Centre for Climate Science and Policy Research at Linköping University, Sweden. Currently, he is a visiting fellow at the Institute for Science, Innovation and Society (InSIS) at Oxford University's Saïd Business School. His research focuses on international policy-making on climate change, food security and sustainable development. His recent publications analyse integration of policies on climate change, sustainable development and low-carbon energy technologies as well as climate visualisation, transnational governance and utopian/dystopian thought in climate science and policy. Published books include among others "The Return of Malthus: Environmentalism and Postwar Population–Resource Crises".

Elina Andersson is a PhD student in Sustainability Science at the Lund University Centre for Sustainability Studies (LUCSUS). Her work explores changing land management strategies among smallholder farmers in Uganda as a response to land degradation. The key focus is on the roles of collective action and local innovation for soil improvement.

Sara Gabrielsson is currently in the last stages of her PhD in Sustainability Science at the Lund University Centre for Sustainability Studies (LUCSUS). Proceeding from a framework of climate vulnerability, her research project focuses specifically on understanding how smallholder farmers in the Lake Victoria basin of Kenya and Tanzania face and respond to multiple stressors, including climate variability and change under restrictive political, ecological, cultural and economic circumstances.

Jovita Amurwon is currently a postgraduate student (doctoral candidate) at the Division of Urban and Rural Development, Swedish University for Agricultural Sciences, Uppsala, Sweden. Her research focuses on survival mechanisms of rural based populations in Uganda. She worked as a Health Economist with the Medical Research Council, Entebbe, Uganda.

Tesfanesh Zekiwos Gichamo received BA degree in Economics from Debub University, Hawassa, Ethiopia and MSc. in Rural Development and Natural Resource Management from Swedish University of Agricultural Sciences, Uppsala, Sweden. She has worked as a director in child development project with Compassion International Ethiopia. Currently she is writing a thesis for the masters program in Economics in Södertörn University, Stockholm.

Christian Stein is a research fellow at the Stockholm Resilience Centre (SRC). His research focuses on the social dimension of water resources management and the tradeoffs between water for agriculture and other ecosystem services. He uses network analysis as an analytical approach to explore how social relationships influence natural resources governance processes and outcomes in agro-ecosystems. His research activities currently focus on Burkina Faso, Tanzania and Zambia. Before joining SRC Christian worked for the Stockholm Environment Institute (SEI) in a project on agricultural water management. Christian holds an MSc in Ecosystems, Governance and Globalisation and a Diploma in Business and Engineering in Environmental Science. Before moving to Stockholm he worked for the Potsdam Institute for Climate Impact Research (PIK).

Conference Abstracts for Early-Career Scholars

Global Food Security:
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Mats Lannerstad
Stockholm Environment Institute

"Global Livestock Production and Food Security through the Water Lens"

Agriculture is the largest global consumer of freshwater, and the link between dwindling water resources, food production and food security is apparent. Several studies analyses crop production in relation to water resources. However, although the livestock sector claims one third of global croplands, including >40% of the cereal production, and 30% of the global land surface for pastures, no comprehensive assessment of green and blue water amounts consumed and their variations among products, production systems and regions exists so far. Findings from a completed data- and model-based detailed analysis of nine livestock products in four production systems, distinguished in three climatic zones and 29 regions worldwide will be presented. The study builds on baseline data on production systems, livestock production and feed utilization from the livestock model RUMINANT. The process-based vegetation and hydrology model LPJmL is used to quantify evapotranspiration (ET) of concentrates, cultivated roughage, and grazed biomass. Both models are calibrated to FAO statistics to ensure consistency between production and crop feed use for the year 2000. The results describe the ET from the livestock sector from the global to regional system levels, including the virtual water content per kilo and per calorie for all analysed animal food products. Globally 5,500 km^3 yr^{-1} of freshwater is used for feed production, significantly more than for food crop production, 3,300 km^3 yr^{-1}. The combined approach overcomes shortcomings of earlier attempts to quantify the fraction of total ET from pasture that actually contributes to the production of animal-based goods, estimated to 3,800 km^3 yr^{-1}.

Nathan Mueller
National Science Foundation/Swedish Research Council Fellow
University of Minnesota/Stockholm Resilience Centre

"Opportunities and tradeoffs for global cropland intensification"

Sustainable cropland intensification is increasingly promoted as a favored strategy to meet future food demand while avoiding carbon and biodiversity impacts from cropland expansion. Here we provide the first integrated, global-scale assessment of opportunities for cropland intensification, drivers of yield limitation, and environmental tradeoffs of achieving increased yields. Utilizing global datasets and simple empirical models, we find global patterns of key agricultural management practices explain yield gaps for many major crops. Large production increases from closing yield gaps are possible by addressing yield-limiting factors while decreasing total nitrogen and phosphate inputs. Meeting the interconnected food security and sustainability challenges of the coming decades will require informed investment in agricultural management.

Magdalena Kuchler
Water and Environmental Studies and
Centre for Climate Science and Policy Research (CSPR), Linköping University

"Challenging the food vs. *food* dilemma: genealogical analysis of the biofuel discourse pursued by international organizations"

This paper takes a critical look at how food and agriculture-, energy security-, and climate change-oriented international organizations have consolidated and modified the biofuel discourse in relation to the agricultural system. Using Foucault-based genealogical analysis of discursive formations, the paper traces the last twenty years of institutions' biofuel debate in relation to rural production. We find that the prevalent motive is an aspiration to combine the agriculture and energy markets into one, which prompts structural changes and challenges in the rural sector. This has implications for the future role and shape of global agriculture and – contrary to the food vs. fuel perspective – calls for re-conceptualizing the biofuel debate as the food vs. food dilemma.

