

Incorporating Stakeholder Engagement in Regional Earth System Modeling

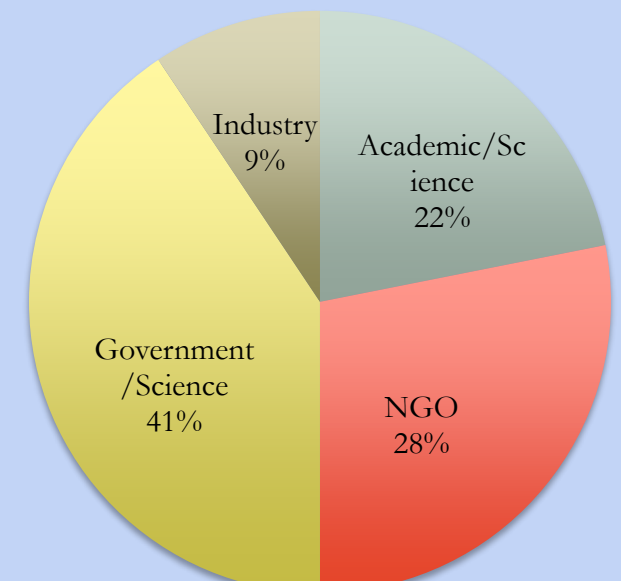
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Engaging directly with regional stakeholders who may use model results to inform their decision-making has the potential to improve model accuracy and relevance.

Background on the Workshops:

In February 2013 the BioEarth project's communication and extension working group convened two full-day stakeholder advisory workshops. These meetings brought together a diverse group of 32 stakeholders and 12 BioEarth researchers. This is an initial step toward establishing two-way communication that enables stakeholders to provide guidance and feedback to the modeling team.

