Working Together for Usable Climate Change Impacts Models:

Thoughts on Developing Metrics to Assess Interdisciplinary Environmental Research Efforts

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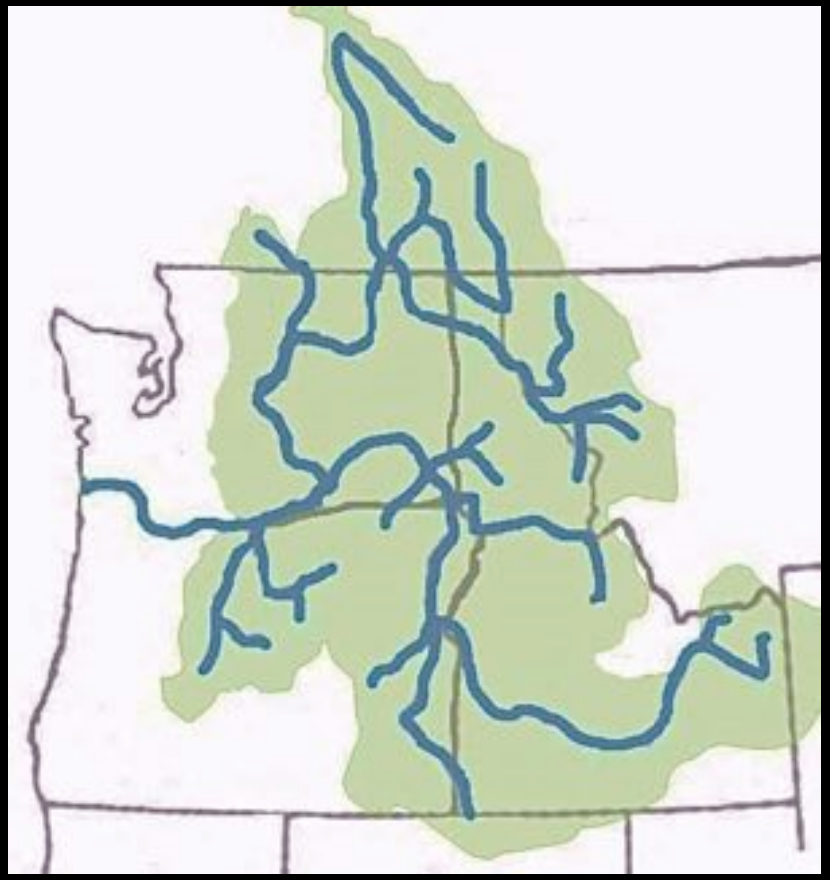
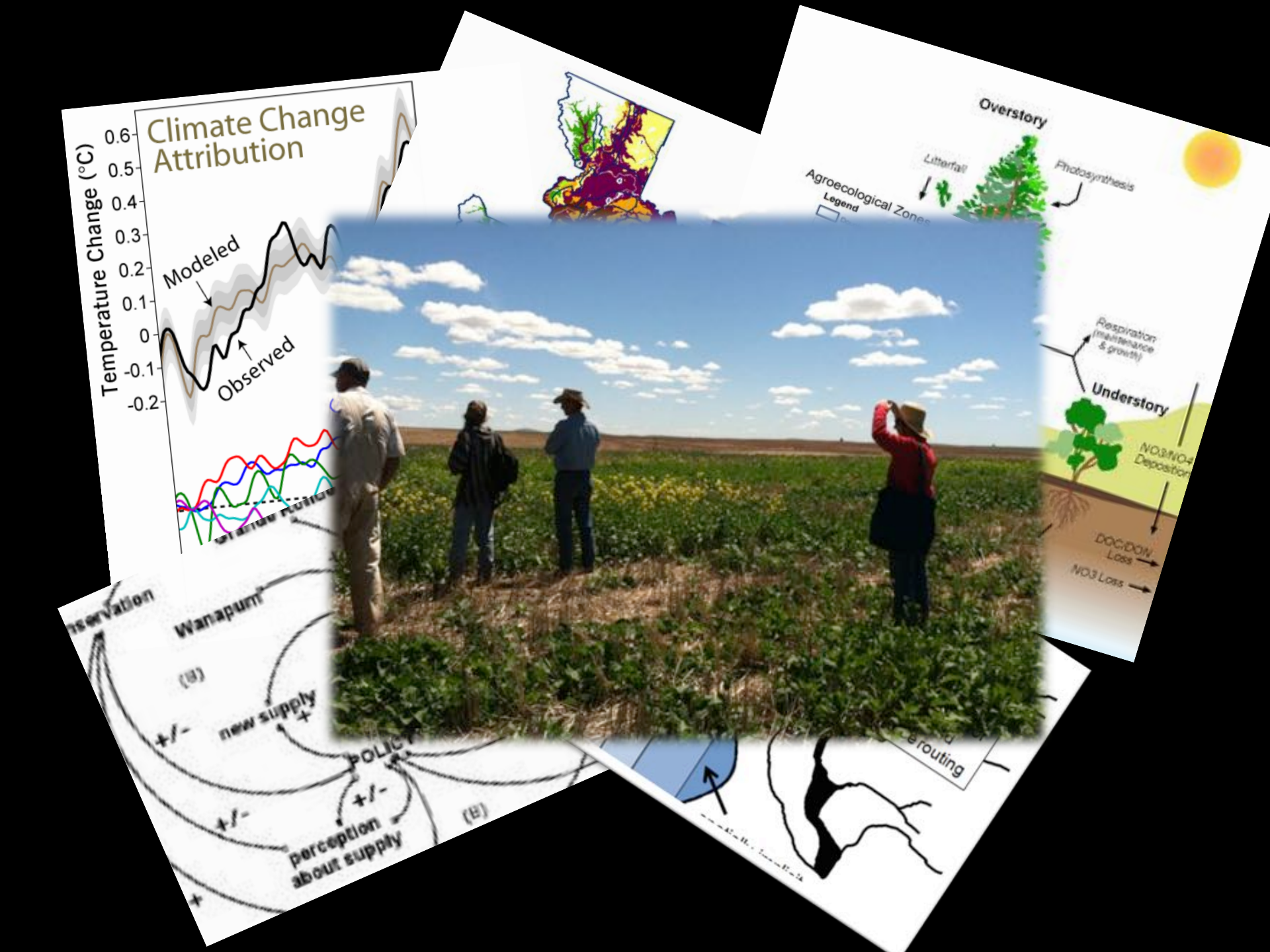
Innovations in Collaborative Modeling
June 2016



