Tällberg 2013 Invited Initiative Meeting
Navigating New Risk Landscapes & Opportunities in Global Food Systems

June 11th – 13th, 2013, Tällberg Sweden at the Villa Långbers Hotel

Sponsored by the Center for Integrated Modeling of Sustainable Agriculture and Nutritional Security (CIMSANS), an initiative of the International Life Sciences Institute, the World Bank and an anonymous donor to the University of Wisconsin – Madison

Meeting Report

Meeting organized by Molly Jahn and David LeZaks (UW – Madison), Aled Jones (Anglia Ruskin University) and the Marc Levy (Earth Institute, Columbia University)

Meeting Synopsis

The Knowledge Systems for Sustainability Collaborative was invited by the Tällberg Foundation to bring together ~40 global leaders from business, academia, government, multilateral international organizations, and civil society to map out large-scale efforts toward dynamic, integrated reflections of systemic risks and opportunities to improve sufficiency and resilience in agriculture and food systems. Private/private, public/private and public/public collaborations were highlighted in pre- and post-competitive space that focus on sharing data, information, knowledge, analytics, improved reflections of risks, and opportunities related to humanity's sustainable provisioning at the land/water/energy nexus. We assembled frontier globally significant initiatives, and best-in-class organizations to focus collectively on innovative approaches to challenges at various scales in food systems. Further, we focused on consequences of and potential opportunities created by failures in global food systems in human and environmental dimensions. Alignments, coordination, and more detailed discussions of partnerships and alliances, technical and otherwise, were explored where partners see mutual benefit toward prospective approaches to quantifying and managing risk and opportunity in global food systems. Exiting the meeting, meeting participants and non-attending partners will work toward mobilizing aligned assets and commitments to set up more ordered approaches to describing and managing the dynamics of food systems, viewed more holistically as sets of nested geospatially and temporally explicit processes. Specific follow-up actions, deals and meetings will promote our shared vision and commitments toward more innovative and effective approaches to mitigating risks of failures in food systems, and developing opportunities across scales to steer local and global food systems toward outcomes of sufficiency, prosperity and stability within long term resource limits.

Executive Summary

For the first time, as far as participants know, this meeting assembled major public and private interests representing global food systems, holistically conceived, to recognize the opportunities related to current and future risks linked to humanity's provisioning demands for food at the land/water/energy nexus. A key goal of participants was to progress toward a representation of the global food system to facilitate sufficiency and resilience, particularly with respect to foreseeable shocks that result in market crises and the need for humanitarian relief. One key advance from this meeting is the figure appended to this report (Figure 1). Using this graphic, which lists only a few examples of communities that are now committed to move forward together, we agreed to progress toward global teams focused on "layers" of the food system, each one a large global effort that includes data, information and knowledge assets, modeling and decision processes related to that dimension. Each "layer" is synthesized from diverse linked data, information, knowledge assets, modeling and meta-modeling efforts, and analytics that anchor in decision processes relevant to the condition of the Earth and its inhabitants. While still rudimentary, this structure will allow more systematic exploration of decision processes related to our sustainable provisioning at the land/water/energy nexus. These global teams were inaugurated at Tällberg with representation from wide arrays of premier public and private sector partners to form a matrix of knowledge assets and activities (e.g., "layers" focused on, e.g., agricultural productivity, soils, water, governance, nutritional security) and "cases" (e.g., Wales, the Horn of Africa, S. Asia, Chesapeake Bay). While not specifically discussed in detail at Tällberg, the Knowledge Systems for Sustainability (KSS) Partnership is supporting a parallel process focused on maturing a set of KSS "cases," anchored in a large, geographically focused best-in-class projects or programs charged with some aspect of sustainable provisioning related to food systems. At the intersection of "layers" and "cases" we define laboratories for our commitments to integrate data, information and knowledge into decision processes focused on sustainable provisioning of humanity at the land/water/energy nexus.

