Knowledge Systems for Sustainable Landscape Management
11-13 June, 2012

Meeting summary

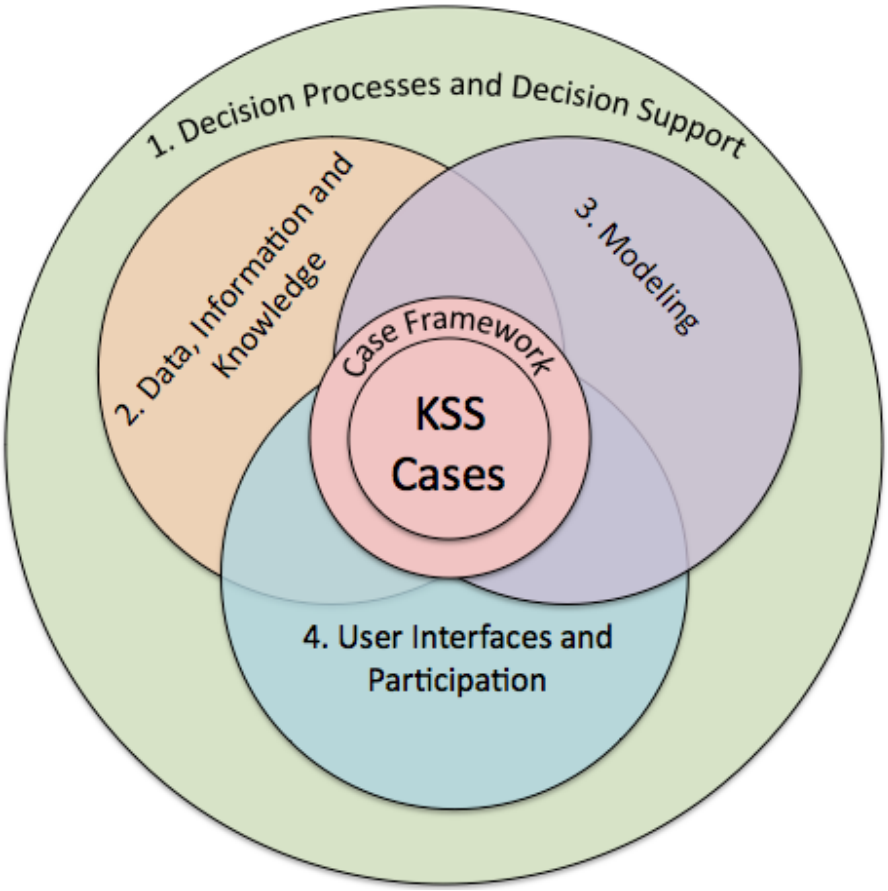
Hosted by the International Food Policy Research Institute (IFPRI), the U.S. Agency for International Development (USAID), U.S. Department of Energy (DOE) Oak Ridge National Laboratory (ORNL) and the University of Wisconsin-Madison (UW).

- 11 June: KSS General Partnership Meeting (held at IFPRI).
- 12-13 June: Leveraging data assets, information technology and cyber-infrastructure in broad partnerships toward improved outcomes in human and environmental dimensions in the developing world (held at USAID).

Synopsis

A series of meetings that began in 2010 focused initially in the U.S. federal government on enhancing the value of research investments in sustainability science has grown to include a number of high-level U.S. and international partners that recognize the need to build and implement a new global knowledge system for sustainable landscape management. The Partnership is now known as "Knowledge Systems for Sustainability" (KSS). The 11 June General KSS Partnership meeting solidified the roles and contributions of member organizations and welcomed several additional partners, notably, the U.S. Department of Energy's National Laboratories led by the Oak Ridge National Lab (ORNL), the Australian federal research organization, Commonwealth Science and Industry Research Organization (CSIRO) and the United Kingdom's National Environmental Research Council (NERC). The focus of the 12-13 June meeting held at USAID was to review the ongoing activities in a number of international "KSS Cases." By "Case," we mean a specific, large, funded project focused on sustainable management of valued services, accessed from a landscape, area and/or region, at scale. The KSS Partnership is focused on the formulation of a new type of knowledge system that can more adequately support local decision-making about how valued services are accessed from landscapes that, in aggregate, determine longer term, larger scale trajectories toward "safe operating space" for human beings and the planet. We use geographically defined "cases" anchored in a common framework to work systematically across scales and geographies to access and link data, information and knowledge assets to decision-making through a learning knowledge system.

Our concept of a knowledge system has four intersecting dimensions: i) decision processes and decision support; ii) data, information and knowledge; iii) modeling; iv) user interfaces and participation. We have now established teams of colleagues, drawn from across sectors and countries, for each knowledge system dimension and for the overall KSS Partnership framework and cyberinfrastructure.



Moving forward after the June meeings, KSS colleagues who have accepted responsibility for leading each Dimension Team, and the KSS Framework and Cyberinfrastructure Teams will continue to develop the theoretical and operational structure of the KSS. At these meetings we formalized an additional set of teams focused in each of the major international "KSS Cases." Each case leader has agreed to document the purpose, activities and desired outcomes of their projects that are relevant to KSS and to explore framing these in terms of the broader KSS concepts and principles. Each international KSS Case presented at this meeting was selected to anchor in the CGIAR Consortium composed of 15 international agricultural research and development centers who collectively execute a series of Consortium Research Programs (CRPs). The three cases considered at the meeting were i) Cereal Systems Initiative for South Asia (CSISA); ii) Africa Rising—a program embodying USAID's sustainable intensification research portfolio in Africa; iii) the Borlaug Institute for South Asia (BISA). All presentations are posted on a Basecamp site (See Annex 8) available to meeting attendees and available to prospective partners by request.

The KSS Cyberinfrastructure Team and the KSS Framework Team will each advance their respective aspects of the knowledge system within each KSS Case in landscapes where the objective is to focus on the role of local decision-making in sustainably accessing valued services from that landscape (food, materials, energy, water and/or other ecosystem services).

KSS partners drawn from government agencies, academia, non-profit non-governmental organizations and industry will continue to refine a set of core documents including i) a white paper that provides a comprehensive detailed overview of our initiative focused on Knowledge Systems for Sustainable Landscape Management; ii) a short paper intended for publication in PNAS Perspectives; iii) a short "elevator pitch" document and slide library.

This meeting marks an important transition in the development of the KSS Partnership. We have to date, held a primary focus on setting the conceptual structures and frameworks that will inform our coordinated approaches to the challenges of managing our demands from landscapes more sustainably. There was broad consensus that we are ready to begin to explore strategies that will operationalize these concepts, testing the ways in which these commitments and insights will forge pathways from data and information to knowledge specifically relevant to demonstrably "improved" outcomes at scale. Within each case, we are now prepared to begin the processes that will test the value of the KSS approach, and further inform the Partnership's shared commitments. Sets of teams supported by organizations and institutions are now defined and will be launched and supported moving forward.

The next major general Partnership meeting will be (tentatively) hosted by Oak Ridge National Laboratory **27-28 November, 2012**. Another major Partnership meeting is now confirmed for **11-12 June, 2013** linked to the Tallberg Forum in Sweden where we have been invited to showcase our work as a major theme of their annual meeting. Other Partnership meetings including Dimension and Case Teams, activities, conferences, and proposal preparations are listed in the full meeting report below.

Full Meeting Report

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June 11 and June 12-13 Meeting Objectives

- Review KSS Partnership Principles and written documents from the February 2012 meeting and set next steps and teams responsible for KSS Partnership written work products.
- Updates from KSS Dimension Leads including discussion of major related initiatives in order to set specific next steps for each KSS Dimension Team and to set next steps with major groups and efforts aligned with each KSS Dimension.
- Review a draft 'case framework' with the purpose of building a standardized or partially standardized framework for cataloging mutually informative project information. The case frameworks are important for developing comprehensive approaches to track progress toward more holistic outcomes from interventions in landscapes.
- Conduct in-depth discussion of several international geographically defined cases and their suitability for testing the KSS framework. Define KSS case leads, teams and specific tasks/commitments.
- Set near to mid-term meeting schedule through 2013 to advance key collaborations with the CGIAR, government agencies and KSS.

Objective 1: KSS Partnership Teams and Work Products

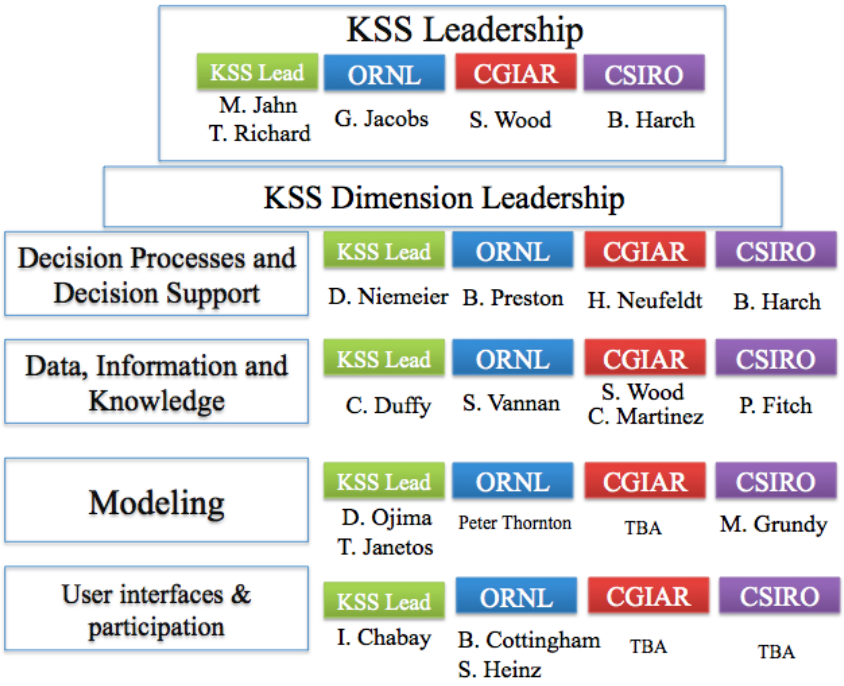
The current list of KSS Partnership members and affiliations are available in Annex 7. Beyond the contributions of individual partners, which are made as individuals unless otherwise noted, the following organizations are providing key staffing and coordination of the activities in this emerging community of practice. The KSS Partnership Principles document was reviewed and discussed and has been updated to reflect discussion (Annex 4). The meeting was conducted under Chatham House Rules with the recognition that we are creating shared intellectual capital where contributions by partners and the role of the Partnership should be acknowledged by any individual who refers to this work.