Columbia River Basin

Climate change will affect agriculture, forests, air and water quality, water supply, storm frequency


Climate Change Attribution
Temperature Change (°C)
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
Modeled
Observed
Overstory
Litterfall
Photosynthesis
Agroecological Zones
Legend
Respiration (maintenance & growth)
Understory
NO3/NO4 Deposition
DOC:DON Loss
NO3 Loss
Wanapum
new supply
perception about supply
routing

Comparative assessment of 3 teams

WISDM

Collaborative system dynamics modeling;

Basin-specific approaches

BioEarth

Stakeholders help define researchable questions;
Issue-based workshops

REACCH
Regional Approaches to Climate Change – PACIFIC NORTHWEST AGRICULTURE

Stakeholder input on regional scenarios;
Separate objectives

Continuum of approaches to stakeholder engagement

Process-oriented ⟷ Product-oriented

Who are the key stakeholders?

What is ***USABLE*** science?

What should the role of universities be?

The "gap" between science & practice

Study Purpose:

Document evolving perceptions within interdisciplinary teams

in order to

Determine which approaches contribute to *usable* information for regional decision-makers

Research Methods

- Focus groups at workshops
- Detailed observational notes
- Multiple choice surveys
- Semi-structured interviews

Interviews with Researchers

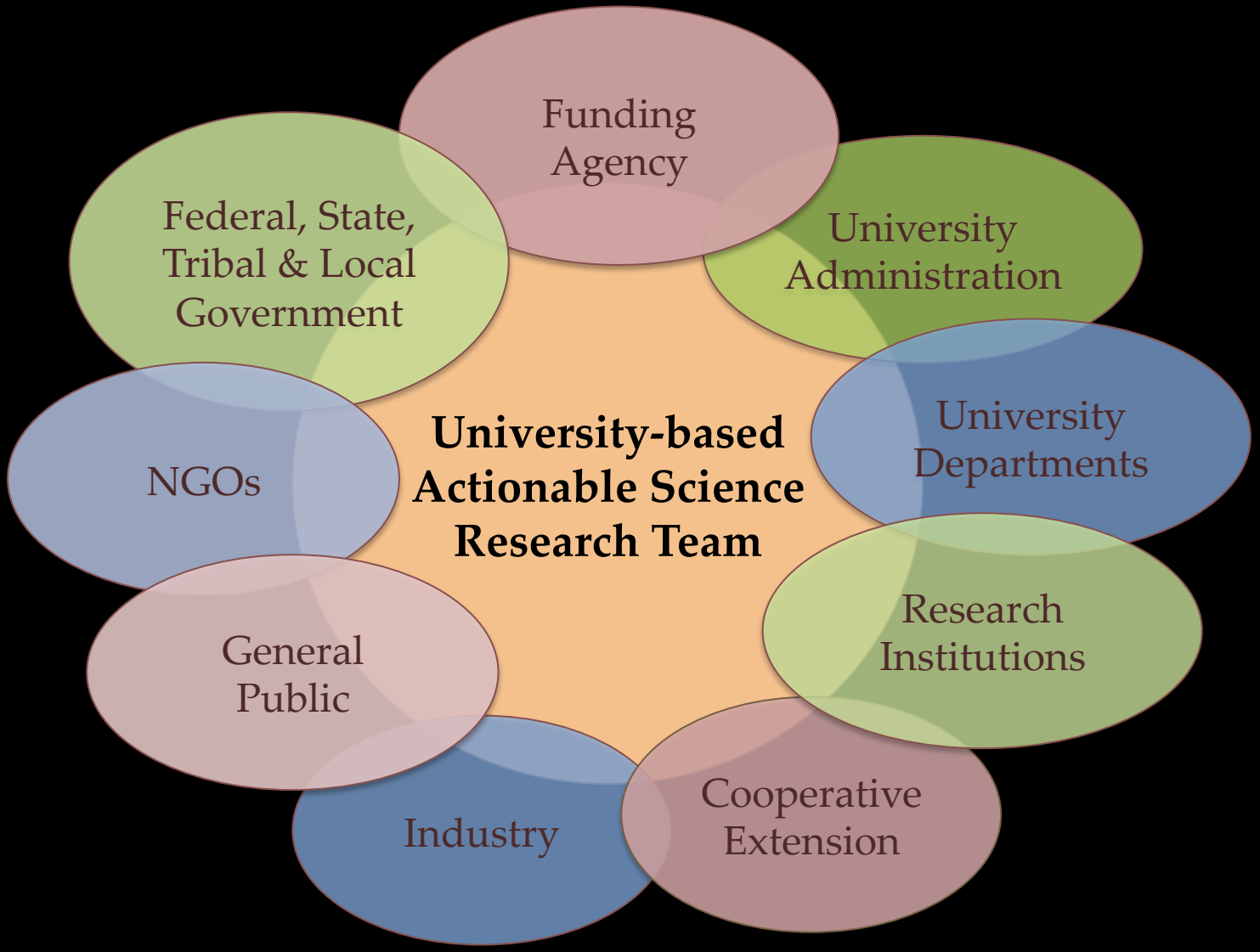
Summer 2011-Winter 2015

WISDM	BioEarth	REACCH	Total Individuals
	11		11
4			4
4			4
	1		1
1			1
		4	4
9 co-PIs	20 co-PIs	8 co-PIs	25 co-PIs

Foundational Concepts:

- In order to manage adaptively, decision-makers must be engaged in research
- Boundary organizations negotiate between cultures and norms
- Learning organizations create, retain and transfer knowledge

