BioEarth

Biosphere-relevant earth system model

2013 Stakeholder Advisory Workshops Synthesis Report

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.

Contents:

Workshops were designed to gain insight about 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?

I. Stakeholders represented at the workshops

Academic/science (7 individuals): University faculty with agriculture expertise (3), university forestry extension professionals (3), and a university extension tribal liaison.

NGOs (9 individuals): Representatives from an organics recycling council, a national water resources organization, an international environmental research institute, a regional climate policy organization (2), a national forestry organization, a regional conservation and development council, a farmland conservation organization, and a state water resources organization.

Government/Public Sector (13 individuals): Representatives from a city public utility, a county conservation district, state departments of agriculture (4), ecology, and natural resources, a regional clean air agency, the Environmental Protection Administration (2), the Natural Resource Conservation Service, and the National Parks Service.

Industry (3 individuals): Diversified irrigated farmer, agricultural supply company representative, and an environmental engineering consultant.

Groups not represented at the stakeholder meetings, but recommended for future inclusion by attending stakeholders:

Tribal governments were frequently mentioned as very important interest groups in the region; state departments of natural resources and fish and wildlife; more producers and industry (shellfish industry, wine growers, agriculture representatives from west of the Cascades, hydropower, private forest landowners); municipal leaders including county commissioners and other elected officials; Office of the Columbia River's Policy Advisory Group; National Marine Fisheries Service; and the Army Corps of Engineers and Bureau of Reclamation.

Citation: Allen, E., Kruger, C., Leung, F., Stephens, J. and Yorgey, G. (2013). *BioEarth Stakeholder Advisory Workshops Synthesis Report*. Washington State University.

II. Dominant regional problems of concern

Among stakeholders who deal with water availability issues in a professional capacity, water supply is a primary concern for decision-making. Stakeholders whose work is related to nutrient management see nitrogen management as a very important concern (but not the only one), and carbon management as a somewhat important concern.

Specific concerns about water availability: Reduced snowpack, reductions in summer flows, changes in precipitation, impacts of land management changes, increasing water demands, changes in the efficiency of irrigation systems, salmon management, hydropower demands, loss of riparian zones and salmon habitat; and tradeoffs between fish and energy. A considerable amount of discussion focused on tension between state and regional water management; i. e. with increasing water scarcity each state would act independently to serve their own interests, leading to questions about how to integrate management at the regional level. Some participants expressed that joint management of surface and ground water needs to happen and that the abandonment ("use it or lose it") doctrine in water rights is increasingly problematic.

Specific concerns about carbon management: Carbon storage potential and the impacts of land management practices and the role of fire, CO_2 fertilization, forest thinning (conflicting theories on how forest thinning impacts carbon were acknowledged), increasing attention to biofuels and the impacts of policies aimed at changing energy use patterns. Participants frequently noted that very little is known about underground carbon storage or the impacts of land use change and climate change on terrestrial carbon stores.

Specific concerns about nitrogen management: Runoff and nitrogen leaching (especially, but not exclusively, from synthetic fertilizer and organic amendments applied to crops), water quality impacts. Difficulty in defining excessive nitrogen use was widely acknowledged; i. e. quantifying how much is too much is a challenge. Precision nitrogen technology for agriculture was discussed; questions about the potential and limits of this technology for enabling new patterns of nitrogen management were raised. Whether specific sub-sectors of the agriculture industry that are particularly sensitive to changes in the price of nitrogen (possibly the Christmas tree industry) was discussed. Concerns about the impacts of increasing N_2O emissions on climate change featured strongly in the digital response questions.

Concerns about agricultural and forestry policy: The suggestion was raised that society needs to find ways to address the complex relationships between agriculture and climate change in ways that are acceptable to the industry; currently the agricultural industry is perceived by many to be "climate change skeptics", but by engaging agricultural interests more productively around climate adaptation may be possible. Another discussion that took place challenged the high yield paradigm; several of the stakeholders expressed the viewpoint that the environmental cost of continually increasing the intensity of agriculture is unsustainable, and reductions in fertilizer and herbicide inputs, for example, could contribute to a transition to more sustainable, though lower-yield, systems. The diversity of concerns for forest managers, depending on whether they are corporate entities who have to manage to maintain annual profitability, or family farmers or public land managers, who may have different management goals was also discussed.

III. Anticipated Future Changes:

Environmental changes: Changes in the frequency of multi-year droughts and extreme events, seasonal timing of water availability, growing season, habitat, ranges of invasive species, impacts of increased atmospheric CO_2.

