Stakeholder engagement in the development and application of a regional earth systems model: an analysis of researchers' perceptions

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Introduction:

BioEarth is a regional earth systems modeling project that aims to improve understanding of interactions between nitrogen and carbon cycling in atmospheric, terrestrial, and aquatic systems in the Pacific Northwest. The project was designed to inform decision-making of stakeholders in two critical sectors of the regional economy: agricultural and forestry. Due to the complexity of the systems being investigated, stakeholder input is critical to accurately represent model attributes and guide research questions.

Many modelers, ecologists, and economists have limited experience engaging stakeholders from outside academia. A growing body of literature examines best practices for stakeholder involvement in environmental research and decision-making (Shackley 2003, Prell 2007, Voinov 2008, Dougill 2006, Cash 2000, Welp 2006). To date, however, there has been minimal analysis of researchers' perceptions and attitudes about stakeholder engagement in the development and application of earth systems models.

Communication and Engagement Objectives:

- I. Conduct research on the baseline goals, perspectives and experiences of BioEarth Principal Investigators (PIs) to inform the design of stakeholder engagement strategies for the project.
- II. Analyze information obtained from surveys and interviews conducted with the 18 co-PIs to better understand challenges and opportunities for scientific communication and contribute to the literature on interactions between researchers and non-academics stakeholders.

Methodology:

We conducted a brief quantitative questionnaire and a 20-45 minute semi-formal interview with each of the project's 18 PIs on the topics of stakeholder engagement and project communication. 11 of the interviews were conducted in person, the remaining 7 were conducted over the phone. Interview transcripts were coded and interpreted following a thematic content analysis approach. On the basis of survey and interview data, we outlined continuums of perceptions among researchers about who the primary stakeholders are and what their roles within the research process ought to be as well as the major challenges to be overcome. We identified various concepts of when and how stakeholders should be engaged. Continuing analysis of the interview transcripts will allow for further discussion of how PIs perceive the production and character of knowledge as it relates to their visions of successful outcomes for BioEarth. Researchers' assertions and opinions can be clustered together to create mental maps that represent different modes of perceiving the role of stakeholders in the creation and application of earth systems models.









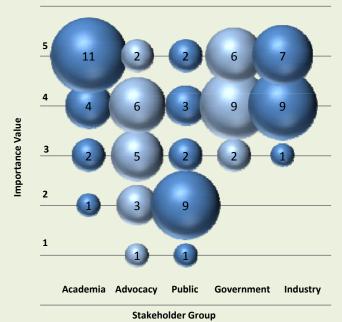
Analysis of Questionnaire Data



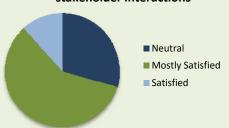
BioEarth researchers' self-reported



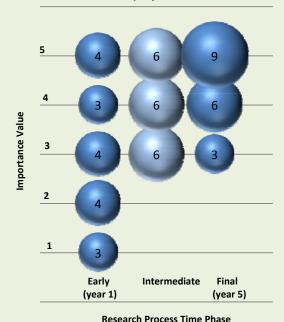
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BioEarth researchers' level of satisfaction with previous stakeholder interactions



Perceived importance of stakeholder engagement at various phases in the project



Bubble size indicates the number of responses from PIs

Analysis of Interview Data: Continuums Representing Researcher Perceptions Each dot represents the place where one PI's response falls on the spectrum being depicted Case 10: "There should be some representative of the Which groups constitute stakeholders? general public, state taxpayer group, kind of the non-Case 14: "I think BioEarth would really be special interest special interest. It's the hardest group more relevant for stakeholders that make to represent, but you really need to." decisions over large spatial areas." Broad definition of Narrow definition of stakeholders that stakeholders. encompasses every members of inhabitant of the region, academia are Case 3: "Community groups that may have a Case 12:"If it takes 20 scientists to make the model, a includes members of the identified as stake in decisions that are made by those stakeholder can never run it in that form... the general public. major industries that are the dominant primary number of people who will actually be able to use the stakeholder group are obviously very stakeholders. integrated model is a pretty small number." important." What defines a successful outcome for Case 2: "We're looking at creating a demonstration of what is possible with the current technology and the research project? scientific understanding...by engaging stakeholders we'll educate ourselves about the terms of interest for those communities, learn to speak a language that matters to them." Resource management A successful outcome decisions are made on •••• •• will advance the basis of the model. technical modeling stakeholders may Case 5: "It will open new opportunities for capabilities and Case 8: "I think the diversity of actively use and apply Case 17: "I really hope that the output research as well as modeling to help us better scientists involved in this project is contribute to will include some real tools for the model. understand how the whole system works... It really a challenge in that means we scientific knowledge. stakeholder decisions, but what you need will certainly provide a great training ground for all have different conceptualizations to do is to really take into account the PhD students and post-docs." of what this coupled modeling system input that stakeholders need in order to is going to look like. I think there is What are the project's major challenges? trust the output." great potential to confuse and inflate expectations for this model." The primary challenges Challenges are are related to technical in nature; the •••••• communication, ensuring focus is on integrating stakeholder model components participation, and that focus on multiple Case 11: "We envision developing a project based on a really Case 9: "The challenge is finding the right balance diverse set of tools at many different scales, so we have to be between complexity and simplicity... it is particularly spatial and temporal appropriate integration dealing with all the processes that happen at very local important to keep in mind how stakeholders are going of stakeholder input in scales. to use this information for trying to find that balance." the model.

Conclusions:

A range of perceptions among BioEarth researchers regarding the kind of involvement and degree of influence that stakeholders may have in the model development process is observed. An association has emerged between how broadly stakeholders are defined and how expected project outcomes are conceptualized. Those PIs who described primary stakeholders as members of academia were more likely to focus on the capacity of the research to build knowledge of model development and integration in the scientific community. Those PIs who defined stakeholders broadly were likely to discuss the model's possible application as a decision support tool. Attitudes about the major challenges for the project correspond to perception of who stakeholders are and successful project outcomes. Those with broad definitions of the stakeholders and hopes that the model will be applied to regional resource management problems tend to focus on possible barriers to communicating with stakeholders as a central challenge for the BioEarth research team.

Increasingly, research institutions are expanding stakeholder engagement efforts for a variety of reasons: stipulations from funding agencies, calls from advocacy organizations for increased public participation and accountability in research, as well as scientists' interest in expanding the relevance and applicability of their of research. This study represents an important transition toward analyzing baseline expectations and experiences of PIs in order to maximize the effectiveness of future stakeholder engagement efforts and adequately prepare for challenges. In addition to project-specific insights, it is our hope that this analysis will provide general insights into scientific communication on the subject of environmental change research.

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