BioEarth Stakeholder Meetings

The following questions were developed for use during BioEarth's first series of stakeholder advisory workshops that are set to take place in Seattle on February 27th and 28th. We're looking forward to convening these meetings and expect to have about 45 stakeholders from diverse backgrounds in attendance. Using a digital response system (handheld clickers) we'll be able to get input from stakeholders about their current and future concerns, questions, and information needs. The information from the multiple choice clicker questions will guide open-ended discussions about nitrogen and carbon management and water availability. Through these workshops we hope to learn how stakeholders prioritize different issues and scenarios that could potentially be explored in the BioEarth modeling framework.

Input from many members of the research team guided the development of these questions. Although there is not time to make large changes to the questions and agenda structure for the upcoming meetings, we're interested to know if people have suggestions to improve the clarity and utility of these questions, or if there are suggestions about more significant changes that we can apply to stakeholder workshops in future years.

Carbon and Nitrogen Supply Questions for Stakeholders

Objective I: *To understand current concerns about carbon and nitrogen management in forests and agricultural systems (environmental, economic, resource availability, other problems).*

1. To what extent do concerns about nitrogen influence your decision-making? This may include direct or indirect decisions about land management, educational programs or regulatory policies, or research and technology development.
    a. Not at all
    b. A little
    c. A lot
    d. The primary driver

2. To what extent is nitrogen's contribution to atmospheric GHG concentration a matter of concern?
    a. Not a matter of concern
    b. Relatively little concern
    c. Moderate concern
    d. Extreme concern
    e. Haven't thought about it

3. To what extent is nitrogen's impact on surface water quality a current concern?
    (Multiple-choice options for questions 3-6 are the same as those in question 2)

4. To what extent is nitrogen's impact on air quality a current concern?

5. To what extent is the current cost of nitrogen fertilizers a matter of concern?

6. To what extent are regulatory measures related to nitrogen a matter of concern?

7. Are you concerned about other current nitrogen impacts not mentioned above?
    a. Yes (please mention these during the discussion period)
    b. No

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

a. Wastewater
b. Atmospheric (fossil fuels)
c. Synthetic fertilizer applied to crops
d. Runoff from manure or sewage applied to crops
e. Runoff from dairy farms/ livestock operations
f. Ecosystem or non-human derived sources
g. Other (please mention during the discussion)
h. Haven't thought about it

9. To what extent do concerns about carbon influence your decision-making? This may include direct or indirect decisions about land management, educational programs or regulatory policies, or research and technology development.

a. Not at all
b. A little
c. A lot
d. The primary driver

10. To what extent is the impact of carbon on ecosystem productivity a current concern?

a. Not a matter of concern
b. Relatively little concern
c. Moderate concern
d. Extreme concern
e. Haven't thought about it

11. To what extent is the impact of carbon on agricultural productivity a current concern?
(Multiple-choice options for questions 11-17 are the same as those in question 2)

12. To what extent is the impact of carbon on forest productivity a current concern?

13. To what extent is the effect of carbon emissions on climate a current concern?

14. To what extent is the impact of fire on carbon stores a current concern?

15. To what extent is the impact of climate change on carbon stores a current concern?

16. To what extent are current land management practices' impacts on carbon stores a concern?

17. To what extent are the impacts of pests and plant diseases on carbon stores a current concern?

18. Do you have other concerns about other factors that impact carbon stores?

a. Yes (please mention these during the discussion period)
b. No

Objective I Open-ended Discussion Questions:

A. What concerns about the impacts of N and C do you have that weren't mentioned in the clicker survey? Why are the things you marked as your top concerns so urgent? (Why are some things less urgent?)

B. Which decisions are influenced by N concerns? How do these concerns drive decision-making? How does N relate to other factors when they come into conflict for making decisions? (Eliciting examples may be helpful here.)

C. What decisions are influenced by C concerns? How do these concerns drive decision-making? How does C relate to other factors that are influencing your decisions? (Elicit examples.)