Elina Andersson and Sara Gabrielsson
Lund University Centre of Excellence for Integration of Social and Natural Dimensions of Sustainability (LUCID)
Lund University

""Because of poverty, we had to come together" -Collective action for improved food security in rural Kenya and Uganda"

Agricultural productivity in East African smallholder systems is notoriously low and food production is faced by multiple challenges, including soil degradation, decreasing land availability, poor market integration, disease burdens and climate change impacts. However, recent evidence from an in-depth-study from two sites in Kenya and Uganda show signs of new social dynamics as a response to these multiple stressors. This article focuses on the emergence of local social institutions for collective action, in which particularly women farmers organize themselves. Although previous research on collective action largely has focused on common-pool resource management, we argue that collective action is one potential pathway to livelihood and sustainability improvements also in a setting of private land ownership. Trust building, awareness raising and actions to improve livelihood security through risk sharing and pooling of labor and other limited assets have given people more time and resources available for diversification, preventative activities, experimentation and resource conservation. Thus increasing farmers' capacity to cope with change and facilitate innovation adoption, as well as contributing to agency at the local level.

Jovita Amurwon
Department of Urban and Rural Development,
Swedish University of Agricultural Sciences

"Impact of Illness and Death on Household Food Consumption – a Longitudinal Study"

Early research on impact of HIV/AIDS on the African rural populations predicted that the epidemic led to progressive declines in agricultural production, affecting livelihoods and causing food insecurity. Because a significant proportion (more than 80%) of the African population lives in rural areas, it was assumed that most had a farm-based livelihood. Early research predicted that individuals and households affected by illness and death would not adapt over time. There was little understanding, if any at all, of other factors that would moderate, limit or eliminate the impact of loss of labour over time. Not much consideration was given to include other drivers that independently could affect food production and hence food security. These studies also had methodological limitations, primarily basing conclusions on data from cross-sectional studies. The current study set out to examine the impact of AIDS-related illness and death on household food consumption in Uganda using data collected longitudinally. The results indicated that there is a complex interaction of factors that influence food production and consumption which make attribution difficult. Households are exposed to stress, not only due to AIDS-related illness and death, but also, erratic rainfall—leading to drought, opportunistic pests, diseases and unfavourable market prices. From this study we learn that households spread and shared risks, including labour loss and food shortage, among a network of kin and friends. However, the livelihood pathways taken by households, faced with similar stresses, were not similar with some of them having a declining trajectory.

Tesfanesh Zekiwos Gichamo
Rural Development and Natural Resource Management
Swedish University of Agricultural Sciences

"Dispute, Conflict or living together in harmony? Bean theft and cultivation in Rural Ethiopia"

In a country, like Ethiopia, where agriculture is the main source of livelihood for most rural households, soil fertility is crucial. However, previous studies in Beseku Ilala peasant association, South Central Ethiopia have shown that soil fertility is decreasing in the area due to an absence of crop rotation practices, including the nitrogen-fixing legume, faba bean (Vicia faba). Bean cultivation has been abandoned because of widespread theft. In order to solve this problem, the communities agreed to formulate by-laws using an existing local institution called Iddir to punish the thieves and to support farmers to start growing faba bean. However, in some areas farmers had not begun growing the bean again. The overall aim of this study was to examine the factors that affected the reintroduction of bean growing in enhancing household well-being and food security. The methods that were used in the study were in-depth interviews, focus group discussions and transect walk. Open ended and closed questionnaires were administered. Content analysis and descriptive statistical methods were used to analyze qualitative and quantitative data respectively. The result revealed villagization, fear of conflict, small land holdings, population growth, migration and lack of women participation in decision making were the main factors that affected the adoption of bean growing. Moreover, unemployment, poverty, and delinquent behaviours have also been found to be contributing factors. The study concludes that youth employment and gender participation, especially in key decision making processes is important if food security and poverty reduction is the goal.

Christian Stein
Stockholm Resilience Centre
Stockholm University

"Agricultural Water Management for Improved Food Security: A Social Network Approach "

Decisions impacting agricultural production involve a range of stakeholders related to each other through complex governance arrangements. Any transformation path towards a more sustainable and equitable global food system will need to work through these complex webs of social relations. This paper develops and applies social network analysis (SNA) to assess how social networks provide both opportunities and constraints for improving agricultural water management and thereby increasing food security. We demonstrate how to use SNA as an analytical tool to systematically describe cross-scale and multi-stakeholder governance networks from three meso-scale watersheds (100-10.000 km2) in Burkina Faso, Tanzania and Zambia. The focus is on small-scale farming systems, but we also consider the broader governance context in which they are embedded. Using a questionnaire and semi-structured interviews, we generated social network data on collaborative relations between state agencies, NGO's, private companies, farmers groups and traditional authorities. With the help of SNA software, we assessed how existing social structures provide opportunities and constraints for individual actors, groups, as well as the whole network. Results from the three watersheds illustrate how local informal networks perform important functions with regards to land and water resources management. However, there is no organization that coordinates the various land and water related activities at the meso-scale and local actors are not well integrated into the formal governance system. A better understanding of existing structures can help identify points for interventions and how to build on existing social structures to improve agricultural production in a sustainable way.