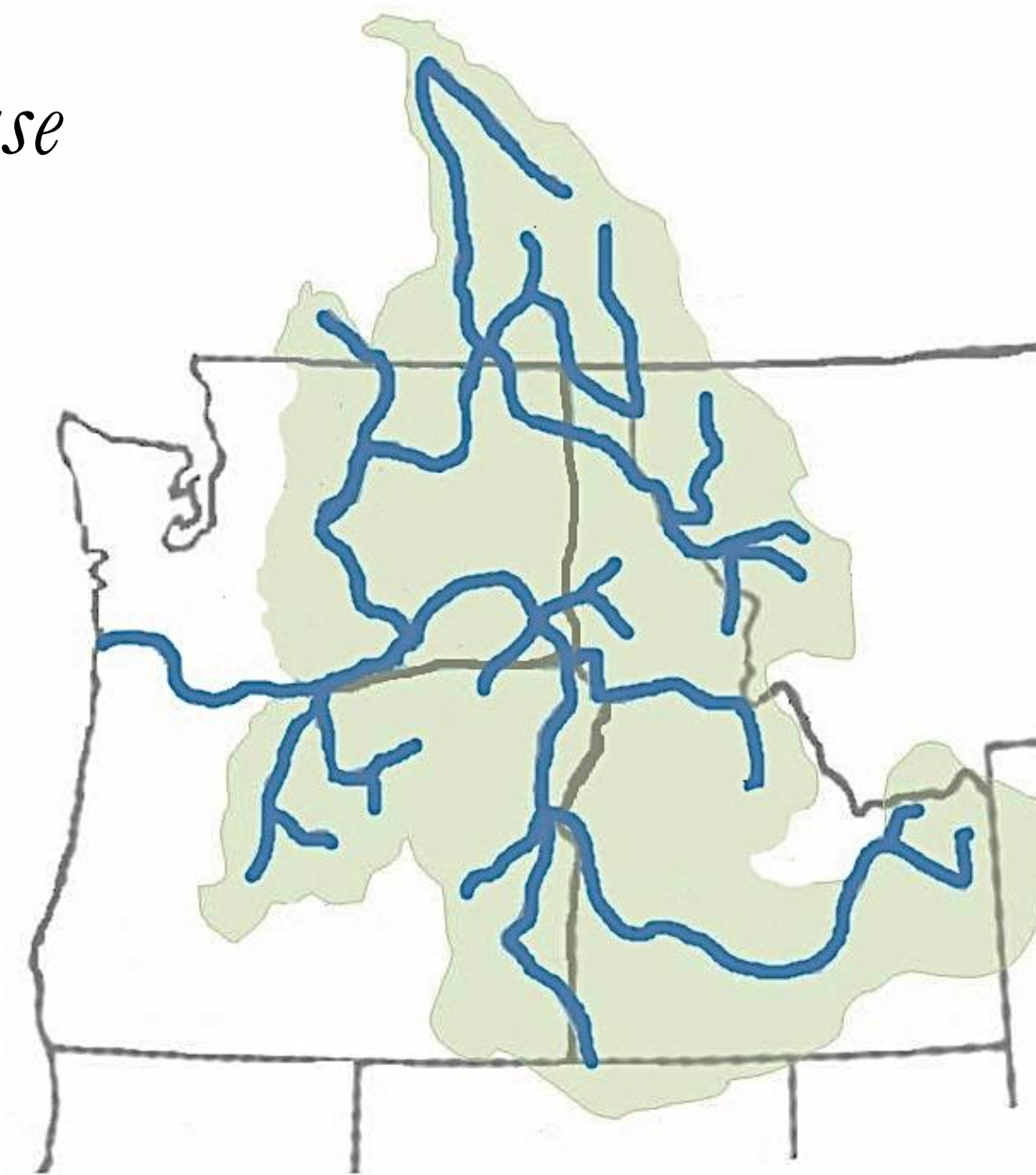


Our goal was to gain insight on 3 key questions:

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?

Our approach:

Through a facilitated round-table discussion and digital response “clickers” that allow real-time visualization of the group's perceptions we were able to elicit stakeholder's questions and concerns and draw on their expertise. We conducted pre- and post- workshop surveys to gain information about stakeholders' attitudes about the workshops and the integrated model being developed.



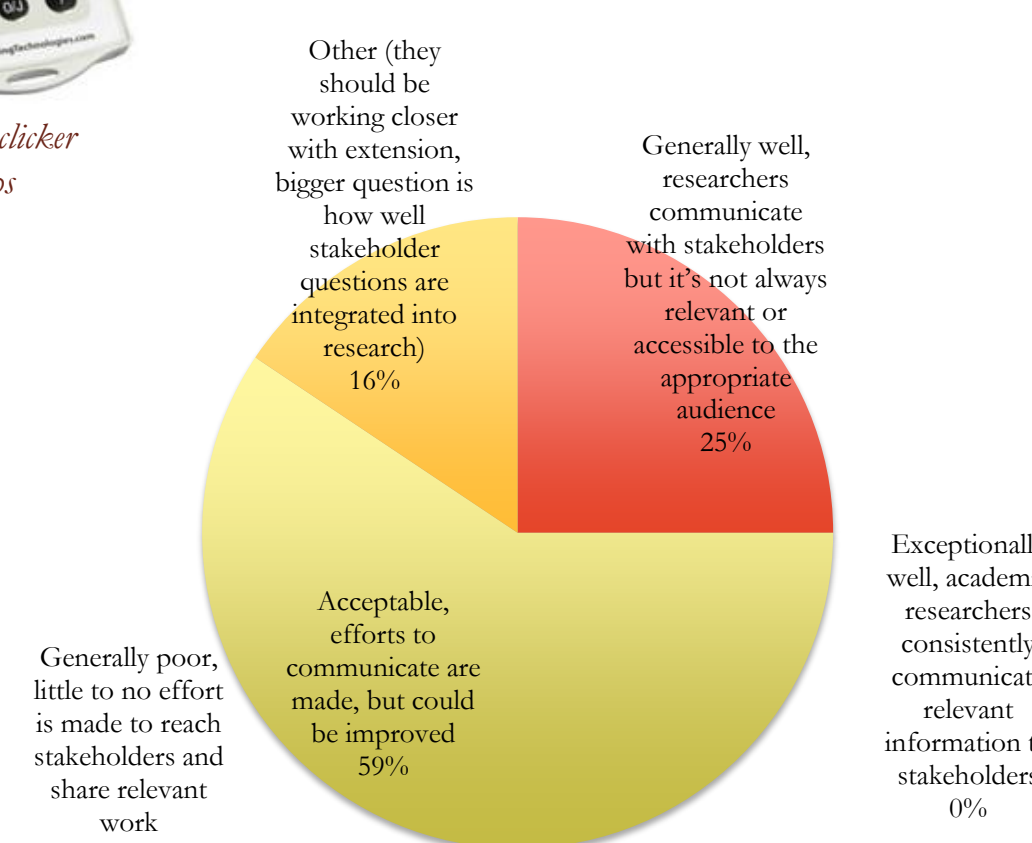
BioEarth is a 5-year project addressing climatic and anthropogenic impacts on water availability, nitrogen and carbon cycling in the Columbia River Basin. BioEarth will integrate and modify multiple existing models.

