Learning from stakeholder engagement in a regional earth system modeling initiative

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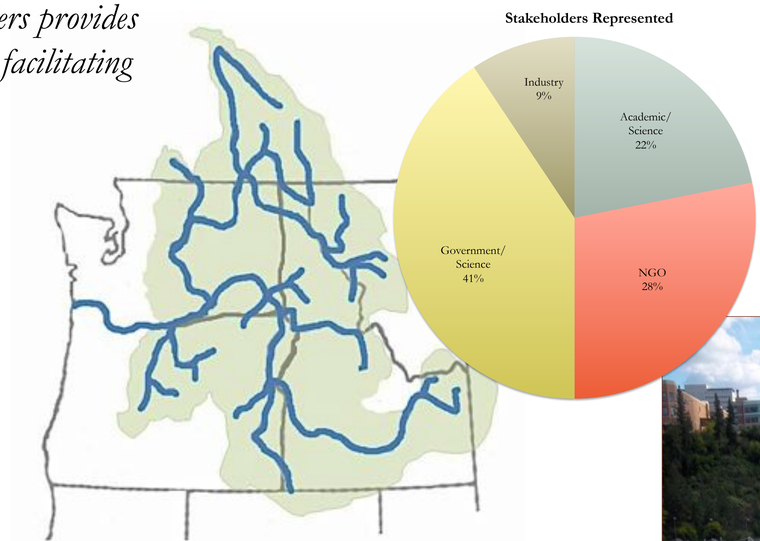
Study of interactions and evolving perceptions among researchers and stakeholders provides insights into how to better develop engagement strategies that achieve the goal of facilitating communication between the scientists and communities outside of academia.

Introduction to BioEarth:

BioEarth is regional earth systems modeling project based at Washington State University. The study aims to improve understanding of interactions between nitrogen and carbon cycling in atmospheric, terrestrial, and aquatic systems in the Pacific Northwest. It is hoped that findings from BioEarth will inform decision making by stakeholders in the agricultural and forestry sectors, two important components of the regional economy. Due to the complexity of the systems being investigated it is critical to have stakeholder input in order to accurately represent model attributes and guide research questions.

As environmental science research is increasingly justified with a "solutions" orientation focused on societal relevance, integration of stakeholder engagement is becoming a critical component of many earth system modeling projects. In environmental modeling, model developers have potential to engage directly with stakeholders who may be able to use the model results to inform decision-making. Such engagement has potential to improve model accuracy and enhance model relevance for communities outside of academia.

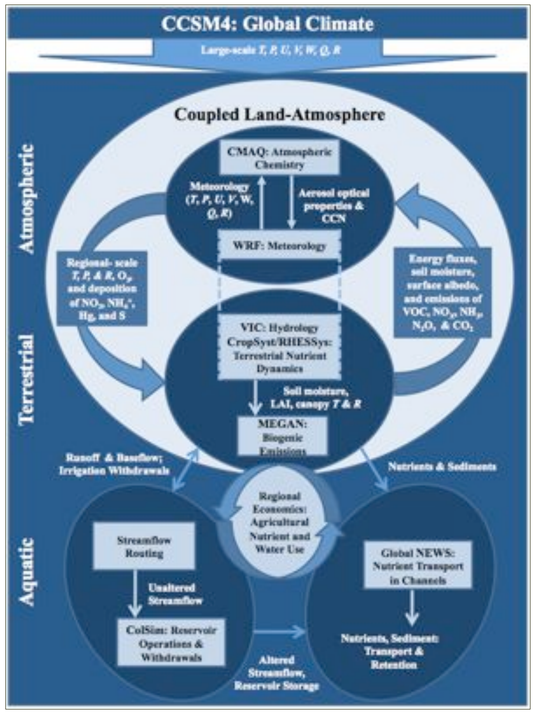
In February 2013 the BioEarth project's communication and extension working group convened two stakeholder advisory workshops in order to build understanding of how the BioEarth integrated earth systems model might produce outputs that are relevant to the needs of decision-makers concerned with carbon and nitrogen management and water availability. These meetings, held in Seattle, brought together a diverse group of 32 stakeholders from throughout the Pacific Northwest region, along with 12 BioEarth researchers. The workshops were an initial step toward establishing two-way communication to enable stakeholders to provide guidance and feedback to the modeling team as part of our effort to apply academic research to pressing social and environmental questions.

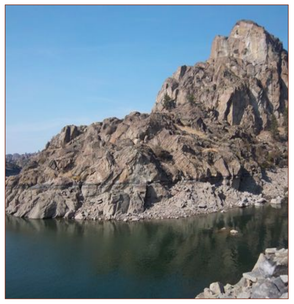


Workshops were designed to gain insight on 3 key questions:
1.What are current problems of concern related to environmental, economic and resource availability issues?
2. What questions about future changes are there and what information would aid in making better decisions?
3. What future scenarios would stakeholders be interested in seeing represented within the model?