Leaving Tällberg, commitments will advance in both "layers" and "cases," pursued in open communities in nationally and internationally-based communities. With particular contributions from the insurance and actuarial sciences community, Thomson Reuters, ESRI, and leading efforts in the public sector, e.g., GEOGLAM, World Bank, we are committed to supplying a more granular and inter-active set of representations of the global food system. Shortly after the Tällberg meeting, the international maize and wheat center, CIMMYT, and US Department of Energy's Oak Ridge National Laboratory met to discuss specific interactions structured as above. These organizations, with engagement from Australia's CSIRO, CGIAR collaborators, and others, will pursue a study of the probability of multiple failures of global breadbaskets that could serve as a trigger for the financial and insurance communities. It is possible that the probabilities of extreme events in key global agricultural areas fall within well-established limits of concern. We hope to deliver a preliminary, but actionable report this fall. There is enthusiasm to meet again as a community. Explorations of options for future meetings and collaborative efforts are currently underway as described below.

Acknowledgments

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Session Summaries

Session 1: Partnerships and parables: Exploring "layers" as components of Knowledge Systems for Sustainable Provisioning at the Land/Water/Energy Nexus
Session Leads: Tony Janetos & Mike Grundy

Meeting participants explored the utility of a concept of "layers," linked sets of data/information/knowledge, models/meta-modeling approaches/analytics connected to decision processes reflecting spatial and temporal dynamics and patterns of natural and social phenomena (see Figure 1). Discussions focused on the necessary characteristics of layers and potential alignments across pre-competitive, post-competitive and public space to draw these resources together. The goal is to build more complete representations of food systems, risks that relate to their failure, and opportunities to innovate toward stability and sufficiency. A list of the specific layers we agreed in community to explore are listed as "Layers Describing Global Food Systems."

Session 2: Navigating New Risk Landscapes & Opportunities in Global Food Systems
Session Leads: Aled Jones and Joe Arvai

In a globalized world, there is demand for information that will allow better management of systemic risk in global food systems, and progress toward sufficiency and resilience in human and environmental dimensions across scales. This session explored new and familiar risk landscapes related to humanity's provisioning at the land/water/energy nexus. A key focus was on sharing tools that will facilitate description and management of food systems, including more dynamic and accurate representations of both food production (and related materials, energy and water dynamics), and consumption. Presentations and discussions focused on the major gaps in understanding, mitigating and managing risk in food systems, and how newly constructed and linked layers of information could improve quality and outcomes of decision processes at the land/water/energy nexus.

Session 3: From Concepts to Action: Integration of existing and planned efforts toward risk mitigation, resilience, stability and sufficiency in global food systems
Session Leads: Marc Sadler & Rowan Douglas

Building on the discussions of "layers," risk, opportunity, resilience and decision processes, this session focused on opportunities partnership and collaboration with respect to sharing information, improving analytics and better understanding, managing and reducing risks in global food systems. Meeting participants highlighted areas of mutual interests for new or continued exploration at larger scales. Examples of some of these concrete next steps can be found in section "Next Steps: Strategic relationships, partnerships and collaborations."