- DOE National Labs including DOE ORNL Environment by Design Initiative and PNNL
- CGIAR Partners
- Australia: CSIRO + Bureau of Meteorology
- UK, US and Australian Government Agencies including UK NERC, US NASA, US State Department and Department of Interior
- University and NGO Partners

We recognize the diverse charters, goals, responsibilities, restrictions and commitments that these institutional partners have, and the importance of building a community of

practice that can begin to link them together and work toward meeting shared sustainability goals.

The following individuals are providing leadership within the KSS Partnership:



Written work products

Updates on the "short" and "long" written pieces aimed at PNAS Perspectives and for use as a comprehensive working paper for KSS were provided with a commitment that they be in final form before the November, 2012 meeting. Ilan Chabay, Deb Niemeier, David LeZaks and Molly Jahn have had primary responsibility for the "short" piece. David LeZaks and Greg Wilson provided leadership for the white paper up until the June meeting. David and Molly will have primary responsibility going forward from here.

In addition to the written pieces, Bronwyn Harch, David LeZaks, Molly Jahn and any others who are interested, will work on a slide library and "elevator speech." This work product is envisioned as a concise method in helping to build the identity of KSS and showcasing the completed, ongoing and planned efforts. This set of slides and complementary text can be used in high-level briefings, short communications, meeting presentations, or to be included in publically available communications from the home institution.

A submission to Science in a Policy Forum format lead by the CGIAR is planned describing the relevance of this type of partnership for meeting the scientific goals prompted by a commitment to "climate smart agriculture" (CSA). KSS Members that are involved in this written product include H. Neufeldt, M. Jahn and D. LeZaks.

Meeting discussions were further enhanced by invited presentations that clarified potential funding opportunities relevant to KSS in the US system. These included the National Science Foundation (NSF) – particularly the Sustainability Research Network, Research

Coordination Networks and Cyberinfrastructure for Sustainability — and the National Aeronautics and Space Administration (NASA) – particularly the Applied Sciences Program.

It was agreed that heading into the next Partnership meeting, a goal would be to enter that meeting with white papers for each major KSS Case, Dimension, or component using a modified Dahlem workshop format.

Objective 2: Knowledge System Dimensions

The goal of a new Knowledge System for Sustainability as applied to landscapes is framed by the overarching goal of informing and supporting decisions at the land/water/energy nexus that lead to more sustainable outcomes. The decision-making dimension now entitled 1) "Decision Processes and Decision Support" then intersects with each of three additional distinct dimensions of a knowledge system. 2) The interfaces the knowledge system presents to users ("User Interfaces & Participation") are themselves critically important in the transmission of useful information and in the assessment of a learning knowledge system focused on local decision support tailored to frame suites of tradeoffs and synergies in human and environmental dimensions (e.g., livelihoods/income, crop yield, nutritional status, energy or water inputs, green house gas emissions, etc.). 3) Models: Diverse models and model ensembles anchored in relevant data assets must be managed toward more flexible utility in a structured, curated, and durable space; and 4) Data, information and knowledge assets related to relevant dynamics in a system must be assembled into functional overlapping interoperable data layers that are always geographically specified. A detailed review of these dimensions took place in February, 2012 at the DOE Pacific Northwest National Laboratory/UMD Joint Global Change Research Institute so we did not emphasize further refinement of KSS Dimensions at this meeting. On June 11, the Dimension leads that were present briefly reviewed the scope and structure of each dimension, and further identified confirmed dimension team membership.

On June 12-13, through a set of invited presentations, meeting participants were briefed on relevant initiatives that represent leading examples of knowledge system advancement as well as potential partnership opportunities for developing the four KSS dimensions. These included ORNL's Environment by Design, CGIAR Research Programs, Australia's National Plan for Environmental Information, the UK's Environmental Virtual Observatory (EVO), the Multi-Agency Collaboration Environment (MACE), the Global Earth Observation System of Systems (GEOSS), the Agricultural Model Inter-comparison and Improvement Project (AgMIP), and NSF's EarthCube project. Through open discussion, other relevant initiatives were described including Future Earth and EcoHealth Alliance.

Larry Sugarbaker with Emily Fort described the US Department of Interior's Landscape Decision Tool that is being developed in partnership with the Morris K. Udall and Stewart L. Udall Foundation. The tool will be used to inform DOI policy development and resource management decisions by better mobilizing information assets. Executives will

have access to high quality information about DOI lands and management activities on large landscapes crossing multiple management boundaries. The goal for the tool is that others (including those in the KSS Partnership) will engage with the Department by using our information, sharing their information, and collaborating in new ways.

Brad Doorn (US NASA) reported on activities from the Group on Earth Observation Global Agriculture Monitoring initiative (GEO-GLAM), whose goal is to reinforce the international community's capacity to produce and disseminate relevant, timely and accurate forecasts of agricultural production at national, regional and global scales. There has been strong support for this initiative from within the US Government, along with other governments, such as India.

We agreed that we will use the Dimension Teams as they have come together with the entrance of ORNL, the CGIAR and CSIRO as the basis to prepare Dahlem style white papers for our November, 2012 Partnership meeting. At this meeting, we will use the cases we have now established to as the test geographies for building out the four dimensions in context.

A key development now confirmed is the possibility of holding separate workshops focused on each dimension with funding targeted to support the development of each dimension as a community of practice. We congratulate Deb Niemeier and her colleagues who have just received notification that an NSF proposal for a workshop on Governance and Climate Change has been funded. This workshop will support efforts in the Decision Processes and Decision Support Dimension, has been funded. Details will be forthcoming. Other Dimension Leads and Teams were encouraged explore similar or analogous approaches as possible and appropriate.

A key decision at this meeting has been to isolate two components of the knowledge system from the dimension structure for specific attention by selected teams: KSS Framework (see Objective 2) and Cyberinfrastructure.

Cyberinfrastructure Team

From the earliest days of discussion of the KSS concept in U.S. federal government, the central role of cyberinfrastructure has been obvious. This refers to the development of conceptual and operational cyberinfrastructure components that act to facilitate the delivery of useful information to decision-makers. This "backbone" of the KSS will assist in organizing and delivering the content of the KSS to decision-points, automating work-flows, and brokering ethical, legal and other sensitive information sharing processes.

Nelson Villario presented an update on the Geoshare project (presentation file on BaseCamp), based at Purdue, which clearly represents an aligned activity that could serve to anchor a significant portion of the KSS cyberinfrastructure. Nelson reviewed next steps for Geoshare using HubZero, an architecture that may be highly relevant to KSS. We agreed to follow up with a visit to ORNL or Purdue to ensure close and full alignment.

The team identified to represent this portion of KSS includes R. Cottingham (ORNL), C. Maitland (PSU), P. Raghavan (PSU), M. Livny (UW) V. Nelson (Purdue), P. Fitch (CSIRO), O. Degnan (Marshfield Clinic) and C. Gomes (Cornell U). Bob Cottingham has agreed to lead the team in considering ELSI (Ethical, Legal and Social Implications) issues in this context. The CI team will consider the following questions and issues before our next meeting in November. David LeZaks will coordinate the efforts of this working group.

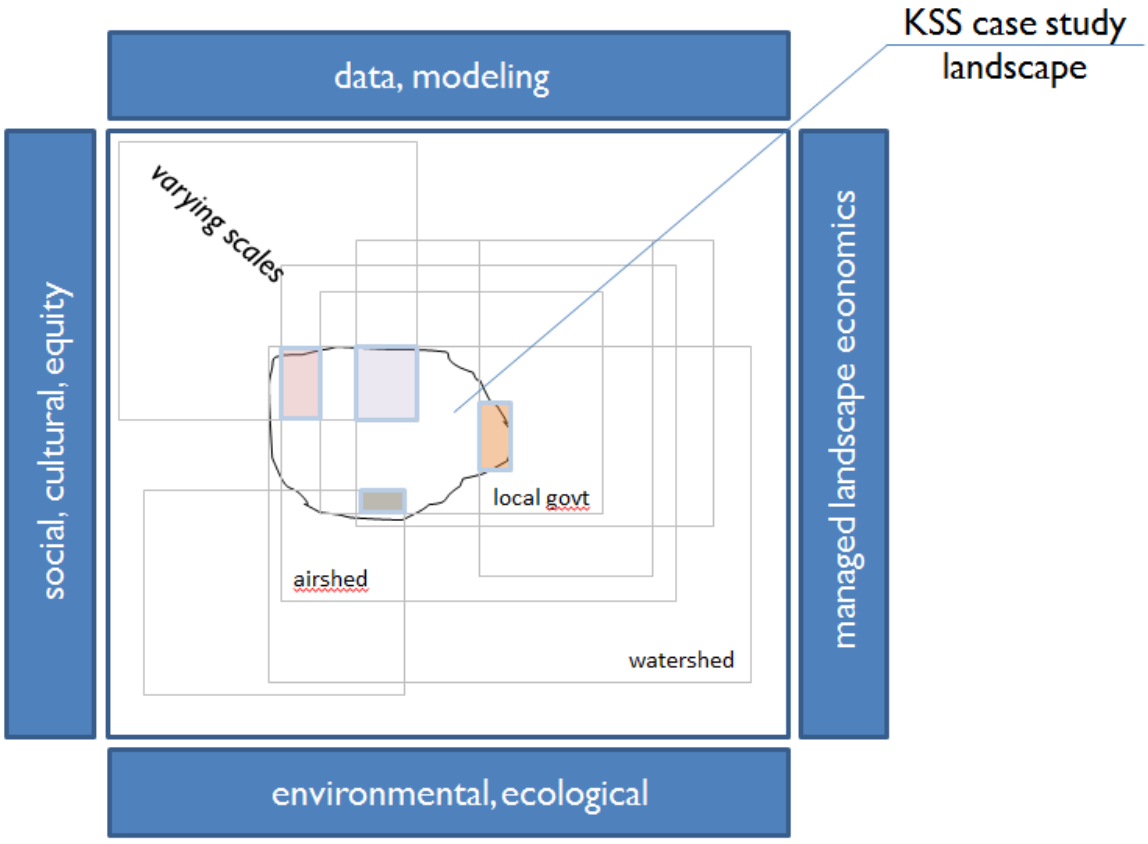
- Should there be a KSS Chief Information Officer?
- How will we organize ourselves to deal with the acute need for directory services related to KSS?
- Automated workflow will be critical in setting up the cases and generic approaches are likely within reach.
- Data standards will be critical. We should circle back soon with the US federal CENDI group and Federal Geographic Data Committee (FGDC) to assess relevance.
- Can we leverage the investments made in the intelligence and defense communities focused on the setting up of Information Sharing Environments with support of partners such as the Multi-Agency Collaboration Environment (MACE)? Katie Schemm and Megan Marsh will serve as points of contact for outreach for ISE.
- How will we provide a coherent, systematic approach to geospatially explicit data of priority in landscape science and to the creation and/or leverage of global data layers in areas such as soil, water, etc.? Australia's model for water through the Bureau of Meteorology and partnership through CSIRO will be very helpful with Peter Fitch as a contact.

