# Stakeholder engagement in the development and application of a regional earth systems model: an analysis of researchers' perceptions GC23C-0975

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# Introduction to BioEarth:

### 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

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:

research questions.

- 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.

# Questionnaire

in your previous work? (check ☐ Not at all Rarely Occasionally Frequently Always

2. How satisfied have you been with previous stakeholder interactions? (check one) Dissatisfied Mostly Dissatisfied Neutral

Mostly Satisfied Satisfied ☐ Very Satisfied

3. How often have you interacted with stakeholde for the BioEarth project so far? (check one) ☐ Not at all ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7-8 times ☐ More than 8 times

critically important to the project's success. a. Government agencies \_\_\_\_\_ c. General public \_\_\_\_ d. Industry (ex. agriculture and forestry) \_\_\_\_ e. Advocacy organizations (including NGOs) \_\_\_\_ 5. Please rate on a scale of 1-5 your assessment of the stakeholder engagement at each of these phases in the BioEarth Project. "1" represents no role for stakeholders and "5" signifies that stakeholder input is critically important to the project's success. a. In the **first year** of BioEarth b. In the **intermediate** phase of developing the BioEarth c. In the **final** phase of

BioEarth \_\_\_\_

5 the importance of involving

each of these general

stakeholder groups in

BioEarth. "1" signifies that

there is no role for this group

of stakeholders, "5" signifies

that input from this group is

## **Interview Questions**

1) What is your role in the BioEarth project? How did you come to be affiliated with BioEarth? 2) How does this project fit in to other work that you are doing? 3) How is it similar to or different from other projects that you are working on or have worked on ir

(Probing questions: in terms of size of the group? Number of different disciplines involved?) 4) What do you expect to result from this project?

(Gauge how much they are thinking about stakeholder issues – applicability, results vs. process)

5) How important is communication between researchers in this project? To what degree does communication factor into the outcomes (successes? failures?) of a project such as BioEarth?

in place to ensure that people communicate regularly and make information about what they are doing available to the group? Should the discussions among modelers be public – part of the same forum where stakeholders interact with modelers?)

<u>Stakeholder Engagement</u> 7) Who, in your view, are the "stakeholders" for BioEarth?

8) From your perspective, how should stakeholders be engaged in the project? 9) What, in your view, is the potential for stakeholder engagement in the component(s) of BioEarth that you are taking the lead on? For BioEarth as a whole? From your perspective, what would make stakeholder engagement easier? What could be done to

generate more useful stakeholder input? 10) How do you imagine that stakeholders from the agriculture and forestry sectors will be able to

(Do stakeholders have unrealistic expectations because they don't know what is achievable?) 11) What do you see as the major challenges for the BioEarth project? Are there particular challenges associated with involving stakeholders in the development of a regional earth-systems

(Are there significant barriers to involvement? To what extent is there a role for stakeholders in the actual development of the model? In the use and application of the model? 12) To what extent do you think that interaction with stakeholders can improve acceptance of the BioEarth project's findings?

## 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 Interview Data: Continuums Representing Researcher Perceptions

possible with the current technology and scientific nderstanding...by engaging stakeholders we'll educate

learn to speak a language that matters to them."

Case 14: "I think BioEarth would really be more

evant for stakeholders that make decisions over

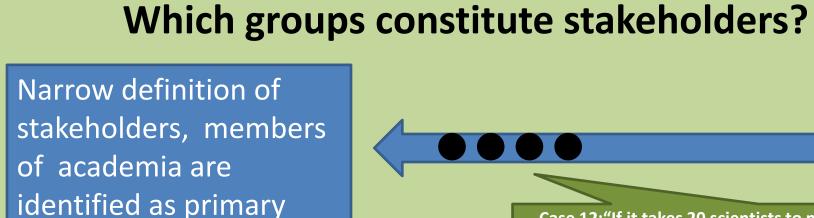
Neutral

Satisfied

stakeholder engagement at various

phases in the project

■ Mostly Satisfied



00000 Case 12:"If it takes 20 scientists to make the model, a stakeholder can ver run it in that form... the number of people who will actually be abl to use the integrated model is a pretty small number."

What defines a successful outcome for the research project?

A successful outcome will advance technical modeling capabilities 00000 and contribute to scientific knowledge.

## What are the project's major challenges?

Challenges are technical in nature; the focus is on integrating model components that focus on multiple spatial and temporal scales.

stakeholders.

Case 5: "It will open new opportunities for research as well as modeling to help us better understand how the whole system works... It will certainly provide a great training ground for PhD students and post-docs. Case 8: "I think the diversity of scientists involved in this project is really a challenge in that means we all have different nceptualizations of what this coupled modeling system is goin to look like. I think there is great potential to confuse and inflate

0000

Case 11: "We envision developing a project based on a ally diverse set of tools at many different scales, so we nave to be dealing with all the processes that happen a very local scales."