BOUNDARY SPANNING

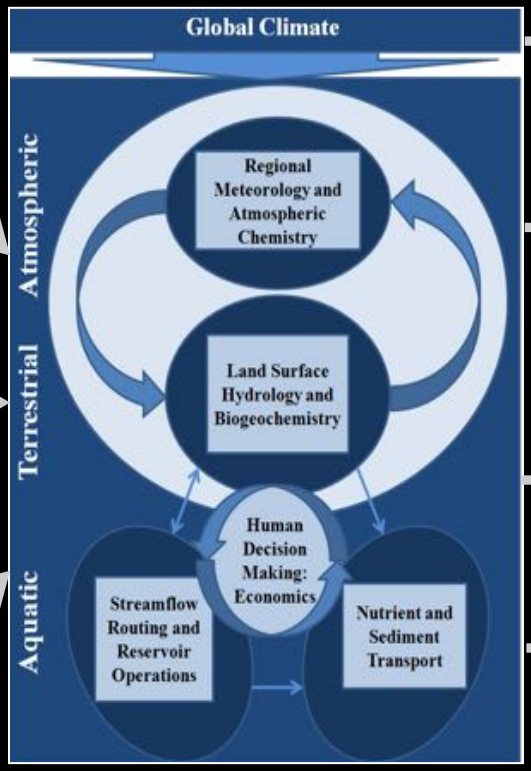


Models as Boundary Objects

Resource Managers

Policy Decision-Makers

Researchers



Publications, Fact sheets, Presentations

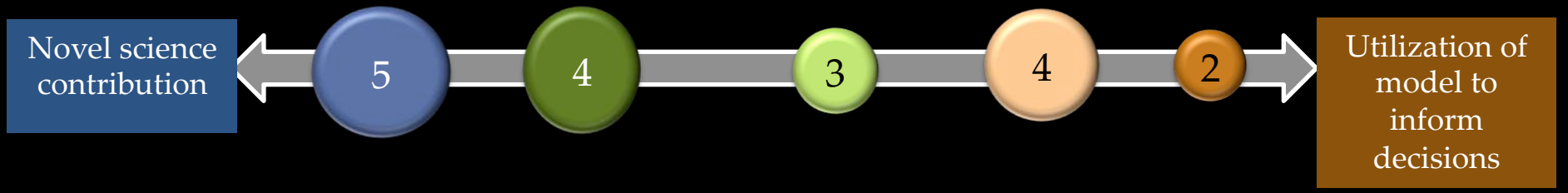
Projections of Impacts ("Scenarios")

Identification of Vulnerabilities

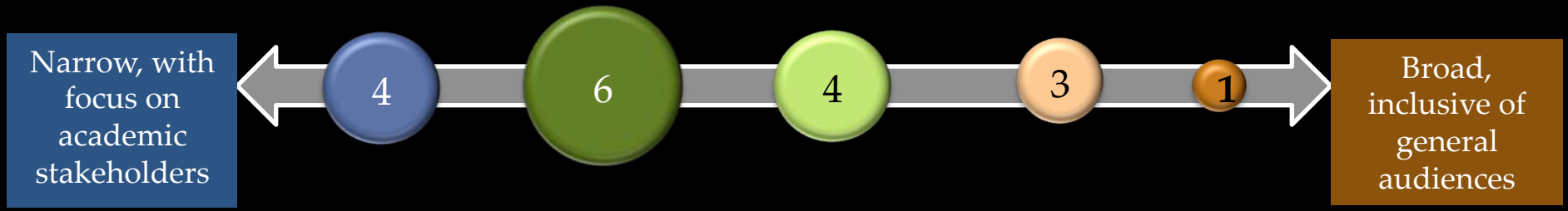
Decision Support Tools

Interview Results: Perceptions among BioEarth Researchers (2011)