Objective 3: Case Framework, Case Tracking and Description of Cases

One of the key mechanisms by which we hope to advance our understanding of decision-making for sustainability is through deeper engagement in analysis that is both time and scale relevant across case studies that are within the KSS portfolio. A geographic location or geographically bounded project is suitable as a KSS "case" if:

- There are temporal and spatial sustainability challenges in the built and natural resources, and/or ecosystem services accessed from landscapes, e.g., biodiversity, climate services;
- Decision making for sustainable management is constrained by limitations in (1) the availability of data, information and knowledge assets; (2) modeling capability to simulate how decisions can affect prospective future states and their relationship to desired outcomes; and (3) the availability of tools for evaluating tradeoffs and synergies and developing pathways toward sustainability.

The intention of the KSS Case Framework is to survey these facets of a case and to determine how the realignment of existing resources, new partnerships, and/or other interventions can improve the provision of more sustainable outcomes.



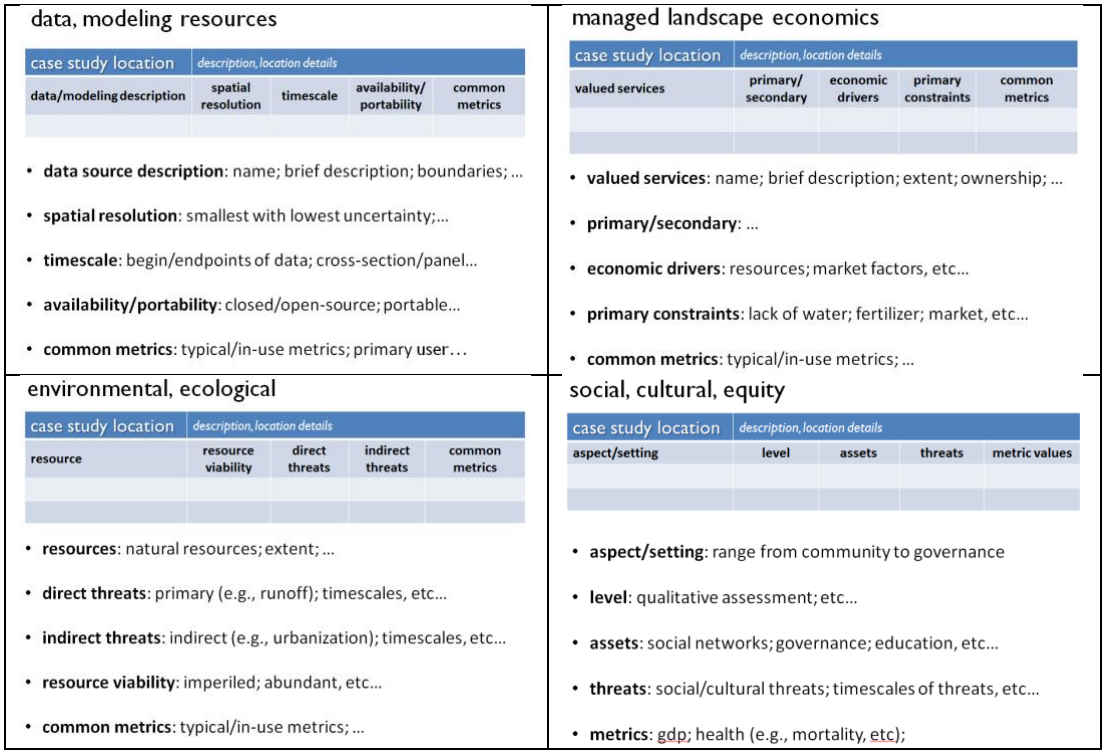
The KSS Partnership intends to motivate new knowledge systems designed to move from "one-off" projects to more integrated examples of ways we approach generic problems related to outcomes in human and environmental dimensions related to the accessing of valued ecosystem services from landscapes including agriculture, materials, energy, natural resources, etc. In order to facilitate the kinds of KSS knowledge-building we hope to motivate, we must have a consistent method for initially cataloging information from prospective Cases (See Annex 5). In February, 2012, we introduced the concept of a framework or "protocol" to provide systematic order for the activities of the partnership in specific locations and to ensure mutual relevance across specific geographic cases.

The framework approach is intended to help us explicitly describe and structure information about each geographic test case or pilot case as it is added to the KSS portfolio. The February protocol has transitioned into a document and subsequently into the slide deck that Deb Niemeier presented, which is now referred to as the "KSS Case Framework." Henry Neufeldt then presented an integrated approach to assessing outcomes in projects and target geographies following specific interventions in a landscape in multiple dimensions (see "Case Tracking Approaches" below). Together, these two tools have become part of the "KSS Case Framework", which provides the starting case study foundation for the various dimensions of the knowledge system (see discussion below and diagram above).

The starting framework presented allows for prospective cases to document the available resources within and across the following categories:

- Data and Modeling Resources
- Managed Landscape Economics
- Environmental and Ecological Resources
- Social, Cultural, Equity Contexts

The initial Case Framework has been specifically derived in a more open-ended manner to allow participants to expand and draw out data unique to their case. That is, the Case Framework represents a starting point for assembling data on each casw. We expect the Case Framework to continue to evolve to facilitate ease of use, generalization, and incorporation into future stages of KSS development. In gathering the required information to complete the Case Framework documentation, it has been recommended that the ethical, legal and social implications (ELSI) of such activities are also assessed. The KSS team will begin to synthesize case information as it is provided.



Case tracking approaches

In an operational KSS framework, we will need coherent and consistent integrated approaches to measure institutional, Earth and human dimension changes over time and be able to compare the changes observed between multiple cases in different geographies. In the meeting, an example of such a framework that was developed for work at ICRAF was presented and feedback was given to align it closer to the KSS (See Annex 6 for more

information). Additional work is planned to improve such a tracking mechanism. Henry Neufeldt and Deb Niemeier are leading this effort.

Role of a Project Mapping Tool in KSS

There are emerging or *de facto* standards with regard to the basic description and geographical mapping of program/project investments, pioneered primarily by Development Gateway and its partners. Those standards have already been adopted in a number of specific, web-based Project Mapping tools, e.g. World Bank, African Development Bank, Development Gateway, and the Gates Foundation, and are currently being applied to AGRA project investments in Africa. Such resources will support ready access to and interoperability of key project-related data collections, and KSS will build on them to support its own case study documentation and data sharing capacities. Meeting participants agreed that the following team would explore the feasibility and implications of adopting this such standards and tools as is or with modifications that may reflect the KSS Framework and tracking tools: Andrew Impey, Carleen Maitland, Bob Cottingham, Lorne Miller, Chris Gingerich, Jerry Glover, Bronwyn Harch, Molly Jahn, Stanley Wood, Paul Thomassin.

Modifications to the mapping tool, for example, may include specific attributes connected to the definition of the project e.g., nature of valued services in question, key outcomes in human dimensions, the metadata associated with the case, etc., and other specific descriptors of importance to KSS per the Case Framework. Molly Jahn and David LeZaks will organize a follow-up call once the background work has been done to evaluate this idea and specific decisions to be made for the KSS partnership. We will consult Budhendra (Budhu) Bhaduri (ORNL) who has offered specific assistance in coordination with experts across government particularly at USAID and Stanley Wood on technical details.

Role of Industry in KSS

While the core components of KSS emerged from discussions in academia and government, there is a strong interest from industry groups in the capabilities that the KSS is developing. There are both market opportunities for KSS-inspired technologies and alliances that emerge from research institutions and opportunities to leverage existing technologies, platforms and hardware across cases and dimensions of the KSS. George Meyers (Cassidy & Assoc.) along with Andrew Impey (UK NERC) have agreed to lead the dialogue between KSS partners and industry members. Molly Jahn and David LeZaks will be on-point for the KSS Partnership engaging partners in this conversation. The Environmental Virtual Observatory, a UK NERC project, has an active industry advisory panel with several groups aligned with KSS.

There has also been an active dialogue with several constituents in the actuarial sciences community. Molly Jahn addressed an international actuarial meeting in May 2012, and has since been in dialogue with Aled Jones, Director, Global Sustainability Institute at Anglia Ruskin University in the UK on potential collaboration with the KSS partnership. Jones and colleagues are working on several global economic and actuarial models related to

natural resource sustainability. Molly Jahn plans to meet with Jones and colleagues again in December to advance this conversation.

Objective 4: Geographically defined KSS Cases

The 11-13 June meetings represented the first formal consideration of international cases focused on agricultural and economic development and food security. (A list of U.S. cases carried forward by the KSS Partnership is appended at the end of this section.) On 13 June, breakout groups focused on three geographic cases, described below, to (a) test suitability of draft Case Framework for characterizing cases, (b) to identify specific opportunities for leveraging capacities and working together, and (c) to articulate action steps and specific commitments. We plan specific follow-up meetings for each of these cases, the first of which is now planned for the CSISA case on 20 August 2012 in the CGIAR offices in Delhi. At these meetings, we will identify KSS teams focused on each case as well as specific collaborations and linkages that we identified at this meeting. We plan white papers for each case to be prepared for a Dahlem format workshop perhaps held at ORNL in November, 2012 or in conjunction with the Tallberg Forum in June 2013.

A key outcome of this meeting is recognition of the opportunity to advance a collaboration anchored in the CGIAR and its commitments to the world's poor focused on food security and economic development.