Meeting Outcomes, Actions and Partner Commitments

"Layers" Describing Global Food Systems

Global food systems are complex, interconnected, and dynamic systems. Despite the importance of our activities in this realm, we lack an organized framework to track and manage the ways that we provision ourselves, and the collateral dynamics related to water, energy, materials and environmental consequences of our choices. Vast investments have been made in information and analytics to describe significant features of food systems, yet many challenges, e.g, scale, integration, and dynamics across historically separated domains, obscure our ability to achieve a goal of a coherent visualization of the world's food systems along with improving representation of the resource bases upon which our survival depends. We agreed that organizing relevant information assets toward more relevance to decision processes in "layers" could improve management outcomes. Leadership was identified among meeting attendees and non-attending participants to assess the current state of information resources; identify pre- and post-competitive collaborations and partnerships; and leverage existing assets toward a more complete characterization of each layer. Complementary relationships and commitments in geographically specified locations, "cases," in our parlance was discussed.
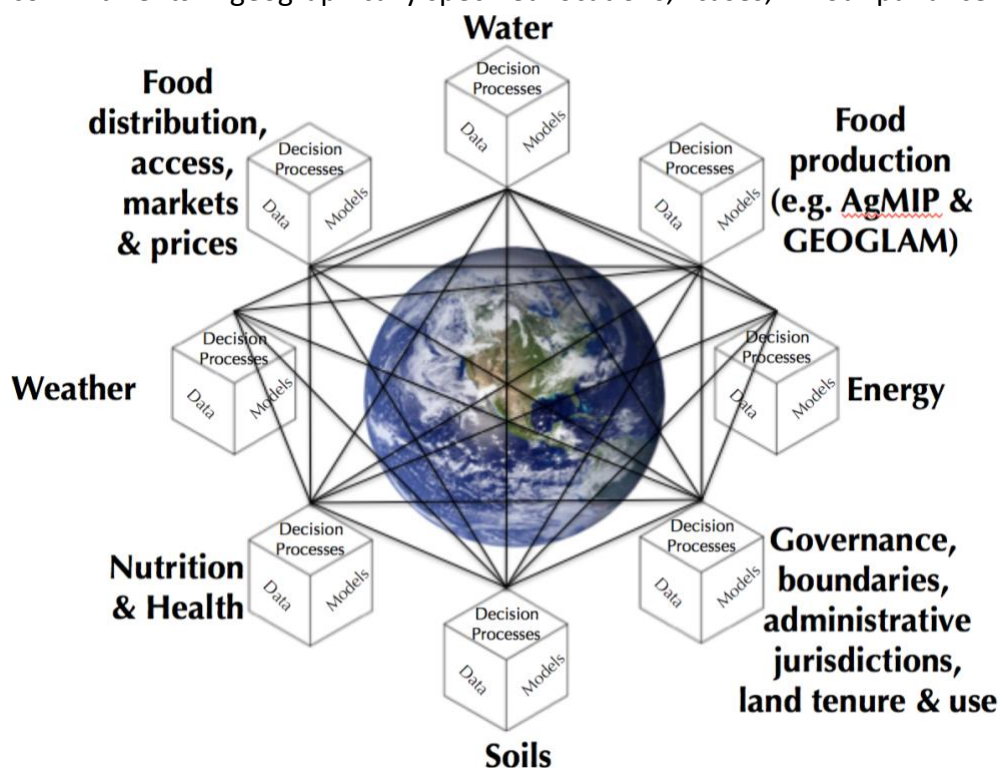
Figure 1: "Layers" that define critical components of global food systems. Note: the "layer" communities in the figure are only offered as exemplars; this representation is not meant to be comprehensive and does not include all current and future efforts.

Candidate layers to advance in community

Layer Focus	Point(s) of Contact
Food (productivity, distribution and monitoring globally and across landscapes, stocks and flows)	Chris Justice , Marc Sadler (w/ GEOGLAM + AgMIP
Land use, land cover, management and ownership	John Antle, John Ingram, Michael Obersteiner (possibly Tom Hertel)
Waste	David Newman
Soil	Neil McKenzie
Landscape Sciences	Mike Grundy
Water	Andrew Noble, Brad Doorn
Weather and climate	Gerrit Hoogenboom, Peter Thornton
Sustainable nutritional security	Dave Gustafson / CIMSANS, UNGC
Public Health	Jonathan Patz
Demographics	Budhu Bhaduri and Marc Levy
Agricultural genetic diversity	Steve Goff and Molly Jahn

Candidate layers to be considered in the future

Capacity for learning, participatory processes related to governance of natural resources
Energy
Fisheries and aquaculture
Livestock
Markets (flows of commodities, resources and burdens)
Prices (including externalities)
Safety nets
Subsidies, incentives and insurance
Pests and disease
Household income
Insurance
Public Health

Proposals to Move the "Layers" Concept Forward

The development and coordination of assets related to each layer listed above varies greatly. Many important information and analytical assets were designed and are used for complementary purposes and can be adjusted to fit within new frameworks that leverage

information to inform decision making. In the past 2 years, as we have been investigating the validity of the layer concept, we have discovered many complementary, yet unconnected and often solitary resources (e.g. offline databases) that can relatively easily be aligned with similar resources for broader benefit.