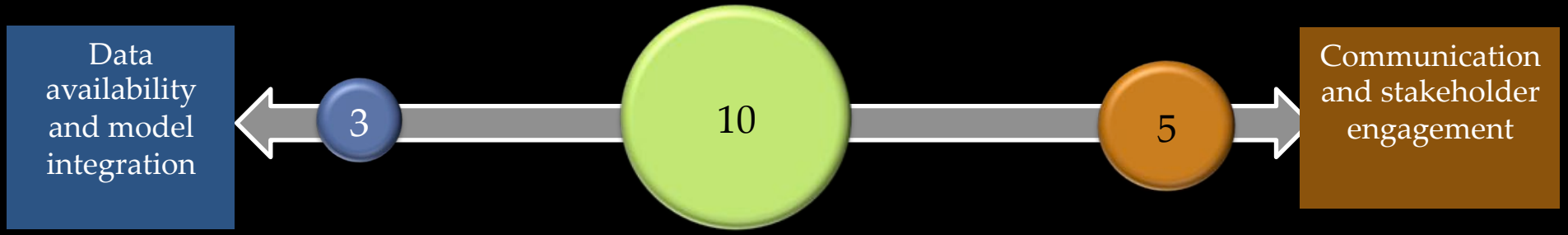
a. What defines a successful outcome for the research project?



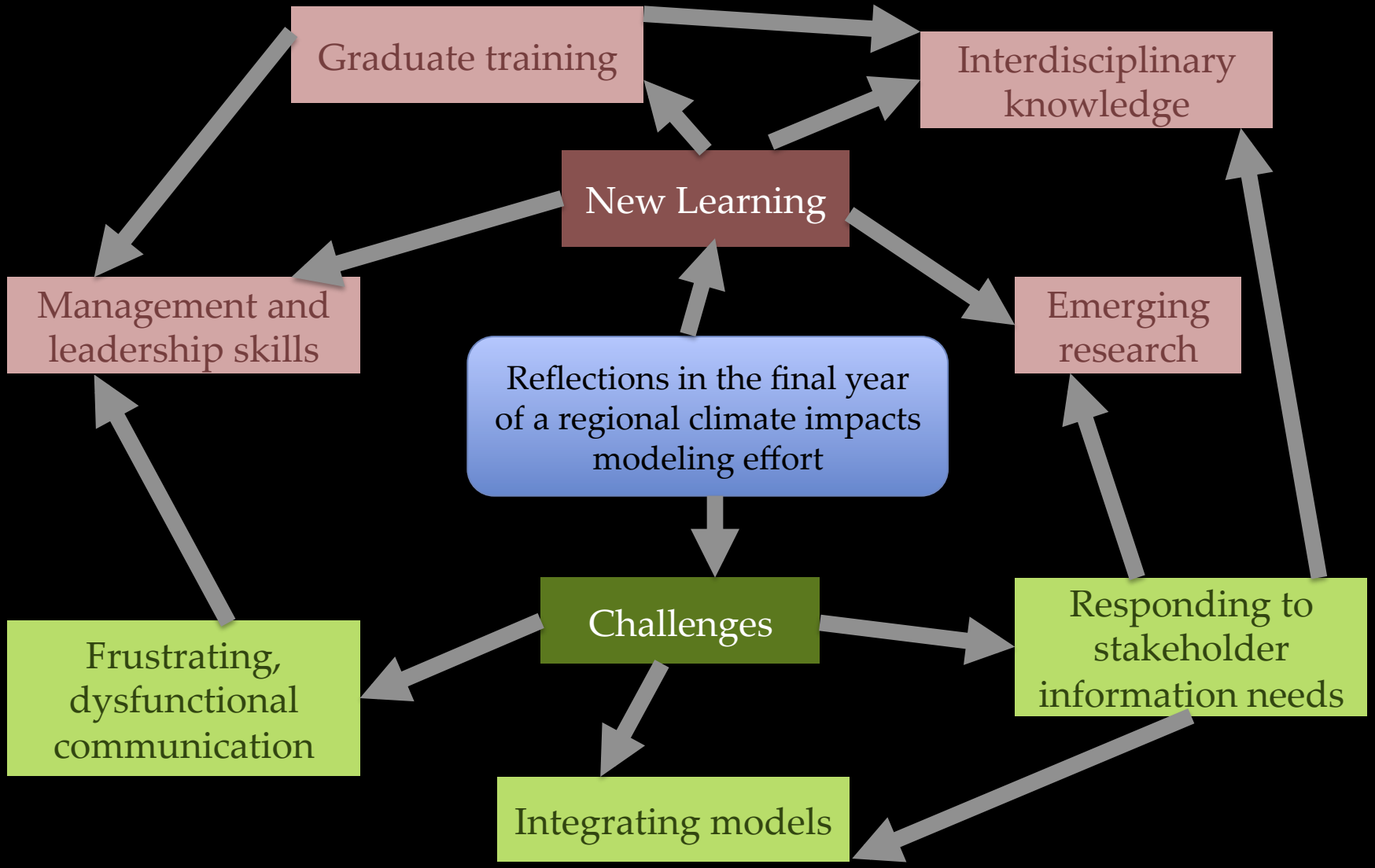
b. Which groups constitute stakeholders?