1. Africa Rising

Case Leads: Stanley Wood and Jerry Glover (presentation on Basecamp)

Case Summary:
Africa RISING is a collaborative sustainable intensification research effort launched by USAID in 2011 under the U.S. Government's Feed the Future Initiative (FtF). Africa RISING operates at multiple scales, from plot to landscape, within a geographically-defined stratification (delineated by agroecological and population density/market access gradients) of three major agricultural production systems of sub-Saharan Africa; the Sudano-Sahelian savannah of West Africa, the highlands of Ethiopia, and the maize-based systems of Eastern and Southern Africa. Within each of these three closely-coordinated sub-projects, action research sites are being established for focus farming systems, sub-regions, and countries. The *a priori* stratification of each of the three production system extents provides not only a basis for guiding initial site selection, but also a robust framework to support subsequent up-scaling and out-scaling of tested interventions and learning. Hallmarks of the Africa RISING initiative are: individual farmer selection of existing Sustainable Intensification (SI) intervention options to be tested, co-learning about the efficacy of those components at the whole-farm scale, concern for landscape scale ecosystem service impacts, and the emphasis on interventions that improve outcomes for women and children. Initial efforts are aimed at evaluation of technologies and practices for the sustainable intensification of cereal-based and crop-livestock systems in 5 countries over the 3 regions (Ghana, Mali, Ethiopia, Tanzania and Malawi). Decision audiences include farm households, public and private farm service providers and suppliers, and

various public sector governance and executive entities that can advocate for and implement change.

Africa RISING is currently engaged in an intensive period of deliberation and design on its research approach and action plan as well as the associated monitoring, learning and evaluation (M, L&E) capacities; these two elements to be bridged by a coherent (set of) data and analytical platform(s). M, L&E in Africa Rising is extending beyond delivery of a restricted set of required FtF output and outcome indicators and is embracing the notion of integrated information and knowledge management capacities linked to decision-oriented analytics. Effective decision support is considered critical not only to program management and partner effectiveness, but, of even greater long-term significance, to enhancing local and spillover impacts for farm households and farming landscapes (across the target set of income, nutrition, health, and key ecosystem service indicators).

Initial Africa RISING partners involved in KSS include USAID and IFPRI, but other CGIAR centers (including IITA and ILRI as project managers, and ICRISAT, CIMMYT, and AfricaRice as project-specific partners) are also involved. While there is clear interest and potential for contributions from CSIRO, ORNL, Wisconsin, Penn State and other KSS partners, the modalities of such engagement have yet to be defined. The immediate goal is to create nodes of communication that provide a basis for identifying and acting upon collaboration opportunities and deliver a successful KSS case study. The approach being taken to the M, L&E involving knowledge management and decision support in particular is seen to be highly congruent with the KSS approach.

The practical follow-up steps as Africa RISING proceeds to define its first year of field implementation from October 2012 include;

- Sharing the draft Research and the Monitoring, Learning & Evaluation Plans with KSS partners to provide a more complete picture of the scope of the ambitions of the program. Both planning documents will be in draft form by September 2012.
- Elicit feedback from KSS partners on the drafts, especially with regard to finalizing processes and responsibilities for implementing the KSS Case Study as part of the Africa RISING work plan, as well as identifying specific entry points for KSS partner engagement in the actual program implementation.
- Invite KSS case-study partners to upcoming program-wide design and planning meetings (NB: M, L&E plan review meeting scheduled for 5-7 September in Addis).
- Participate in the upcoming KSS meeting at ORNL (now scheduled for November 2012) to follow up on Case Study implementation, as well as explore specific data and tool collaboration opportunities (e.g. remote sensing, climate and population data sources, landscape and farm management related models and advanced search, synthesis, and spatial analytic algorithms and tools.

2. Cereal Systems Initiative for South Asia (CSISA)

Challenges in data & information management, metrics and analytics.

Leads: Andy McDonald and David Spielman (presentation on Basecamp)

The Cereal Systems Initiative for South Asia (CSISA) was established in 2009 to catalyze sustainable intensification of staple crop production at scale in South Asia's most important grain baskets while substantially improving rural livelihoods. Operating in rural hubs in Bangladesh, India, Nepal, and Pakistan, CSISA involves more than 300 public, civil society, and private sector partners in the development and dissemination of improved cropping systems, resource-conserving management technologies, new stress-tolerant cereal varieties and hybrids, livestock feeding strategies and feed value chains, aquaculture systems, improved policies and strengthened markets. In essence, CSISA is an innovation system platform that links a wide range of public, private, and civil society sector programs within and across South Asia.

CSISA is now entering is second phase (2012-2015) and internalizing lessons learned during the first phase of the project. CSISA had many areas of excellence in Phase I, but cross-project integration was insufficient. The project is now migrating towards a holistic planning approach where all activities are defined along common impact pathways. In a similar vein, the other major area where CSISA needs to improve in Phase II pertains to data management, integration, and leveraging the same for internal and external decision making, including impact pathways management. For any single project, handling data management and integration with 'custom' solutions is both inefficient and typically ineffectual. CSISA's experience was no different. By collaborating with KSS-affiliated organizations such as ORNL, Purdue, Penn State, McGill, University of Wisconsin - Madison and CSIRO who have specialized skills and well-development tools for managing, integrating, and operationalizing data, CSISA is eager to embrace strategic partnerships that offer robust systems with high levels of performance, longevity, and visibility within targeted user communities; together, we hope to contribute to agricultural decision science in S. Asia with tools that are highly functional and accessible to a broader user community. Specific aims of CSISA's collaboration with KSS institutions are likely to include:

- Strengthen public-access data portals that apply common standards to remote sensing (RS), climate, and other geo-spatial information to include more data sources from South Asia and, in cases, deploy advanced algorithms and RS to estimate data where existing monitoring networks is sparse.
- Advance the development of robust decision tools for agricultural management that are seamlessly coupled with archived and 'real-time' data streams.
- Strengthen agricultural simulation models, especially where key algorithms are functioning beyond their development domains in stress-prone environments.
- Moving agricultural systems simulations beyond point-based analysis with realistic boundary conditions and scale considerations.
- Contribute to the development of 'whole of society' models that puts investment and interventions in a common frame in order to assess direct and indirect contributions to divers development goals (e.g. agriculture – nutrition convergence).

By working closely with farmers and across academic disciplines, CSISA offers a context-rich learning platform for KSS partners for contextualizing the value of data integration and

decision science among farmers and policy makers that who will ultimately judge the merit of what the KSS network produces.

3. Borlaug Institute for South Asia (BISA)

A proposed research institute hosted by CIMMYT in India.
Lead: Kevin Pixley.

The BISA break-out group recognized the potential of BISA to advance understanding of outcome-driven decision science, a key need under KSS, through robust investment in institutional relationship building (i.e., among CGIAR and local institutions) and scanning for more specific research partnerships. Break out group participants offered several useful recommendations and identified interested partnership opportunities for BISA summarized by Kevin Pixley below. Etienne Duveiller has been appointed to lead BISA and has been updated on the potential collaborations and relevant perspectives.

Specific key points in discussion:

- Plan BISA by defining pathways to desired outcomes, and then design your research:
    - What capabilities will be needed to innovate and scale up benefits?
    - What infrastructure will be needed for research? For scaling up benefits?
    - What networks and large scale collaborations must be developed?
- Recognize that BISA impact is limited by factors we have little ability to control. More and more focus on productivity alone will not achieve the desired outcomes by itself. Define what modifications to policies and rules would enable or enhance impact:
    - The importance of interactions with the private sector were recognized
    - Institutional design—BISA offers a remarkable opportunity to test the types of intellectual communities that can be defined around sustainability challenges in food security
- Behavioral Science: See how innovations fit in early, rather than later.
- BISA must be anchored firmly in economics and other social sciences
    - From technology driven to demand and impact driven
    - Develop institutions instead of varieties
- Outcome-driven decision science and impact evaluation
    - What are the 3-4 highest priority desired outcomes: Define and focus them.
- BISA is an opportunity to "be bold" and catalyze a different way of doing things in the CGIAR
    - Beyond agroecological focus to – to food systems, health, livelihoods
    - Human dimensions of the Green Revolution
- Several potential partnerships were represented at the KSS meeting, encompassing various areas of expertise and astounding human and/or infrastructure resources to bear on pertinent issues for BISA
- Specific partnerships with KSS, US DOE ORNL, CSIRO, the McGill Platform, Indian Science Agencies, NASA and other advanced science providers were discussed. CSIRO may be able to contribute intellectual assistance and experience with outcome-driven decision pathways as foundation for research design, as well as impact evaluation

and indicators, while learning from BISA about impact pathways. ORNL is interested to engage in intellectual conversations at multiple levels and explore collaborations on fundamental science questions and data mining / data analytics. McGill is interested in mutual learning about full system approaches that look at outcomes for communities, agriculture, policy interface, etc.

4. U.S. cases confirmed as candidates

- Menominee Forest (Menominee Nation, ORNL, SI, & UW Madison)
  Leads: Menominee Nation members, Jonathan Thompson, John Kress & Dan Ricciuto; Team: Cathy Robinson (CSIRO), Molly Jahn (UW)

Project Abstract: We will develop a highly integrated knowledge system for sustainable forest management using the Menominee Forest, a rare example of an ecosystem managed for long-term sustainability, as a case study. The overarching goal of this knowledge system is to establish an infrastructure for communicating policy-relevant information from climate models to stakeholders and vice versa. The primary model in the project will be the Community Land Model with carbon-nitrogen biogeochemistry (CLM-CN), which is the land model component of the Community Earth System Model (CESM). Significant new capabilities will be drawn from more detailed process models and added to CLM-CN including 1) a more detailed forest management and disturbance submodel, 2) explicit treatment of model uncertainty at multiple scales, and 3) a web-based, interactive interface that can process climate and management scenarios from stakeholders and return probabilistic information about relevant model output variables via intuitive visualizations. We will form a close partnership with the Menominee Nation and other regional stakeholders to identify and obtain datasets necessary for constructing a reliable model and to engage in scenario planning with the goal of directly informing future management decisions. In particular, we will use this system to address the following scientific hypotheses:

H1: The Menominee-managed forest has reduced sensitivity to and increased resilience from extreme climate events compared to other nearby managed forests.

H2: By integrating empirical data with stakeholder input, novel management strategies can be identified to increase carbon sequestration without impacts on long-term harvest volume.