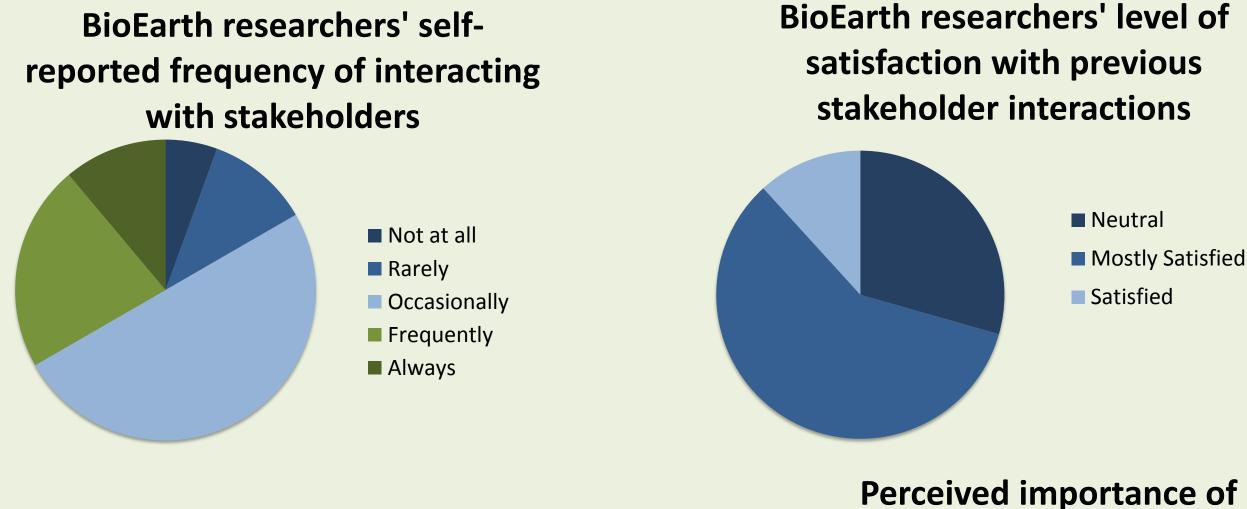
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ieral public, state taxpayer group, kind of the non Broad definition of stakeholders that 0000 encompasses every inhabitant of the region, Case 3: "Community groups that may have a stake in includes members of the ons that are made by those major industries that general public. se 2: "We're looking at creating a demonstration of what is

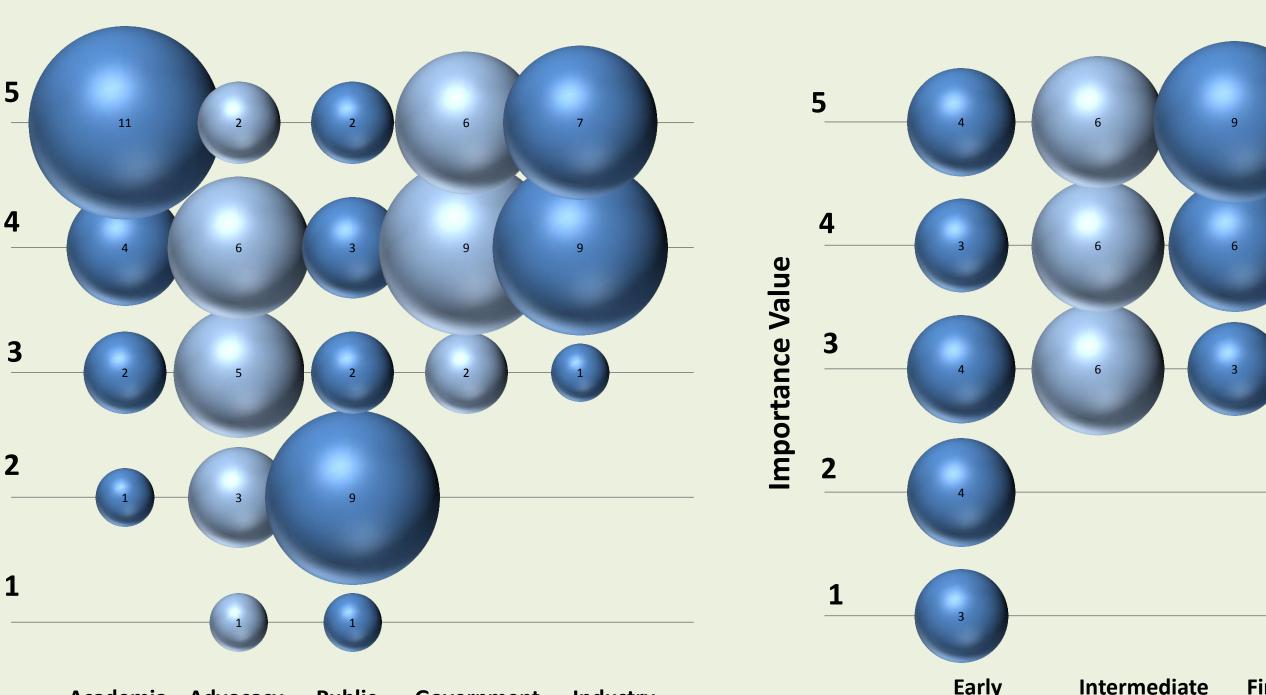
> Resource management decisions are made on the basis of the model, stakeholders may actively use and apply the model.

The primary challenges are related to communication, ensuring stakeholder participation, and appropriate integration of stakeholder input in the model.

# Analysis of Questionnaire Data



## Perceived importance of engaging various stakeholder groups



**Stakeholder Group** 

W O R C E S T E R • M A S S A C H U S E T T S • U S A

Bubble size indicates the number of responses from PIs

(year 1)

**Research Process Time Phase** 





(year 5)

## Conclusions:

ols for stakeholder decisions, but what you need to do is to

eally take into account the input that stakeholders need in

order to trust the output."

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Case 9: "The challenge is finding the right balance

etween complexity and simplicity... it is particularly

use this information for trying to find that balance."

rtant to keep in mind how stakeholders are going t

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.

# Acknowledgements:

se 10: "There should be some representative of the

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