Toward our goals, we are collecting short concept notes describing the current state and trajectories of a selection of layers working toward building a series of proposals that can be submitted to funding agencies and organizations that share our vision for more resilient global food systems. We hope these "layers" will be balanced in human and environmental dimensions.

Greg Fienhold, Columbia University, is collecting proposals from partners with complementary strengths.

Next Steps: Strategic relationships, partnerships and collaborations

Below, we have captured how meeting participants plan to work within their institutions, and collaboratively, to weave a fabric of thinking and doing to demonstrate a vision for more resilient global food systems.

Objective	Specific Elements	Point(s) of Contact
Effective near real-time Earth observing systems that provide information of importance for managing global food systems	• Assess elements of current Earth observing systems, document needs and gaps • Propose new systems to fill gaps, analyze, disseminate and use information • Identify sources of novel information as well as consumers / users of the information • Present proposal to P80 Group Foundation / Club de Madrid • Explore collaboration with global shipping	Aled Jones, ORNL Marc Sadler, WB

Realistic disaster scenarios	• Explore low probability / high impact events with consequences for global food systems
	   o Convene diverse stakeholder groups to develop scenarios
	   o Select a small number of events to investigate further in terms of their food system impact
	   o Multiple breadbasket failure study (below) is first test-case of a testable realistic disaster scenario
		Rowan Douglas and others (e.g. Aled Jones, Nick Silver, Trevor Maynard, MACE, ORNL, Rockefeller Foundation, Marc Sadler, Gavin Maguire, Molly Jahn)

Multiple breadbasket	• Develop and test scenarios of multiple,	Molly Jahn,

failure study	simultaneous breadbasket failure
	   ○ Model the social, economic and environmental consequences of these events
	   ○ Identify adaptation strategies to minimize negative consequences
	• Identify prospective partners
	• Obtain funding and develop work plan
	• Perform rapid assessment
	• In-person meeting to review results and document the results of the study
		Aled Jones, Tony Janetos, Marc Levy, Nick Silver, Trevor Maynard, Chris Justice, Amy Wolf & Olaf Erenstein Yaneer Bar-Yam, Rowan Douglas

Explore pre-competitive space for food systems science and business	• Engage UN Global Compact Knowledge Track for Sustainable Agricultural Business Principles
	   ○ Develop information sharing plan structure and timeline for sharing relevant information held by businesses and pre-competitive uses in the science community, and beyond
	   ○ Identify collaborative opportunities within the marketplace that improve the resilience of food system components
	• Plan UNGC Knowledge Track meeting with key Tällberg attendees and representatives from the UNGC and WEF processes.
	• Publish and distribute UNGC Sustainable Agriculture Business Practices White Paper (available here)
		Puvan Selvanathan and others

Mechanisms to systematize landscape science	• Landscape science at the land-water-energy nexus requires better defined pathways to ensure that investments in scientific communities are accessible and used by decision-makers who manage landscapes
	   ○ Propose a special session at a relevant science meeting (e.g., Resilience 2014) to explore opportunities to systematize landscape science
	   ○ Special issue in a journal connecting the many elements of landscape science, global food systems and resilience
	   ○ Develop interface with UNGC Knowledge track and /or other private sector parties to assess their needs for landscape science
		Mike Grundy, Puvan Selvanathan, ORNL and others

Visualization of global food systems	• Information collection, aggregation, analysis and visualization tools are needed to assist stakeholders (business, policy, government, farmers) throughout the food system
	   ○ Develop short white paper on the basic characteristics of food system visualization tools
	   ○ Document relevant information sources (and their quality), information gaps and required analytical capacity for improved food system visualization
	   ○ Develop proposal to visualize global food systems
	• Other complementary components include:
	   ○ Quantifying GHG emission from food shipping (Ingram and Macguire)
		Marc Sadler