- San Joachin Valley Deb Niemeier (UC Davis-lead)

This project addresses a critical need for metrics that integrate built environment standards (air and water quality standards) with education, employment and health performance measures (e.g., access to schools and health care). A very simple yet compelling example of how key systems are isolated from each other is the intersection of water quality metrics in California's Central Valley with nutrition policy-driven educational and economic interventions to promote water as a substitute for soda consumption. At odds are the reality of the state of available drinking water (exceeding healthy levels of nitrate) and the nutrition standards being applied in the local school systems and marketplace. We will develop new integrated metrics that are responsive

to performance across the air and water physical systems and the economic and social systems of education, health, and employment.

Our research goal is to develop new integrative system performance metrics that better align priorities in the built environment with health, economic and educational policy objectives, and in doing so, increase the potential for long-term community sustainability. Drawing on current literature, we will invoke community-based participatory science, with which our research team is well versed in our target communities. By building knowledge capacity across various community-level stakeholder groups, these metrics can be used to support more efficient and equitable resource allocation and improve the effectiveness in informing policy in regional and state legislative decision-making. We will develop our metrics working with stakeholders in a community of 10,000 Mexican-heritage residents in the San Joaquin Valley, which has some of the worst air and water quality in the country.

- Snake River Valley - Steve Peterson, General Mills
- Western Kansas - Chuck Rice, Ogalala Aquifer-Kansas State University
- Vonore, TN - Virginia Dale, switchgrass/energy (ORNL)
- Chesapeake Bay Watershed - to be followed up at Penn State - Tom Richard
- DOE's Great Lakes Bioenergy Research Center - Phil Robertson - Regional Intensive Modeling Areas

Upcoming meetings with KSS relevance

Event	Date & Location	Lead
McGill World Platform for Health and Economic Convergence	22-24 June, Delhi	L. Dube / McGill
CSISA Case meeting	20 August, India	M. Jahn
CGIAR Scaling meeting	21-23 August, India	H. Neufeldt
CCAFS data strategy meeting	August, Reading England	S. Wood
Africa RISING – Research design meeting / M, L&E Meeting / Knowledge Management	July – September, 2012	S. Wood & J. Glover
CGIAR meeting	September 11-12, Montpellier, France	S. Wood
AgMIP Meeting	10-12 Oct. Rome	M. Jahn
Chesapeake Bay Watershed Case Meeting	17-18 October, Penn State	T. Richard
Biomass Field Day: From Grow to Go	Vonore, TN	G. Jacobs & ORNL Colleagues
KSS Meeting	November 27-28	G. Jacobs & KSS Team
(possible) Soil processes meeting	ETH-Zurich April, 2013	
Tallberg Forum	June 11-12/13-16 2013	M. Jahn & D. Niemeier
Dimension Meetings (@professional societies / conferences?)		Chris G, Deb N, ISE
(possible) Case focused meetings		Case leads

(possible) Gates Foundation meeting on the data dimension		C. Gingrich
(pending) Santa Fe workshop: academic, theoretical		N. Federoff & M. Jahn

Next steps & To do list

Writing products

- Finalize white paper. Lead: David LeZaks, with help from partnership members
- Finalize "short" paper targeted for a PNAS perspective. Lead: Ilan Chabay, David LeZaks and Molly Jahn. Prepare to reach out to PNAS editorial board.
- KSS elevator speech: a common set of slides and a short document with specifics for KSS participants on Basecamp
- Climate Smart Agriculture - Science Policy Forum manuscript in preparation (KSS Partnership members include H. Neufeldt, M. Jahn, D. LeZaks)

Working Groups

- Case leads are encouraged to work the Case Framework team to better develop the framework and its information needs. A more formal small group process will be designated to finalize the framework. Lead: Deb Niemeier.
- Case Tracking Framework: H. Neufeldt will work with Partnership members to better develop a method and tools to track the progress, and lessons learned for each Case.
- Members of the Partnership that expressed interest in the cyberinfrastructure working group will be contacted to set working group goals and a communications strategy. The near-term goal of the working group is to produce a short white-paper. Lead: David LeZaks

Cases:

- Explore Gates Project Mapping Tool as foundation for KSS framework: (Chris Gingerich-Gates Foundation contact, B. Harch, J. Glover, S. Wood, L. Leonard, C. Maitland, P. Thomassin, B. Cottingham, A. Impey, M. Jahn & D. LeZaks)
- CSISA: One day meeting in Delhi (8/20) with major partners, Case writing teams identified, case documents started
- Africa Rising: M&E extending to a knowledge system as core concept of the USAID Feed the Future investment in Africa
- KSS becomes "roadmap 4" for McGill World Platform for Health and Economic Convergence
- KSS Conceptual Framework (Deb) and Operational Frameworks (Henry)--updated documents and presentations
- Explore ethical, legal and social issues (ELSI) and their implications for KSS. Lead. B. Cottingham.
- Menominee: Work with members of the Menominee Nation, Smithsonian, UW-Madison and other Partnership members. Set short and long-term goals.

- Chesapeake Bay: Plan for (possible) meeting 17-18 October at Penn State, identify key stakeholders and scope of case activities
- Compile additional U.S. case statements for next meeting.

Dimensions:

- Data, Information and Knowledge dimension
  - next step: A healthy data ecosystem meeting sponsored by the Gates Foundation-Chris Gingerich
  - Learn more and connect with the developers of the Australian National Plan for Environmental Information
- Modeling
  - AgMIP meeting in Rome 10-12 October
  - Explore GEOSS ModelWeb
- Decision Sciences
  - Planning NSF sponsored workshop at UC Davis in Fall, 2012
- User interfaces and participation
  - Learn more about the Information Sharing Environment and assess the potential alignment with the KSS
  - Engage with members of the IHDP program on Knowledge, Learning and Societal Change
  - Explore ways in which research on gaming, artificial intelligence and the computer/human interface intersect with our work

Other activities:

- KSS Industry Roundtable: We have made an alliance with the UK EVO group for industry partners. G. Meyers and A. Impey are assembling a list of contacts in the companies we all work with and we will continue with our plan to have an early planning meeting with a larger roundtable to follow
- Further explore the activities and potential for aligning Partnership activities with the following
  - DOI Landscape Decision Tool
  - GEO-GLAM
  - GEOSHARE / HubZero
- Engage foundations and government agencies to assess the potential next steps for collaborating with these groups
- Develop a strategy for forming an alliance with Purdue/GEOSHARE

Meeting Planning:

- Begin preparations for next KSS Partnership Meeting at Oak Ridge National Laboratory.
- Work with staff at the Tallberg Forum to prepare a joint proposal to support KSS meeting, travel and attendance for their June 2013 event.
- Explore the invitation from the US Department of Energy to prepare a proposal for their annual summer Snowmass meeting, 2 weeks focused on KSS in 2014

ANNEXES

- 1. Participants lists
- 2. Agendas for 6/11 meeting
- 3. Agenda for 6/12-13 meeting
- 4. KSS Partnership Principles
- 5. Case Characterization and Scoping
- 6. Case Tracking Framework
- 7. KSS Partnership Roster
- 8. Basecamp Project Management Instructions

Annex 1:

Meeting Participant List

	E-mail	Institution
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Annex 2:

Knowledge Systems for Sustainable Landscape Management

KSS General Partnership Meeting

11 June 2012

At
The International Food Policy Research Institute
2033 K St. NW Suite 400, Washington DC 20006
hosted by the International Food Policy Research Institute, the U.S. Agency for International Development, DOE Oak Ridge National Laboratory and the University of Wisconsin-Madison

Meeting deliverables:
We will be reviewing progress of the written documents from the PNNL/UMD KSS Partnership meeting held in February, 2012 to discuss the trajectory to move them forward. We will review and improve the list of potential geographic cases that have been assembled since the PNNL/UMD meeting. We will review the case framework and the concept that there may be a standardized or partially standardized framework by which we may track the consequences of interventions in landscapes with respect to more holistic suites of outcomes in human and environmental dimensions.

Our colleagues from Oak Ridge National Lab will update us on the Environment by Design Initiative and its relevance for the KSS Partnership, and we will introduce and review existing domestic "cases."

We will welcome colleagues from the UK National Environment Research Council, Australia's National Research Organization, CSIRO and the CGIAR and prepare for our more targeted meeting to be held the following two days focused specifically on international cases.

We will explore the potential for leveraging global investments in big data regarding Earth observations and the human condition toward the challenges of food security, and nutritional health, social and political stability. We will discuss with CGIAR colleagues the imperative of expanded and modernized information management, realizing the implications of the CG Consortium structure.

Special thanks to Dr. David LeZaks, Fatima Zaidi and Maria Theresa Tenorio for their help in organizing this meeting, and IFPRI and ORNL for financial support..

June 11, 2012

Time	Activity	Lead
11:00-11:30	**Welcome & Introductions** **Review of agenda, meeting goals & deliverables**	Stanley Wood and Molly Jahn Christine Negra
11:30-12:30	**Review of output from 21-22 February KSS Partnership meeting** - KSS Partnership Principles Document - Short paper targeted at PNAS Perspectives - KSS white paper - Status of Case Framework (to be discussed in detail later) - Update on KSS Industry Roundtable and potential alignment with UK Environmental Virtual Observatory (EVO) Industry Group	 Tom Richard Molly Jahn Greg Wilson & David LeZaks Deb Niemeier Molly Jahn
12:30-1:15	**Lunch hosted by IFPRI: Presentation: Update on KSS and ORNL's Environment by Design** **Discussion: KSS, ORNL's links with NASA and GEO GLAM**	Gary Jacobs & "ORNL KSS Dimension Leads" Brad Doorn
1:15-1:45	**The UK's Environmental Virtual Observatory**	Andrew Impey

1:45-3:30	**Review of KSS Partnership: strategic goals, partners and opportunities**
	• *Introduction & update from KSS Dimension Leads—Each lead will provide a brief reflection on our partnership's trajectory and specific updates on our progress and major related initiatives*
	  • **Data, information and knowledge dimension; updates on major related initiatives**
	  ▪ EarthCube
	  ▪ Geoshare & HubZero
	  ▪ U.S. GEO
	  ▪ Welcome to our CSIRO partners! Australia's National Plan for Environmental Information
	  ▪ The potential intersection of project monitoring and evaluation (M&E) and data management & analytics
	  • **Modeling**
	Updates: Model Web/GEOSS; AgMIP
	• **Decision Sciences**
	  ▪ Possible NSF-sponsored workshop at UC Davis
	  ▪ Department of Interior's Landscape Decision Tool
	  • **Cyberinfrastructure**—perspectives from Carleen Maitland, PSU update on Carla Gomes' NSF Sustainability Research Network pending proposal
		Tom Richard
		