Political and social changes: Possibility of water markets, growth and development, urbanization, conversion of farmland to urban or suburban uses.

Technological changes: Potential for alternative energy sources, precision agriculture, new crop varieties, increasing efficiency of irrigation systems (questions were raised about the limits of additional efficiency improvements in the study area).

IV. Information that Could Improve Decision-Making:

- Assessment of the outcomes of pursuing current best management practices for croplands, forests and rangelands. Evaluation of whether management changes would bring the region closer to or further from regional goals.
- Comparison of proposed beneficial uses of incentive dollars across a range of options: where are the greatest gains for the least cost possible?
- Vulnerability Assessments: identifying areas that are more or less sensitive to future changes.
- Information about how forest thinning impacts nutrient dynamics.
- Information quantifying the likelihood of various future environmental changes would be helpful.
- Understanding potential contributions and limitations of political, social and technological changes designed to address environmental challenges.

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.

V. Future Scenarios to Explore:

- Climate change regimes and impacts on crop production: possibilities for new crops, potential negative impacts on existing crops. Researchers need to think about how to incorporate future genetic change (or not) and what this means for the usability of results for stakeholders.
- Land use change scenarios: what would be the impacts of future land use changes on carbon, nitrogen and water availability?
- Changes in water quantity supplied and demanded, and impacts on water quality and water temperatures
- Pesticide use changes: will pesticide use increase as climate change expands the range of some pests?
- Shifting energy sources (emphasizing biomass-based energy), and resulting impacts on nutrients and water
- Changes in wildfire patterns
- Impacts of increasing efficiency in irrigation systems and water distribution systems on water availability (different in different locations?)

Specific policies of interest:

Stakeholders suggested that modeling these policies may allow for analysis of possible outcomes and unintended consequences.

- Aggressive climate mitigation policies
- Impacts of different future energy scenarios (management of hydropower versus other alternatives) on water availability.
- Different prices on carbon or nitrogen: what are the links between the price of carbon and the price of nitrogen? What are possible unintended consequences of a tax on carbon and/or nitrogen?
- Policies that further develop ecosystem services markets
- Policies that further develop water markets (including water leasing for conservation): how would they impact water availability and flows? A concern of agricultural sector representatives is that water could be unavailable to producers if there are other users willing to pay more. Conservation groups expressed concern about potential negative impacts on flows, even for conservation leasing.
- Changes in waste management/re-distribution of C and N (how far does it make sense to transport wastes?)
- Regulations about harvestable timber (e.g. ESA listings, slope requirements)

Opportunities to model policy scenarios being explored by other regional entities:

- NOAA-Ruckleshaus Center discussion of salmon fisheries management policies
- Consider impacts of the Columbia River Treaty renegotiations

VI. Reflections on Communication:

- Future communication with stakeholders should continue to include multiple opportunities for reflection, refinement, and revisiting (e.g. providing sample outputs that people can respond to and providing additional time for written responses in addition to oral discussions).
- Enhanced development of relationships with community-based Extension programs might help engage more stakeholders with interests related to BioEarth
- Demonstrating potential sample model outputs in a more tangible way could help stakeholders understand the scope and scale of what is possible. Making the discussion of outputs concrete (showing sample outputs) may be helpful
- Discussion of the model and potential outputs needs to be simple: visual data (graphs and conceptual models) are easier to understand than text or lots of numbers.
- Many stakeholders would like to see information shared through an online format with an easily navigable website allowing stakeholders to interact directly with researchers, in addition to face-to-face meetings.
- Communicating model inputs is important, as is highlighting assumptions and uncertainties. Clear discussion of interpretation of results should also include the limits of the relevance of model outputs.
- Recognition of the project's ambition as well as its challenges was widely expressed among participating stakeholders. Participants also demonstrated appreciation for the opportunity to contribute to the BioEarth project.

Communicating with stakeholders about model uncertainty is one of the central challenges of developing a model that seeks to be actionable.

Additional detail and the full transcripts of the workshop sessions are available from the BioEarth Communication team. The attached appendix of digital response (clicker question) results may be useful if you'd like to understand participating stakeholders' perspectives on a more specific issue or question. We greatly appreciate the time and energy that BioEarth researchers and stakeholders invested in this process, and feel that the questions raised and perspectives shared at the stakeholder advisory workshops were extraordinarily valuable in guiding the research team's approach to model development.

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