Selected results from survey questions during the BioEarth stakeholder advisory workshops

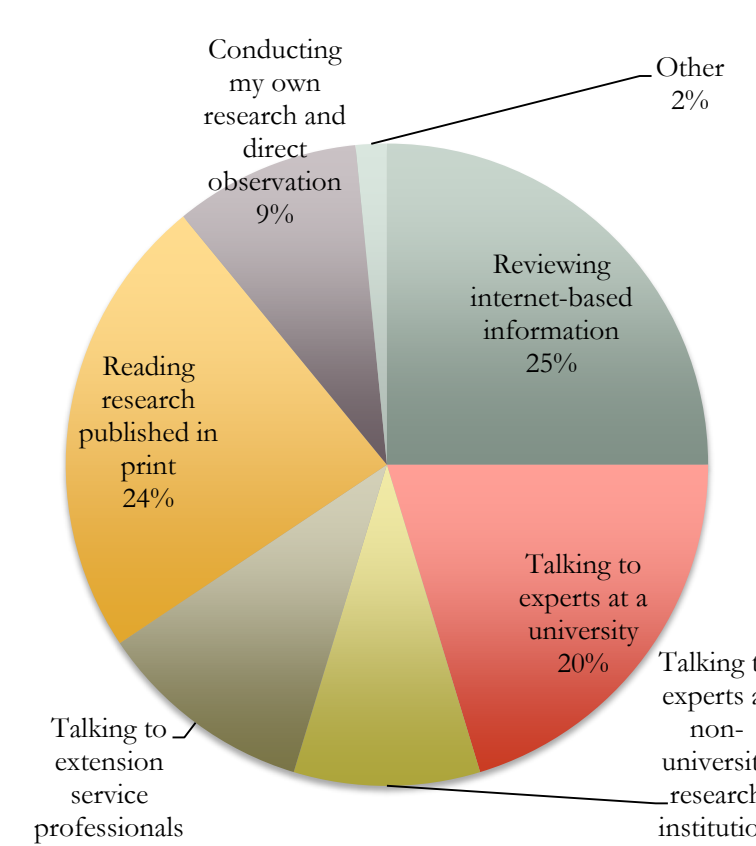


Digital response clicker used in workshops

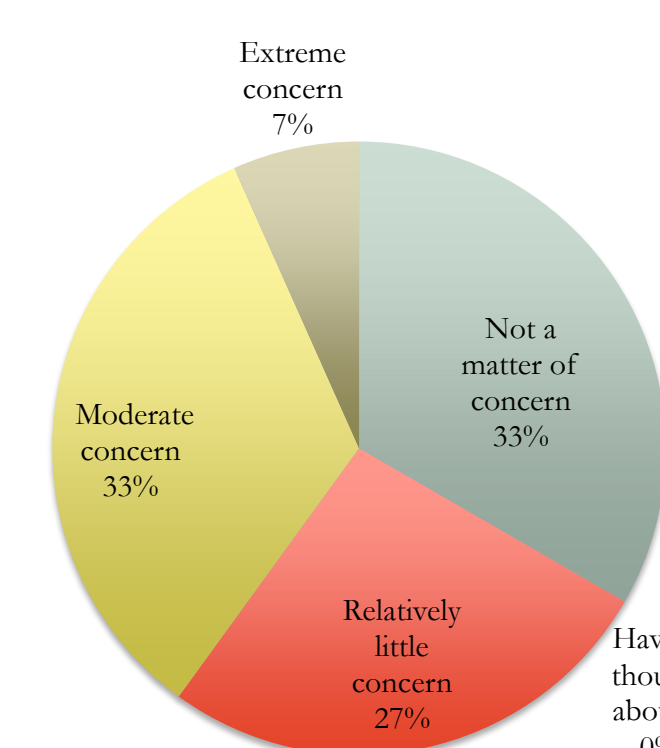
In general, how well do academic researchers communicate with stakeholders?