		Chris Duffy
		
		Nelson Villoria
		Len Hirsch
		
		Bronwyn Harch
		
		Stanley Wood
		Peter Thornton & Dennis Ojima
		Deb Niemeier
		Larry Sugarbaker
		Carleen Maitland
		Molly Jahn

3:30-3:45	Break	
3:45-4:15	KSS cases and the need for a "case framework" and ways to track cases in a portfolio	Deb Niemeier

4:15-4:30	Quick enumeration of existing U.S. KSS "cases"
	  ▪ Chesapeake Bay Watershed
	  • Menominee Forest (ORNL, SI, & UW Madison)
	  • San Joachin Valley
	  • Snake River Valley
	  • Western Kansas—Ogalala Aquifer
	  • Vonore, TN -- switchgrass/energy
		Lorne Leonard, Doug Miller & Tom Richard
		Molly Jahn
		Deb Niemeier
		Molly Jahn
		Chuck Rice
		Gary Jacobs

4:30-5:00	• *Welcome to CG partners*
	  • Potential placement of our partnership in existing CGIAR Research Programs (CRPs); Possible relationships between KSS capacities and CG-led efforts
	  • Can we nominate volunteers from the CG to hold working titles as "Dimension Leads"?
		Stanley Wood

5:00-5:15	**Updates on related meetings and initiatives** For each event, we will organize a KSS team and specific next steps: ○ KSS Working Group meeting at "Ecosystem Services Come of Age: Linking Science, Policy and Participation for Sustainable Human Wellbeing" at Portland, OR 7/31-8/4/12 *Opportunity to organize U.S. cases into portfolio* ○ Invitation to develop a Santa Fe Institute workshop ○ Possible UC Davis Decision Sciences Dimension workshop (Should we target similar opportunities for other dimensions?) ○ Invitation to the Tallberg Forum 2013; Update from Deb on KSS presence at the 2012 Forum ○ Next KSS Partnership Meeting in the fall at ORNL	All
5:15-5:45	**Next steps—** **Finalize specific commitments and next steps** Where do we need funding? Staffing? Meeting conclusion	Tom Richard, Gary Jacobs, Deb Niemeier and Molly Jahn
5:45-7:30	Reception hosted by IFPRI	

Annex 3:

Knowledge Systems for Sustainable Landscape Management:

Leveraging data assets, information technology and cyberinfrastructure in broad partnerships toward improved outcomes in human and environmental dimensions

in the developing world

12-13 June 2012
At
Suite 801 (Nile and Congo rooms)
U.S. Agency for International Development 1717 H St. NW, Washington, DC 20006
Hosted by the International Food Policy Research Institute, the U.S. Agency for International Development, U.S. Department of Energy's Oak Ridge National Laboratory and the University of Wisconsin-Madison

Meeting deliverables: This meeting will review several large integrated "cases" that focus on the links between agriculture, natural resources and outcomes in human dimensions such as agricultural productivity, food and nutritional security, poverty and livelihoods. A key challenge shared by each of the selected cases focuses on the ability to access and link data, information and knowledge assets with appropriate analytical approaches that are geospatially and temporally explicit.

We will review the ongoing activities in these cases that tackle this challenge to determine the opportunity to bring together new partnerships and capabilities to advance our ability to share and analyze information about agriculture, food, natural resources, climate, infrastructure, health and socioeconomic status. We will test the concept that these cases can usefully be placed into a framework that will allow us to abstract more general insights from each specific set of activities. In the second day's breakout sessions, we will focus on the specific tasks needed for our partners to facilitate each case's commitments. Drawing on materials provided by each case ahead of the meeting and discussion at this meeting, we expect to establish specific commitments among partners and specific next steps in framework development.

The goal of the meeting is to promote the ability of several major projects to realize their specific goals with respect to mobilizing new categories of information assets and implementing more integrated ways of tracking outcomes and outputs and managing project-related data of a variety of types.

Special thanks to Dr. David LeZaks, Fatima Zaidi, Maria Theresa Tenorio and Kayla Williams for their help in organizing this meeting and IFPRI and ORNL for financial support.

June 12, 2012

Time	Activity	Lead
0830-0900	Continental breakfast	Hosted by IFPRI
0900-0930	**Welcome from our host** **Overview: history of the KSS initiative, meeting structure, and proposed goals** **Review of agenda, deliverables, and objectives** (1) review specific cases in the KSS framework; (2) determine what can be done to tackle data/information/knowledge/ analysis/decision-making challenges through partnerships; (3) define specific tasks/commitments for partnerships. (4) determine how to clarify the connections of each case to the framework and goals of the KSS	Jerry Glover Molly Jahn & Stanley Wood Christine Negra
0930-1000	**Introductions of meeting attendees and organizations (**Name, affiliation and organizational objective for the meeting (e.g., learn about projects, communicate potential contribution, gain partners)	All
1000-1015	**Introduction to the proposed conceptual and operational framework for this meeting: An integrated knowledge system for sustainability** Introduction of KSS leads: Chris Duffy (PSU) (data & information), Tony Janetos (DOE PNNL) (modeling), Deb Niemeier (UC Davis) (decision sciences and case structure), 'Pic' Bob Piccerillo (ODNI MACE) user-defined operations & learning knowledge systems	Molly Jahn & Tom Richard
1015-1045	**Introduction to DOE Oak Ridge National Lab's role in KSS;** DOE ORNL, PNNL and the **Environment by Design Initiative;** allied US Government capacities— **NSF and Relevant Cyberinfrastructure for Sustainability** **NASA and GEO GLAM** **Smithsonian Institution and US GEO**	Gary Jacobs & USG colleagues C. Maitland Brad Doorn Len Hirsch
1045-1100	Break	
1100-1115	**Adaptive approaches to monitoring and evaluation (M&E) in large projects; Overview of the CGIAR's interest in rationalizing and modernizing its relationship to project data and geospatially explicit data resources for environmental, agricultural, economic and human dimensions**	Stanley Wood
1115-1130	**The role of "Cases" i.e., geographically explicit tests of this approach** **Review of a proposed *"Case Framework" Document***	Deb Niemeier

Time	Activity	Lead
1130 - 1145	**Overview of 4 key cases for this meeting and introduction of teams** • U.S. State Department's studies on Bangladesh & Afghanistan • Cereal Systems Initiative for South Asia (CIMMYT, IFPRI, IRRI, ILRI) • McGill World Platform for Health and Economic Convergence; World Bank/Booz Allen Hamilton/IFPRI nutrition/agriculture • Africa Rising/USAID	Molly Jahn
1145-1245	**Discussion of Cases** **Case 1: US State Department: Rise of extremism in Bangladesh and Afghanistan** Working in a geospatially explicit framework, this team highlights linkages between social, biophysical and economic dimensions and illustrates sophisticated approaches to social media, sharing information assets among trusted partners and generic analytics.	Emily Goldman, Bob 'Pic' Piccerillo, Amy Dalton & Jim Wickman
1245-1330	Lunch hosted by IFPRI **Briefing:** U.K. Natural Environment Research Council & The UK's Environmental Virtual Observatory Australia's CSIRO flagships and The National Plan for Environmental Information	Andrew Impey Bronwyn Harch
1330-1430	**Case 2: The Cereal Systems Initiative for South Asia (CSISA): Challenges in data & information management, metrics and analytics** CSISA was established in 2009 as a platform to support regional and national efforts on improving cereal production growth in South Asia's most important grain baskets, and is beginning a Phase 2 with a commitment to emphasis on data management and integrated impacts at scale. Operating in rural hubs in Bangladesh, India, Nepal, and Pakistan, CSISA involves 4 CG centers and >300 public, civil society, and private sector partners in the development and dissemination of: improved cropping systems; resource-conserving management technologies; new rice, wheat and maize varieties; livestock feed supply chains; aquaculture systems; improved policies; and public-private delivery systems.	David Spielman, Andy McDonald & Kevin Pixley

Time	Activity	Lead
1430-1530	**Case 3: The Whole-of-Society Knowledge Architecture and Modeling Platform for Real-Time Monitoring of Food, Nutrition, and Health Across the Development Continuum (McGill U & partners)** This initiative examines the full development spectrum, ranging from subsistence agriculture communities still struggling against hunger and nutritional deficiency as the rate of obesity and diabetes starts to rise (India, Palwal State), to industrialized societies that are making major investment in whole-of-society transformation to prevent and control over nutrition and its obesity and non communicable diseases (NCDs) consequences (Canada, Quebec; Australia; South-East Region). The overarching goal is to characterize the many shades of biological, environmental and behavioral risk, vulnerability and resilience to hunger, under nutrition, over nutrition, obesity/NCDs and the responsiveness to whole-of-society transformation occurring at both ends of the development continuum, in order to point to paths of convergence for more effective transition. The aim is to work in near real time, on multiple scales with high geographic resolution, combining statistical, mathematical and computational models in order to accelerate effective and integrated knowledge co-creation and translation into policy, innovation and decision making by all actors in society. Links are made with related efforts deployed by World Bank in Bangladesh and India.	Laurette Dube, David Buckridge, Jeroen Strueben. and Paul Thomassin; John Newman
1530-1545	**Break**	
1545-1645	**Case 4: Africa Rising** Africa RISING is a CGIAR-managed research program focused on sustainable intensification of farming systems in the Guinea Savannah zone of West Africa, the Ethiopian Highlands, and the maize-mixed production region of Tanzania, Malawi, and Zambia. The program focuses on demand-driven research at the household scale and assesses intervention impacts at the field, farm, community, and landscape scales. Designed to address country-identified priorities, the program's purpose is to provide pathways out of poverty and hunger for smallholder farmers through increased crop & livestock productivity and improved natural resource management.	Stanley Wood and Jerry Glover
1645-1715	**Discussion, Reactions, Synthesis**	C Negra
1715-1730	**Review of a proposed operational framework to standardize tracking of cases and Discussion**	Henry Neufeldt
1730-1930	Reception hosted by IFPRI	

