The Chesapeake Bay and Knowledge Systems for Sustainability
Summary of Challenges, Opportunities, and Next Steps

Background:
On May 2-3, 2013, a cross section of Chesapeake Bay Program (CBP) partners met with parties affiliated with the Knowledge Systems for Sustainability (KSS) partnership. This document provides a summary of the challenges, opportunities, and next steps identified during that meeting.

The Chesapeake Bay is the largest estuary in the United States. It is facing a number of issues, including impacts to fisheries, water quality concerns, and a variety of other environmental pressures related to population growth. In 2009, President Obama issued an Executive Order mandating clean up Chesapeake Bay by 2025. In 2010, the US Environmental Protection Agency issued a total maximum daily load (TMDL) for the entire Chesapeake Bay Watershed, with clean up targets identified in 2 year periods. Meeting the TMDL by 2025 and actually achieving restoration of the Bay itself, and its contributing waterways, is a significant challenge.

The idea behind Knowledge Systems for Sustainability is to leverage state-of-the-art data systems, models, and decision sciences to address challenges such as those facing Chesapeake Bay restoration. The goal of KSS is to leverage technical, financial, and other resources to better address critical issues facing land, water, and energy decisions, and to help ensure that the knowledge needed to improve those decisions is seamlessly transferable between institutions and to decision makers, both at a policy level and on the ground. By exploring the issues facing decision makers in the Chesapeake Bay watershed, the goal is to build a collaboration that helps identify and employ such resources, and to achieve real and measurable restoration progress.

Problem: Restoring Chesapeake Bay is a Significant Challenge:
As a society, we are not where we need to be in working towards restoring Chesapeake Bay and its watershed; there are a number of important considerations about what it might take to get there.
- What has been undertaken so far is necessary and important, but insufficient.
- In particular, significant issues remain with nutrient and storm water management.
- Among decision makers at all scales, some are proactive about change, but some are resistant. Some perceive Bay restoration as someone else's problem, especially given the dispersed nature of these issues.
- To change this dynamic, we need to think big and act boldly in tackling the challenges before us.

New resources and tools are needed:
- The current population in the watershed is 17 million people and growing rapidly.
- Existing challenges plus predicted growth threaten to overwhelm progress made to date.
- The existing resources are insufficient to meet this challenge, especially given the current limited public funds and importantly, pressures on Chesapeake Bay Program and its partners' time, ever-increasing responsibilities, and other resources.

Vision:
The vision is for a Chesapeake Bay and its supporting watershed to have the benefits of healthy ecosystem that supports the economic livelihood of the region while being resilient to severe weather impacts. The goal is to bring together both existing stakeholders and new perspectives in ways that creatively and effectively address the significant issues raised in meeting this vision.

Action Steps to Pursue:
1. *Integrate social sciences, especially decision sciences, to design knowledge systems and supporting frameworks that inform and motivate better choices on the landscape at all scales, from individual farms and businesses to regional policy.*
   - Identify needed expertise, potential information, resources, tools, and applications.
     - Engage leading scholars and practitioners in behavioral and decision sciences to apply their expertise to Chesapeake Bay challenges.
     - Develop innovative strategies for outreach and education to reach expanded audiences in new and different ways.
     - Create a constructive dialogue for systematic implementation of new tools and new ways of thinking about business and environmental decisions.

   - Understand and leverage the motivations, relationships and synergies that link farm and business operations and environmental practices.
     - Focus on current farm and business advocates for sustainable practices as positive examples that differ from the *status quo*. What are the values, goals, and strategies that differentiate and motivate them to be proactive, and how can we support that?
     - Reinforce those positive outliers through a "trusted peers" campaign.
     - Convene facilitated interactions between producers and food industry customers around joint sustainability goals.
     - Encourage market-based incentives that encourage positive behaviors as part of successful farm and business operations.

   - Integrate decision sciences into overall problem solving.
     - Critically evaluate current incentive mechanisms, from nutrient trading to conservation payments to zoning and permit requirements, to determine what works, what doesn't, why, and what could be done.
     - Modify current processes, tools, and interfaces to incorporate best practices from the decision, behavioral, and information sciences.
     - Develop and promote next generation knowledge systems and decision tools that integrate business operations with environmental analysis to allow decision makers to evaluate alternatives, identify tradeoffs, and optimize overall system performance on a real time basis.