Investigate ethical, legal and social issues (ELSI) for each layer	• Each layer will require ELSI ○ Develop plans to integrate ELSI	(Various)
Advocate for robust national social and environmental information plan	• The Australian Government has drafted a National Plan for Environmental Information (NPEI). ○ This plan may serve as a template for similar schemes to better collect, manage and analyze information related to the dynamics of their natural resources • Work with CSIRO and other Australian Government agencies to present the NPEI to other interested government agencies	

Waste management and infrastructure as a mechanism for agricultural resilience	• Develop partnerships to reduce pre-harvest, post-harvest and consumer losses of food
	   ○ Review local, national and international policy mechanisms to prevent / reduce food waste
	   ○ Evaluate options to close the "nutrient loop" between farmers and consumers
	• Investigate opportunities to capture and use methane from landfills
	   ○ Potential interest from P80 Group Foundation
	• Explore waste collection strategies in developing country urban areas with UNGC
		David Newman, Puvan Selvanathan and others

Host a conference on food security issues for	• Address the following issues, with a focus on information needs regarding:	Tony Janetos

the 21st century	- Year-to-year issues associated with food security - Longer term, planetary food security - Conference to be hosted at Boston University's Pardee Center. - Convene steering committee (drawing from Tällberg attendees) - Output of meeting will be compiled into an edited volume	
Next Steps with CIMSANS	- Harvest Choice - AgMIP	Dave Gustafson
Next Steps with NECSI	Contribute to planning and implementation of multiple breadbasket failures	Yaneer Bar – Yam and NECSI colleagues
Next Steps with AgMIP	- Investigate potential collaboration between AgMIP and insurance and risk management industry - Plan and implement ORNL – AgMIP development sprint focused on data translation tools for biophysical models affiliated with North American bioenergy and regional economic analyses. - Investigate linkages between AgMIP's research and demand for information about food quality, food systems and sustainability - Scope collaborative relationship with GEOGLAM - Global Soil Mapping project - Explore model-based capabilities to project impacts of climate change on the food system by the insurance industry and other public and private stakeholders - Explore opportunity to expand AgMIP's scope beyond food production to other components of the food system, to meet the needs of the insurance industry and other public and private stakeholders - Develop an memorandum of understanding with iPlant to further collaboration (w/ S. Goff)	John Antle, Cheryl Porter and Gerrit Hoogenboom
Next Steps with GEO & GEOGLAM	- Plan for future meeting in conjunction with GEO plenary - Focus on bridging across GEO Societal Benefit Areas within food systems - Develop work plan for GEOGLAM that further incorporates themes from Tällberg meeting, including building out relevant layers	Chris Justice and Len Hirsch

	• Scope collaborative relationship between GEOGLAM and AgMIP	
Geographic Ecosystem Monitoring & Assessment Service project (G-ECO-MON)	• Work with "Cases" to submit proposals to become testbeds for new ecosystem services monitoring technology.	Erik Willén
Next Steps with Vital Signs	• Collaborate with Gerrit Hoogenboom on the weather layer • Work in strengthening connections to international science communities and activities	Bob Scholes
Next Steps with ESRI	• Work with Chris Justice and colleagues at the University of Maryland to facilitate capacity development for global crop outlook forecasting task in GEOGLAM • Continue dialog with David Newman on partnering with ISWA to mapping components of the waste system • Connect with Mike Grundy to learn how ESRI can assist is hosting soil map data on *ArcGIS Online* • Participate in dialog with Marc Sadler and others focused on development of global real-time crop outlook and market monitoring system	Susana Crespo
Next Steps with ORNL	• ORNL – AgMIP Development sprint focused on development of data translation tools for biophysical models affiliated with North American bioenergy and regional economic analyses. • Contribute to breadbasket failure study	Martin Keller, Jay Gulledge and Budhu Bhaduri
Next Steps with iPlant	• Work with Molly Jahn on Agricultural genetic diversity layer • Follow-up with AgMIP	Steve Goff
Next Steps with MACE	• Investigate what data is held, or accessible through MACE that could support this effort • As an experiment, work within a "case" or "layer" and discuss potential of pulling single thread through to obtain all related data	Tracy Morgan and MACE colleagues
Building linkages with Future Earth	• Continue to explore Knowledge Systems for Sustainability Collaborative and Future Earth	Ilan Chabay
Structuring interactions with the decision sciences community	• Design and develop a theoretical (and / or applied) methodology to improve the interface between stakeholders, scientists and decision-makers • Develop a collaborative research proposal whose output could guide more successful decision-relevant science at multiple scales that meets local	Joe Arvai