Wednesday, June 13, 2012

Time	Activity	Lead
0800-0830	Breakfast - Hosted by IFPRI	
0830-0845	**Check in** **Charges for the day in light of meeting objectives**	Christine Negra
0845-0930	**Evaluation of the "case" concept within a knowledge system framework.** **What are the obvious global data holdings relevant to these cases? How can we make specific linkages to mobilize data assets into the cases in a standardized way?** - DOE ORNL (NASA, NOAA) + DOE PNNL - NASA + international partners + GEO GLAM - Can we generalize from Australia's example e.g., water? - Geoshare and HubZero - IFPRI, CIMMYT, CRP2 & CCAFS & the CGIAR Consortium **How can these cases allow us to advance the concept of a community of trusted partners focused on information sharing for improved human and environmental outcomes through agricultural interventions?**	Christine Negra G Jacobs B Doorn B Harch N Villoria S Wood
0930-0945	**Break:** Move to breakout groups to focus on building an action plan and committed partners for each of the selected cases	
0945-1100	Break out groups for projects selected to advance: **Compile action lists and specific commitments either in hand or necessary to move forward;** **Identification of project leads and KSS liaisons** **BREAK OUT GROUPS** 1. Cereal Systems Initiative for South Asia 2. McGill World Platform for Convergence of Health and Economics 3. Africa Rising 4. Borlaug Institute for South Asia (a proposed research institute that could be designed to reflect concepts under discussion in this meeting hosted by CIMMYT in India)	Christine Negra Spielman & McDonald Dube et al. Glover & Wood Pixley et al.
1100-1200	**Report from Breakout Groups** **Conclusions from Breakout Groups-Moving forward on specific cases within a unified framework; relationship of the CG and ORNL to that framework**	Christine Negra, Stanley Wood, and Molly Jahn
1200-1300	Lunch (Hosted by IFPRI): Review of meeting progress & action items	
1300-1330	**Meeting conclusions:** Finalize commitments within each partnership	Christine Negra

	Solidify roles of anchoring partners with capacities of general significance Define next steps for development of the KSS case framework Next meetings within partnerships Next meetings across these cases; the role of the CGIAR going forward	
1330	**Meeting Adjourns** with thanks to our sponsors!	
1400-1600	Optional meeting focused on "Roadmap 4" focused on knowledge systems for McGill Group's New Delhi Workshop June 22-24, 2012	

Background: Natural resources and food security are priorities of paramount importance in the 21st century. In every region on Earth, we face obvious, urgent and inter-connected challenges of meeting both immediate and longer term human demands for food, water and energy in the face of resource limitation, environmental degradation, and extreme weather. In this era where human activities dominate the condition of our planet and its natural resources, many of our fundamental activities such as agriculture are still managed in fundamentally extractive modes. In the face of mounting evidence that these practices can lead to resource, economic and political instability, insufficiency and detrimental impacts on human health and wellbeing, the imperative to shift our decisions to reflect more holistic perspectives that allow us to meet human demands within long term balance with the natural resource base is now inescapably clear. The risks of failure to manage our planet's finite and dwindling resources, whether apparent as conflict, famine, poverty, and/or the rise of extremism are also now increasingly clear to governments and business, yet systematic approaches to bringing our trajectories into alignment with long term "safe operating space" are not generally recognized.

This high-level working meeting will draw together in a structured 2 day meeting with specified deliverables selected key leaders from

- the international agricultural research and development community
- the global science and engineering communities focused on the nexus of food, water and energy, and
- information sciences.

Recognizing the need to improve our ability to better manage linkages amongst human welfare, the state of natural resources, political and economic stability, and long-term economic prosperity, the meeting will explore the potential to leverage massive investments being made across these disparate domains in the form of 4 key cases toward achieving large-scale and accelerated positive outcomes in the human condition, particularly for the world's most vulnerable people.

Cereal Systems Initiative for South Asia
The Borlaug Institute for South Asia (proposed)
The McGill World Platform for Health and Economic Convergence
U.S. State Department's study on extremism and food security in Bangladesh and Afghanistan
Africa Rising/USAID

One specific goal for this meeting is to explore the possibility to identify a team of partners who might come together with the CGIAR Consortium, its Centers and Research Programs to grapple with questions of limited access to, as well as limited capacity to manage and render interoperable, a sufficient spectrum and frequency of critical and sensitive data elements needed to achieve its research goals of addressing global food security and poverty reduction.

This meeting builds on a partnership that has developed a proposed framework for a modern knowledge system (Knowledge Systems for Sustainable Landscape Management, KSS) that would better mobilize existing investments in data, information and knowledge, modeling and meta-modeling infrastructure and decision sciences. In this framework, we resolve 4 dimensions of a modern knowledge system necessary but not sufficient for more sustainable management of agriculture and food systems for improved human outcomes: User-defined interfaces, Decision Sciences, Modeling and meta-modeling infrastructure and capacities to curate, annotate, align and parameterize models and model ensembles and data, information and knowledge assets. A further goal of this meeting is to set into action within a clearly specified framework a series of projects that collectively can deliver proof of concept that include the cases we will consider in detail above, leading to recommendations for the organizations in attendance and others at local, national, regional and global levels.

In summary, there is broad interest in exploring the feasibility of specific approaches that would facilitate the mobilization of descriptive data regarding the Earth system, data regarding the use of ecosystems to meet human demands, and data regarding the human condition via data standardization approaches that facilitate data sharing and aggregation and that allow checks of data quality, as well as analytical approaches that generate testable predictions or scenarios. Toward this end, we will highlight throughout the meeting specific technical strategies used to integrate data relevant to these questions, and layer data, information and knowledge assets into existing frameworks to leverage analytics and allow better elucidation of interactions across dimensions that are not obvious *a priori.* The critical gaps in existing data and data management infrastructure will also be enumerated and prioritized by meeting attendees as the basis for a global call to action.

Supporting documents to be provided:

List of invitees with contact information
Bios of meeting attendees
Briefings for each of the 4 anchor cases to be considered
Case Framework that will allow us to align cases as mutually informative elements in a portfolio
Lexicon of acronyms
Partnership Principles of the KSS

Lexicon of Acronyms

Acronym	Name	Website
AgMIP	The Agricultural Model Intercomparison and Improvement Project	http://www.agmip.org/
Agree	-	http://www.foodandagpolicy.org/
BFS	USAID Bureau for Food Security	-
BISA	The Borlaug Institute for South Asia	http://tinyurl.com/cx6xdmy
CBW	The Chesapeake Bay Watershed	
CCAFS	Climate Change, Agriculture and Food Security (CGIAR research program)	http://ccafs.cgiar.org/
CGIAR / CG	originally the Consultative Group on International Agricultural Research, now the Consortium of International Agricultural Research Centers	http://www.cgiar.org/
CIMMYT	International Maize and Wheat Improvement Center	http://www.cimmyt.org/
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (CGIAR center)	http://www.cimmyt.org/
CRP	CGIAR Research Programs	http://www.cgiarfund.org/cgiarfund/research_portfolio
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)	http://www.csiro.au/
CSISA	Cereal System Initiative South Asia	https://sites.google.com/site/csisaportal/
DoD	United States Department of Defense	http://www.defense.gov/
DOE	United States Department of Energy	http://energy.gov/
DOI	United States Department of the Interior	http://www.doi.gov
EarthCube	-	http://earthcube.ning.com/
EVO	Environmental Virtual Observatory	http://www.evo-uk.org/
GEO	Group on Earth Observations	http://www.earthobservations.org/index.shtml
GEO-GLAM	GEO Global Agriculture Monitoring initiative	-
Geoshare	-	http://www.geoshareproject.org/
GEOSS	The Global Earth Observation System of Systems	http://www.earthobservations.org/geoss.shtml
HubZero	-	http://hubzero.org/
IC	Intelligence community	-
ICRAF	World Agroforestry Centre (CGIAR center)	http://www.worldagroforestrycentre.org/
IFPRI	International Food Policy Research Institute	http://www.ifpri.org/
ILRI	International Livestock Research Institute (CGIAR center)	http://www.ilri.org/
IRRI	International Rice Research Institute (CGIAR center)	http://irri.org/
KAUST	King Abdullah University of Science and Technology	http://www.kaust.edu.sa/
M&E	Monitoring and evaluation	-
MACE	Multi Agency Collaboration Environment	http://www.macefusion.com/

NASA	National Aeronautics and Space Administration (US)	http://www.nasa.gov/
NCD	Non-communicable disease	-
NERC	Natural Environment Research Council (UK)	http://www.nerc.ac.uk
NOAA	National Oceanic and Atmospheric Administration	http://www.noaa.gov/
ODNI	Office of the Director of National Intelligence	http://www.dni.gov/
ORNL	Oak Ridge National Laboratory	http://www.ornl.gov/
PNNL	Pacific Northwest National Laboratory	http://www.pnl.gov/
PSU	The Pennsylvania State University	http://www.psu.edu/
USAID	United States Agency for International Development	http://www.usaid.gov/
USDA	United States Department of Agriculture	http://www.usda.gov
USGS	United States Geological Survey	http://www.usgs.gov/
WB	The World Bank	http://www.worldbank.org/
PM-ISE	Program Manager - Information Sharing Environment	http://ise.gov/

CGIAR Research Centers	
Africa Rice Center	
Bioversity International	
CIAT	Centro Internacional de Agricultura Tropical
CIFOR	Center for International Forestry Research
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CIP	Centro Internacional de la Papa
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi Arid Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
IWMI	International Water Management Institute
ICRAF	World Agroforestry Centre
WorldFish Center	
CGIAR Research Programs (CRPs)	http://consortium.cgiar.org/our-strategic-research-framework/cgiar-research-programs-crps/
CRP1.1	Dryland Systems
CRP1.2	Humid Tropics Systems
CRP1.3	Aquatic Agricultural Systems
CRP2	Policies, Institutions and Markets
CRP3.1	Wheat
CRP3.2	Maize
CRP3.3	Rice
CRP3.4	Roots, Tubers and Bananas

CRP3.5	Grain Legumes
CRP3.6	Dryland Cereals
CRP3.7	Livestock and Fish
CRP4	Nutrition and Health
CRP5	Water, Land and Ecosystems
CRP6	Forests, Trees and Agroforestry
CRP7	Climate Change, Agriculture and Food Security

Annex 4:

Knowledge Systems for Sustainability – Partnership Principles

1. KSS partners join with the conviction that this effort is important, indeed essential, to advancing sustainable management of landscapes. Each partner should have the goal and the expectation that their individual contributions will generate sufficient synergies that they and their organizations will get more out of their participation than they give. Benefits of participation include sharing innovative ideas, technologies, and strategies, connections with potential sponsors and other stakeholders, and opportunities to leverage each other's resources to maximize impact.