Anticipated future changes:

Environmental changes: multi-year droughts, seasonal water availability, growing season, ranges of invasive species.
Political and social changes: Water markets, growth and development, conversion of farmland to urban or suburban uses.
Technological changes: Alternative energy, precision agriculture, new crops, increasing efficiency of irrigation systems.





The approach to modeling regional nutrient cycling and water availability in the context of climate change is being shaped by stakeholder feedback:

Model Scope: The heavy focus on agriculture when discussing possible applications of this model was noted by many stakeholders, who encouraged BioEarth researchers to develop the model with other applications in mind too. Future workshops addressing forestry and rangeland management in more detail may help develop some of those potential applications. One critical question that emerged relates to whether stakeholder engagement at later phases of model development should be limited to a more focused set of stakeholders? The observation "a model can't be all things to all people" encourages consideration of the value of future engagement with a more narrowly defined sub-set of stakeholders, perhaps focused on more specific potential applications of the model.

Model Time Frame: Different decision makers need information on different time scales: both short and long-term modeling is needed. For water quantity and nitrogen concerns, information is most helpful on the decadal or shorter time scale. In the case of carbon management, a 20-50 year time scale is also relevant. Particularly for nitrogen and water concerns, many stakeholders noted the importance of seasonal impacts.

Model Geographic Scale: Scale has critical influence in determining what questions the model may be applied to. Greater clarity about the achievable geographic scale of various model outputs was requested.

Scenarios to explore:

- Aggressive climate mitigation policies
- Impacts of different future energy scenarios on water availability.
- Different prices on carbon or nitrogen: what are the links between the price of carbon and the price of nitrogen?
- Policies that further develop ecosystem services markets
- Policies that further develop water markets
- Changes in waste management/re-distribution of C and N
- Regulations about harvestable timber

Reflections on communication:

- Future communication with stakeholders should continue to include multiple opportunities for reflection, refinement, and revisiting
- Enhanced development of relationships with Extension
- Demonstrate potential sample model outputs in a more tangible way, make the discussion of outputs concrete
- Keep discussion simple: visual data
- Easily navigable website allowing direct interaction of researchers and stakeholders
- Highlighting assumptions and uncertainties
- General appreciation for the opportunity to contribute to the BioEarth project

Paradigm 1:
Predict, Then Act

A best-guess is made about the future, then management plans, investments or policies are designed accordingly.

Guiding Question: What is most likely to happen?

Places unrealistic demands on modeling and climate science.

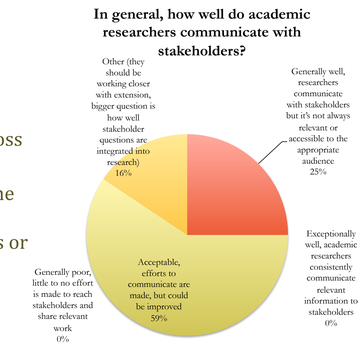
Paradigm 2:
Seek Robust Solutions

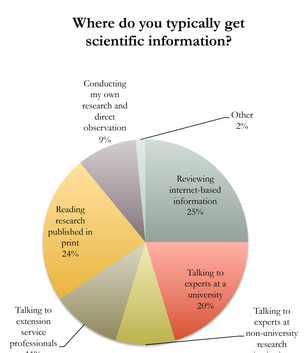
Vulnerabilities for a range of possible futures identified, then decisions that perform well across that range explored.

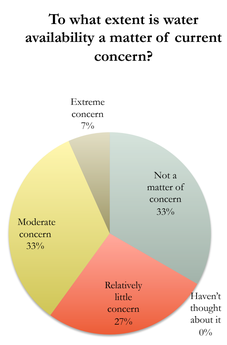
Guiding Question: How does the system work? When might management plans, investments or policies fail?

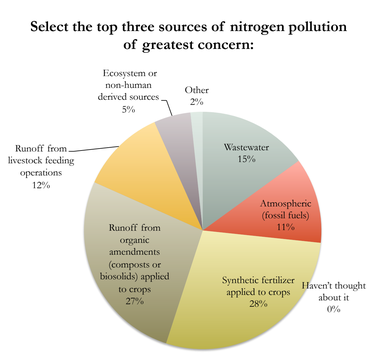
Accounts for complexity and uncertainty in earth systems & human decision-making

Sample results from pre-workshop surveys and digital response question sessions during the BioEarth stakeholder advisory workshops









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