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	and global concerns while being implemented in a timely manner	
Next Steps with Columbia University's Earth Institute	• Host Bellagio conference on Fragile States, March 2014	Marc Levy

Development of draft Layers proposals	• Water
	  o Andrew Noble
	  o Brad Doorn
	  o Others
	• Food (productivity, distribution and monitoring globally and across landscapes, stocks and flows)
	  o Chris Justice
	• Soils
	  o Mike Grundy
	• Weather
	  o Gerrit Hoogenboom
	• General environmental and social information
	  o Aled Jones
	  o Marc Levy
		Greg Fienhold and David LeZaks

Oxford Food Systems Programme	• Continue to develop and refine food systems concepts as an integrating framework to help combine the food chain literature with the food security literature, including:
	  o Enhancing food systems governance
	  o Developing concepts of 'food system ecology'
	  o Improving food system resource-use efficiency and mitigating waste
		John Ingram

Upcoming Meetings

Name	Location	Date	Contact Person
Global Green Growth Summit	South Korea	10-11 June 2013	
Climate Change Governance: Law, Risk, and Decision Making	Tahoe, NV	19-21 June 2013	Deb Niemeier
Path to Institutional investors	London, UK	27-28 June 2013	Aled Jones
Esri International User Conference	San Diego, CA	8-12 July 2013	Susana Crespo
Global Soils Map meeting	France	9 September	Mike Grundy

		2013	
ESA Living Planet Symposium	Edinburgh, UK	9-13 September 2013	
WasteCon	Long Beach, CA	16-18 September 2013	David Newman
World Solid Waste Congress	Vienna, Austria	7-9 October 2013	David Newman
Global Green Grown Forum	Copenhagen, Denmark	21-22 October 2013	Puvan Selvanathan
Santa Fe Institute / International Institute for Applied Systems Analysis workshop on Theory and Practice of Knowledge Systems for Sustainability	Santa Fe, NM	Oct 22-24 2013	Molly Jahn
Regional GEOGLAM meeting	Russia	October 2013	Chris Justice
Global Soil Week	Berlin, Germany	27-31 October 2013	Ilan Chabay
AgMIP	New York, NY	27-31 October 2013	Cheryl Porter
UN Global Compact Knowledge Track for Sustainable Agricultural Business Principles	New York, NY	Fall 2013	Puvan Selvanathan
Agriculture Investment Summit	London, UK	26-27 June 2013 & 8-9 October 2014	Aled Jones
GEO-X Plenary Session & 2014 GEO Geneva Ministerial Summit	Geneva, Switzerland	13-17 January 2014	Len Hirsch
Geneva Association meeting	Geneva, Switzerland	Jan / Feb 2014	Aled Jones / Rowan Douglas
Resilience 2014	Montpellier, France	4-8 May, 2014	Molly Jahn and Debbie Bossio
Adaptation futures	Brazil	12-16 May 2014	
P80 Group Foundation meeting		TBD	Aled Jones
Chesapeake Bay / Wales and Australia	Wales, UK	TBD	Molly Jahn & Bridget

case meeting			Emmett

Appendix

Mind Map of general meeting topics
The main points of the meeting are summarized in the mind map below (Credit: Thilo Wiertz)
(larger version: **https://tinyurl.com/ku4g4kz)**