D. Follow up to get more information about where people are coming from geographically, what they consider to be their geographic area of primary interest, and what information or observations influenced their response.

Objective II: *To understand questions stakeholders have about how future changes (ie. climate, markets, policy) might impact carbon and nitrogen management.*

19. Information about the environmental effects of different nitrogen management practices would help me most if such information were available on the following timescale:

a. Weeks
b. Months
c. 1-2 years
d. Decades – 10 years
e. 20-50 years
f. Other

20. Information about the environmental effects of different carbon management practices would help me most if such information were available on the following timescale:

(Same options as question 19)

21. How do you think most land managers would respond to a 50% increase in fertilizer prices if that increase were expected to be temporary (1 year)? (If you manage fertilizer, please answer for **yourself**)

a. No change in fertilizer use
b. Reduce fertilizer use
c. Reduce use of other inputs (e.g. herbicides, pesticides, water)
d. Increase use of other inputs
e. Adapt using other strategies not mentioned here (please mention during the discussion)

22. How do you think most land managers would respond to a 50% increase in fertilizer prices in the long-term (they expect a permanent price increase)? (If you do manage fertilizer, please answer for **yourself**)

(Multiple-choice options for questions 22-24 are the same as those in question 21)

23. How do you think most land managers would respond to a 200% increase in fertilizer prices if that increase were expected to be temporary (1 year)? (If you manage fertilizer, please answer for **yourself**)

24. How do you think most land managers would respond to a 200% increase in fertilizer prices in the long-term (they expect a permanent price increase)? (If you do manage fertilizer, please answer for **yourself**)

Objective II Open-ended Discussion Questions:

G. At what cost should we reduce N in water bodies? We could discuss whether a 50%--or 200%-- increase in the cost of food (or fertilizer tax / subsidy) in order to mitigate N pollution into water is acceptable, and allow the price to drive our selection of what technology (N inhibitors, precision N application equipment, dairy N recovery technology, more land for manure application, etc.) is considered in the scenario we model.

H. What factors that would drive a change in the fertilizer strategies that producers use? (Synthetic, manure, sewage...)

I. What (if any) policy tools for managing carbon might be plausible in the Pacific Northwest? (Carbon credits in a voluntary market, cap and trade, or other strategies?)

J. What are the gaps in your understanding of carbon storage potential in agricultural and forestry soils in the PNW region?

K. Are there any specific scenarios (environmental, economic, regulatory) that you would you like to see addressed in a model like BioEarth that integrates economics and biophysical processes?

Water Availability Questions for Stakeholders

Objective I: *To understand current concerns about water supply issues in forests and agricultural systems.*

1. To what extent is water availability a matter of current concern?
    a. Not a matter of concern
    b. Relatively little concern
    c. Moderate concern
    d. Extreme concern
    e. Haven't thought about it

2. To what extent do concerns about water supply influence your decision-making? This may include direct or indirect decisions about land management, educational programs or regulatory policies, or research and technology development.
    a. Not at all
    b. A little
    c. A lot
    d. The primary driver

3. In the event of a temporary (one year) 10% reduction in summer water from snowmelt, please rate this concern: **Curtailment of junior water rights holders.**
    a. Not a matter of concern
    b. Relatively little concern
    c. Moderate concern
    d. Extreme concern
    e. Haven't thought about it

4. In the event of a temporary (one year) 10% reduction in summer water from snowmelt, please rate this concern: **Meeting instream water needs to support fish populations.**

    (Multiple-choice options for questions 4-6 are the same as those in question 3)

5. In the event of a temporary (one year) 10% reduction in summer water from snowmelt, please rate this concern: **Increased fire hazard.**

6. In the event of a temporary (one year) 10% reduction in summer water from snowmelt, please rate this concern: **Reduced electricity generation.**

7. Do you have other concerns about the effects of water scarcity not mentioned above?
    a. Yes (please mention these during the discussion period)
    b. No

8. To what extent is increased out of stream water demand a current concern for water availability?

    (Multiple-choice options for questions 8-9 are the same as those in question 3)

9. To what extent are changes in land management practices a current concern for water availability?

11. How significant is the impact of increasing irrigation efficiency on current water availability relative to other factors than impact water availability?
    a. The most important factor
    b. Very important
    c. Average importance
    d. Low importance
    e. Not important
    f. Haven't thought about it

12. How important are the impacts of regulatory policies on current water availability, relative to other factors than impact water availability?