   - Help inform individual and shared management decision-making.
     - Develop tools & processes that allow pertinent information to be conveyed in real time to decision makers ranging from on-farm up to policy arenas.
     - Create collaborative peer learning experiences that celebrate innovation (e.g., on-farm Field Days and on-line "Farminars")

2. *Develop and collaboratively operate a sustained modeling laboratory to support the individual and shared decision making responsibilities of CBP Partnership and continue to advance the science behind and the expanding nature of management applications of the growing suite of decision-making support tools.*
   - Create a transparent and accessible virtual laboratory for model development, calibration, validation, and management application support, as well as inter-model comparisons within and outside the Chesapeake Bay Program community.
     - Expand on existing infrastructure and collaborations (i.e., Mid Atlantic Water Program, HydroTerre).
     - Leverage other key resources (Oak Ridge National Laboratory, AgMIP).

- o Address sustained funding and governance needs
  - Create an inclusive and responsive governance structure.
  - Secure funding on the order of $2 million/year for 10 years.

- o Ensure necessary research & development capabilities to address emerging issues
  - Advance core capabilities with incentives for continuous improvement.
  - Engage external research community on emerging issues through competitive grants and fellows in residence.

- o Expand the longstanding focus on watershed and estuarine water quality simulation to include a "decision sciences" component.
  - Provide a test bed for new modeling approaches that simulate the interactions between policy and market incentives, land management decisions, and environmental outcomes.

3. *Develop spatially explicit and scalable decision-making support tools for optimizing management strategies for maximum benefits and targeting environmental investments.*
   - o Envision application of modeling tools and tracking of data/actions from the smallest decision making scales (i.e., farms, development sites) to a basin-wide scale.

   - o Support decisions with scalable, multiple inter-operable models that address a full suite of sustainability indicators: economic, environmental, energy, and social.

4. *Build new relationships and expand existing partnerships to leverage change*
   - o Work with the agricultural community to turn perceived adversaries into advocates for action.
     - Example: Wisconsin Institute for Sustainable Agriculture.
     - Pilot this approach within PA; focus on smaller dairy farms, poultry industry.

   - o Work with those in the Chesapeake Bay watershed already addressing these issues, but from perhaps unusual directions.
     - Example: Let's Be Shore use of dialogue and the humanities to address water quality issues.
     - Example: leverage actuarial tools from the insurance industry related to severe storms and climate change to monetize and reward strategies that mitigate business risks while enhancing water quality.

   - o Work with others in the country addressing these same issues.
     - Example: Puget Sound Partnership's work on integration of the social sciences/human dimension (http://www.psp.wa.gov/documents.php#por)

   - o Work with those elsewhere addressing issues of a similar nature (e.g., Knowledge Systems for Sustainability partners in Australia (CSIRO Great Barrier Reef) and Wales (Centre for Ecology and Hydrology).

5. *Leverage additional resources beyond the current scope/focus of the Chesapeake Bay Program Partnership.*
   - o Address interactions of water quality and public health.
   - o Reconstitute extension focus and develop tools to reach technical service providers.

o Begin to address mass nutrient imbalance by demonstrating new cropping and manure management systems that increase dairy and livestock profits while reducing nutrient imports. Approach agricultural producers and business to open dialogs on their role in reducing the imbalance.
o Address the need for greatly enhanced storm water management at all scales: identify positive activities; publicize and catalyze action.
o Compile and integrate data/information (i.e., Best Management Practices/farm management information, at the farm scale) by addressing privacy concerns.

Scale	Decision makers	Knowledge Needs
Individual Parcel		
	(Millions of people) • Farmers • Developers • Residents/property owners • Local zoning officers • Technical Service Providers (NRCS, dairy nutritionists, crop consultants, foresters, Cooperative Extension)	• Positive examples • Scenarios and trajectories • Planning tools • Individual impacts: economic, environmental, social
Community and Landscape		
	(Tens of thousands of people) • Community leaders • Township boards • County supervisors • Conservation districts • Chambers of Commerce • Watershed organizations	• Positive examples • Scenarios and trajectories • Planning tools • Community and landscape impacts: economic, social, environmental, cultural
Multi-State Watershed		
	(Hundreds of people) • EPA • USDA • Congress • State agencies • Governors • State legislators • Farm organizations • Environmental organizations	• Positive examples • Scenarios and trajectories • Planning tools • State and regional impacts: economic, environmental

Photos courtesy of USDA Natural Resources Conservation Service.

Summary

Restoration of the Chesapeake Bay and its watershed can benefit from this extended partnership, and the KSS-CBP effort should mobilize new collaborations and opportunities. Expansion of the USDA role in the regional restoration is a huge priority, enabling engagement of the agriculture industry as an advocate for high farm production with increasing water quality improvements.