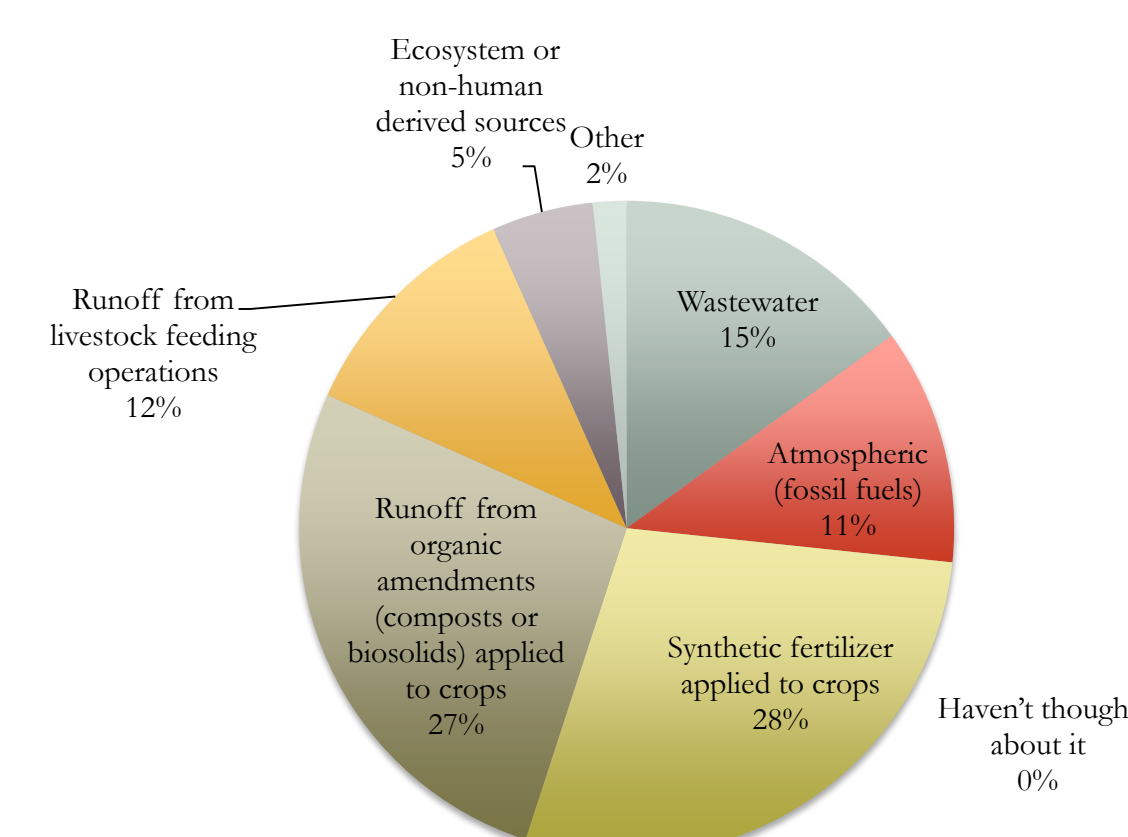
Where do you typically get scientific information?



To what extent is water availability a matter of current concern?