(Same options as question 11)

13. Can you think of other factors that impact water availability which you are concerned about?

a. Yes (please mention these during the discussion period)
b. No

14. Are you aware of producers that have changed their irrigation practices in the last 5 years? If so, how have they changed? (If you do irrigate, please answer for **yourself)** Please select all that apply:

a. Changed cropping patterns
b. Invested in more efficient irrigation delivery systems (drip, center pivot)?
c. Deficit irrigate more often but otherwise keep everything the same.
d. Other strategies not mentioned here
e. Not sure/ don't know of producers who have changed irrigation practices

15. How do you think most farmers who irrigate respond when winter snowpack is low in late winter/early spring? (If you do farm, please answer for **yourself**)

a. No change in planting and expect to deficit irrigate if there are prorated.
b. Reduce acreage of annual row crops.
c. No change in planting and expect to lease water from someone else.
d. Reduce planting of annual row crops and expect to sell, on a short term basis, water to someone else.
e. No change in planting of annual row crops that will be deficit irrigated and sell water, on a short-term basis, to someone else.

Objective I Open-ended Discussion Questions:

A. What current concerns do you have about factors that impact water availability that weren't addressed earlier?

B. What regulatory concerns do you have? At what level might these changes occur? (e.g. state, regional, federal, international)

C. What management decisions do you make that impact water availability? How? What factors (both water-related and non-water related) factor into these decisions?

D. What factors led to changes in irrigation practices? Under what conditions would water marketing be plausible? Are there potential challenges related to water marketing? (Make sure to discuss both in-basin transfers and out-of-basin transfers.)

Objective II: *To understand questions people have about how future changes (ie. climate, markets, policy) might impact regional water supply.*

16. To what extent are future reductions in winter snowpack an issue of concern?

a. Not a matter of concern
b. Relatively little concern
c. Moderate concern
d. Extreme concern
e. Haven't thought about it

17. To what extent are future reductions in summer precipitation an issue of concern?

(Multiple-choice options for questions 17-19 are the same as those in question 16)

18. To what extent are future increases in water demand a concern?

19. To what extent are future changes in land management practices an issue of concern for water availability?

20. How important will **future** changes in irrigation efficiency be for water availability relative to other factors?

a. The most important factor
b. Very important
c. Average importance
d. Low importance
e. Not important
f. Haven't thought about it

21. How important will **future** regulatory policies be for water availability relative to other factors?

(Same options as question 20)

22. How concerned are you about **future** changes in the cost of water?

a. Not at all concerned
b. A little concerned
c. Quite concerned
d. Extremely concerned
e. Haven't thought about it

23. How do you think most farmers who irrigate would respond to a permanent increase in the frequency of water curtailments (not allowed to divert their full right due to in-stream flow requirements)? (If you do farm, please answer for **yourself**)

a. Change cropping patterns.
b. Invest in more efficient irrigation delivery systems (drip, center pivot)?
c. Deficit irrigate more often but otherwise keep everything the same.
d. Sell their water right.

Objective II Open-ended Discussion Questions:

E. What specific scenarios would you like to see addressed in a model like BioEarth that has the capacity to integrate agent-based economic models with a biophysical model? What would be of most interest to you (in terms of understanding the impacts, prompting public conversations?

F. What potential strategies for better managing water supply in the future are of most interest?

G. What gaps in understanding exist for current and future water supply?

H. How do you think most farmers who irrigate would respond to a policy that paid for increased irrigation efficiency with state funds and allowed farmers to increase their total irrigated acreage in exchange for keeping some portion (%?) of the water saved in the stream?