Global Food Systems: Risks & Opportunities

Uncertainty and knowledge gaps
- limitations in climate simulation projections (variability)
- Pests and diseasesas a result of clim change
- Knowledge systems have to change to account for changing problem structure
- Models used to be about physical aspects, now they are about impacts and adaptation
- From land cover to land use

Data challenges
- Making sense of vast amounts of data
- Improve and evaluate data quality
- Make old/existing information accessible and useable
- Intensify coherent global data collection
  - Global near real-time clim and weather data
  - Remote sensing, particularly smart automated sensors
  - What happens to data after it has been used?
- Data accessibility and sharing: e.g. data repository

Components/Layers of the Food System
- Ecosystems
  - Soils
  - Water
  - Climate & weather
  - Pests and diseases
- Components & interlinkages
  - Institutions
  - Waste
  - Health
  - Economy
  - Infrastructure
  - Land use
  - Packaging
  - Transport
  - Development and Human Rights
- The Metaphor of 'Layers'
  - Network of interrelations and processes
  - Particularly useful for quantifiable relations
  - Less well for emergent properties and decision making processes
  - Value of the concept has to be evaluated against specific questions
- Layers to advance in community
  - Land use
  - Land tenure
  - Sust. Nutritional Security
  - Capacity for dialogue
  - (Public Health)
  - see list document

Investment, markets and agriculture
- How to leverage finance?
- Changing the rules
- Market malfunctions
  - Incentives against growing food (e.g. biofuels)
  - Short term perspective of insurance (12 months) and traders (<month)
  - 'Panic' in investment behavior
- Environmental services
  - Consider trade-offs between services, scales and time
- Changing demand patterns
- Markets react to forecast, sometimes more than to observations

Knowledge use
- Co-production with stakeholders
  - Example is the priv. sec where data production is demand (customer) driven
  - Empower people by allowing them to produce own stories (geospatially)
  - Integrate people in risk management and decision making
- Decision making
  - Clarify what the purpose of DM is
  - Who will participate?
  - Prescriptive and descriptive approach
  - Preferences are dynamic and context dependend
  - DM as a questioning process – learn from successes and failures
  - Feedback between analysis and deliberation
- Who will use new knowledge (and to what ends)?
- Connect different epistemic communities (e.g. disciplines & modeling groups & experimental science & practitioners)
- Put complicated things into a black box and design a simple interface
- Knowledge 'threads' combine and recombine in different contexts
- How to translate knowledge into action
- Capacity building in administration
- Make transparent where people are in the chain (geospatially)
- Information available at the right time and location may reduce risks

Managing risks
- Risk as emergent phenomenon of complex interactions
- Strengthen resilience/adaptive capacity of socio-ecological systems
- Different food system related risks are already managed in different ways
- Risk management needs to adapt to changing contexts
- Different cultural perspectives on and approaches to risk
- Risk decisions are embedded in political economic decision making
- Only simple (to understand) risk management can be scaled up easily
- Challenges
  - Identify relevant actors
  - Identify processes that may lead to 'tipping points' in the system
  - Integrate existing national risk assessments with global change discussions

Socio-spatial differentiation
- Food systems are global, but they play out locally
- Differences in terms of productivity, wealth, adaptive capacity, etc.
- (Regional) conflicts and trade-offs around increasing fppd production (e.g. biofuels)
- Changing geographical patterns of production and consumption
- Access to and availability of data

Next steps
- Risk model based on existing knowledge
- World map to show food production and flows in time and space
- Improve data accessibility (repository)
- Meeting in Jan in Geneva
- Overlap geographical efforts (e.g. Tansania)

Partnerships: Pub-Priv, Priv-Priv
- Goal: how to realize the necessary changes in a limited timeframe
- How can priv sector help with interpreting output of simulations?
- What cooperations make sense depends on specific questions
- To integrate private sector, return of investment needs to be identified

Other comments and remarks
- Meeting focus has been on tradable commodity production
- Fatalism about agriculture may impede sustainable solutions
- "Modeling revolution" has made societies much more resilient (via insurance)
- Matching capital, people, and science
- Sustainability in a complex system