Select the top three sources of nitrogen pollution of greatest concern:

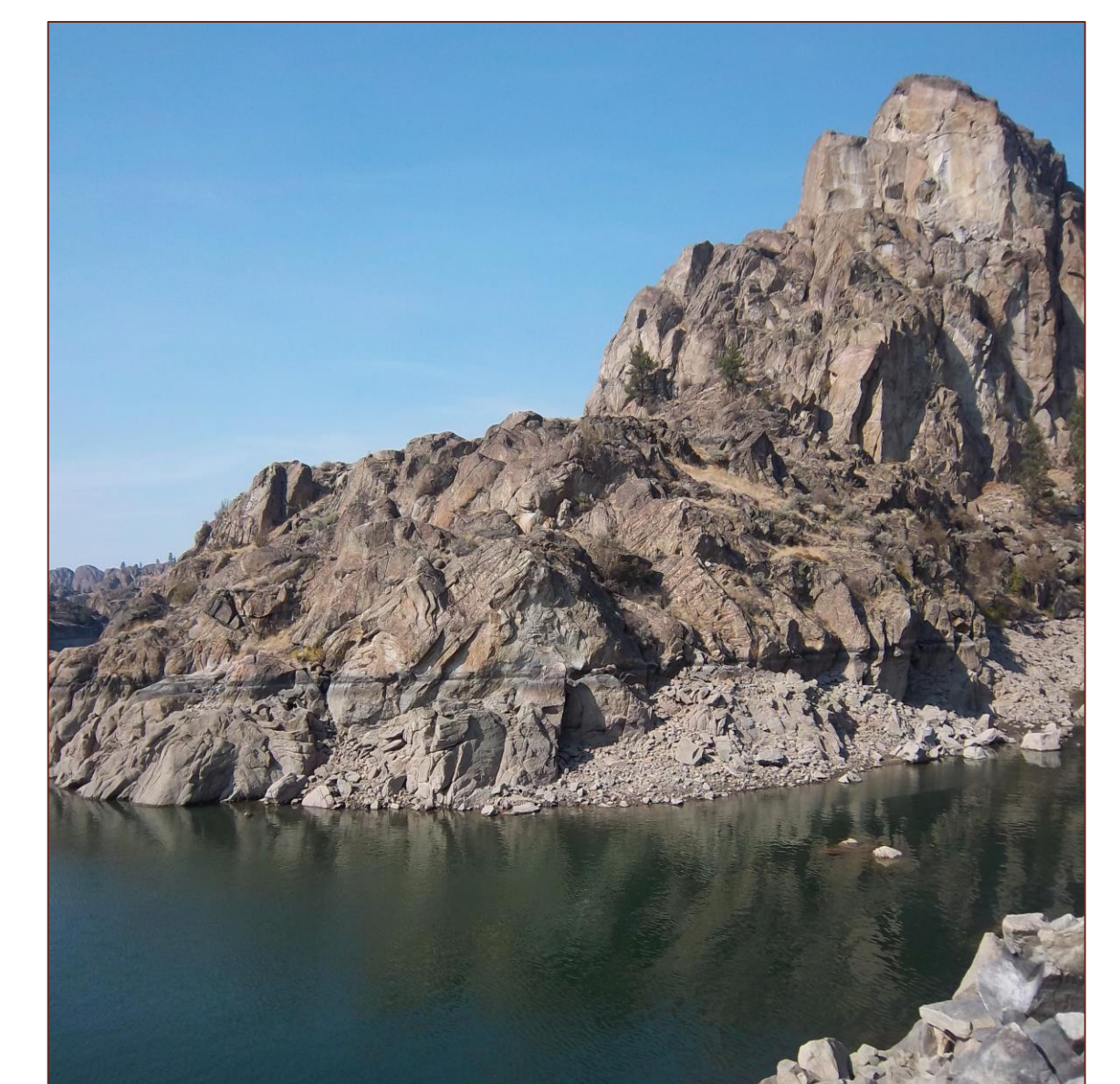


Changes stakeholders anticipated in the region:

- **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.

Scenarios of interest to stakeholders:

- 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 from stakeholders:

- Future communication with stakeholders should continue to include multiple opportunities for reflection, refinement, and revisiting goals
- We should enhance development of relationships with Extension Service professionals
- Future workshops should involve more tribal government representatives and other under-represented stakeholder groups
- There should be sample model outputs displayed in a tangible and visual way, making the discussion of outputs concrete
- An easily navigable website allowing direct interaction of researchers and stakeholders is an important resource to develop
- Communication should involve more education about modeling approaches and should highlight assumptions and uncertainties implicit in the model

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

Insights about how to develop a model that is useful to communities outside of academia:

Model Scope: The heavy focus on agriculture was noted by stakeholders, who encouraged 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 applications.

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.