2. There will be many KSS partners that engage for specific purposes and periods of time, and a few that are deeply engaged for the long term. The KSS core leadership will consist of those partners that are engaged for the long term, and that make exceptional and ongoing contributions to advancing the collective effort, through intellectual, organizational, financial, or other tangible commitments.

3. We recognize that many funding opportunities come with geographical, institutional, and methodological constraints. Core leadership will coordinate with each other and with other relevant KSS partners in developing teams for specific opportunities. Decisions about membership on proposal teams will be transparent and discussed during regular leadership calls.

4. We hold paramount our respect for the intellectual contributions of each partner. When funding constraints limit the financial involvement of members of the leadership team, they will still have the opportunity to "opt in" with their own resources. Decisions about authorship on publications and will reflect the intellectual contributions made to that particular piece of scholarship, and will be shared with the other members of the leadership team in a transparent fashion, prior to publication whenever possible.

5. When the contributions of a member of the leadership team subside to a level that no longer evidence deep, long term engagement and exceptional ongoing contributions, core leadership will discuss this situation and offer respectful feedback.
6. Ilan Chabay will draft an additional principle reflecting the importance of knowledge-to-action research and the mutual and individual commitments that are needed in this new way on engaging.

Annex 5: Case Characterization and Scoping

General Location and Decision Maker Characterization

What is the name / primary descriptor of the pilot geography?

Where is the pilot geography located (general & specific)?

Who owns / governs / makes decisions made on the parcel?

What is the land-use and ownership history of the parcel?

What is the size / location of parcel(s) within the geography where a more in-dept examination of decision-making processes could take place?

Describe how a given parcel within the geography is nested within other local and regional decision making systems?

What are the primary valued services derived from this geography?

What are other valued services derived from this geography?

Decision Making Context

What are the primary natural resource challenges that are faced in this geography?

What are the primary social / human challenges that are faced in this geography?

What are the primary economic drivers of decisions?

What are the primary social drivers of decisions?

What are the primary moral / ethical / religious drivers of decisions?

What are the primary environmental drivers of decisions?

What are the externalities of a given decision (positive / negative, social, environmental, economic)? Are these near-term or long-term impacts? Are these impacts experienced locally, regionally or globally?

How can the social network of the decision maker be represented / visualized?

How can the economic network of the decision maker be represented / visualized (e.g. economic inputs & outputs)?

Data, Information and Knowledge Assets

What are the primary biogeophysical data sources that are collected in the geography? What are the temporal and spatial scales?

What are the primary socioeconomic data sources that are collected in the geography? What are the temporal and spatial scales?

How is traditional ecological (and other) knowledge collected, stored and re-distributed within the geography?

What are the needs for real-time (or near real-time) data collection?

What additional data, information and knowledge assess, and/or models are needed to provide more assistance to individuals making natural resource management decisions?

Are there recent examples or evidence in the geography that making new data, information resources and/or models available to decision makers improved natural resource management decisions? If so, describe some of the significant examples.

Modeling and other Analytical tools

What tools and /or models are used to aid in decision making?

For each of these tools / models, are there any iterative feedback mechanisms that track the eventual outcome of the decision and the effects on the landscape and people?

For each of these tools / models, are there any mechanisms to couple real-time data collection with modeling for improved decision support capacity?

For each of these tools / models, who was the intended user of the tool and is the output designed for their maximum usability?

User Interface

What is the current process for the decision-makers to integrate information into their decision making process?

What types of technology do the decision-makers have access to?

How open are the decision-makers to having their interaction with the KSS interface tracked for use of overall system-improvement (e.g. learning system)?

How does the user interface be adapted for different types of users (e.g. farmer, policy maker, community group, NGO, business)?

What minimum educational / technical skills would be necessary to interact with the KSS interface? How can users be reached who don't meet this threshold?

Desired outcomes

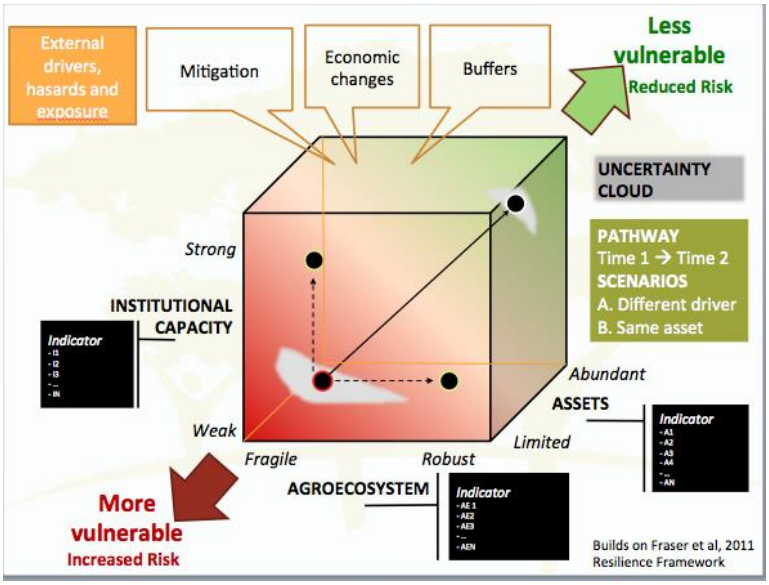
What are goals for the components of interest within the social-ecological system in the pilot geography?

How can the development and deployment of a knowledge system for sustainable landscape management help to meet these goals?

What is the timeline for meeting the stated goals?

Annex 6: Case Tracking Framework

Presented by Henry Neufeldt



A simple tracking framework that builds on a double difference approach towards measuring change over time in biophysical, socioeconomic and institutional/governance dimensions. In the schematic the framework is described around vulnerability and risk, but in principle it is applicable to all sorts of questions related to monitoring and evaluation of change over time. By measuring relevant indicators in these dimensions over time it is possible to see how incentives or interventions, but also external impacts (e.g. weather extremes) affect change. A double difference approach is required to obtain a dynamic baseline and separate endogenous change from interventions and quantify their effects. This approach is open to comment, as to its applicability across a spectrum of development contexts. Relevant indicators will change from case to case though it may be possible to identify some indicators that can be generalized while others are very context specific. Which indicators to chose depends on data availability, geographic scale and the ability to measure temporal change through these indicators. Assuming positive change is happening, the vulnerability clouds indicated between time 0 (more vulnerable) and time 1 (less vulnerable) suggest that uncertainty is decreasing with improved information and understanding of the relationships that lead to change. While this is not necessarily the case, it is expected that through measuring change over time it will be possible to develop hypotheses of relationships between the different dimensions and the ingredients needed to improving the indicators of all three dimensions which in turn will reduce the uncertainty surrounding the measurements and the relevance of the indicators.

Annex 7: Knowledge Systems for Sustainability - Partnership Roster

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Ogallala Aquifer Case

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Vonore, TN Bioenergy Case

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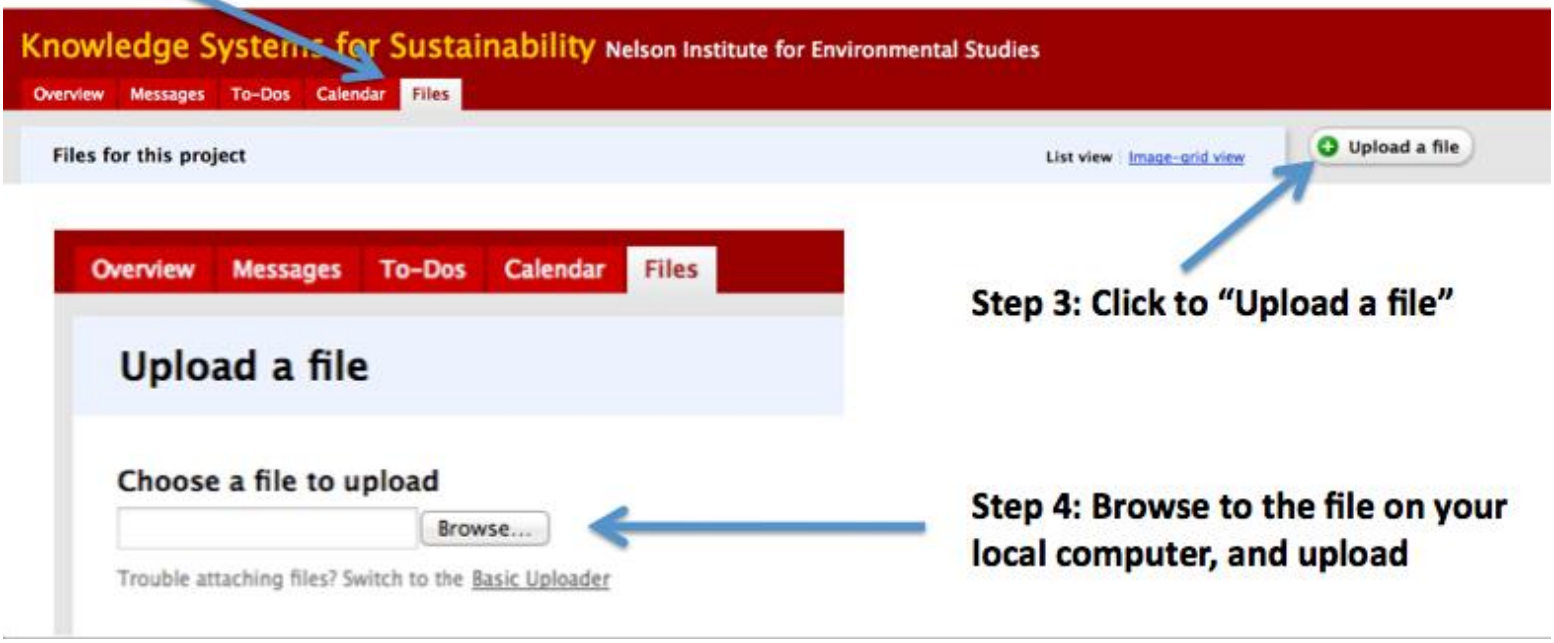
Annex 8: Instructions for Basecamp project management website

Step 1: Login to Basecamp
https://wiscgrad.basecamphq.com
(contact LeZaks@wisc.edu if you need your password reset)

Step 2: Click on "Files" tab



Step 3: Click to "Upload a file"

Step 4: Browse to the file on your local computer, and upload