c. What are the project's primary challenges?



Interview Results: BioEarth Team Collective Mental Model (2015)



Lessons about Stakeholder Engagement

Roles for different groups of stakeholders

- Academic, government & industry are critical
- Varying opinions about NGOs

Expectations for how stakeholders will interact with models

- Mixed at outset
- Increasing emphasis on learning from partnerships

Most critical times for stakeholder engagement

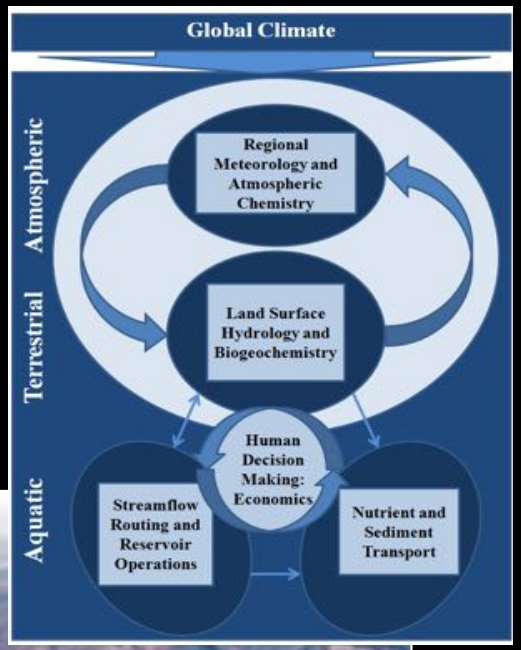
- Early-phase increasingly valued
- Consistent mid- and final-year engagement

5TH YEAR OUTCOMES ACROSS PROJECTS

	WISDM	BioEarth	REACCH Regional Approaches to Climate Change – Pacific Northwest Agriculture
Design of Engagement	Iterative process + small teams = stakeholder trust and buy-in	Diverse stakeholder input = lots of learning, limited actionability	Researcher-driven + extension traditions = mixed outcomes
Team Management	Addressing communication barriers could help research integration	Tools to track progress and accountability could improve productivity	Clear roles and strategic communication could build trust

Lessons about Models as Boundary Objects

- Be flexible in responding to stakeholder priorities
- Navigate issues of domain, scale & key processes before engaging
- Understand decision-making contexts



"SMART" Metrics for research process Evaluation

***S**pecific*

***M**easurable*

***A**ttainable*

***R**ealistic*

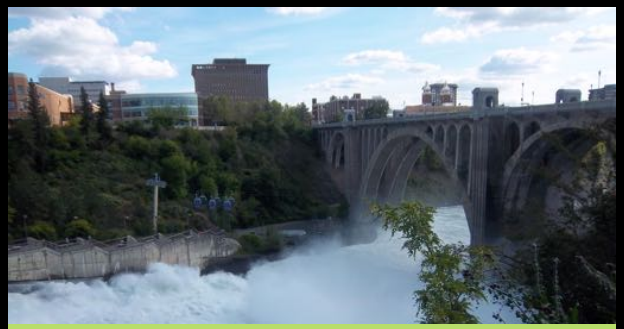
***T**ime-bound*

Recommendations for Stakeholder Engagement Evaluation metrics

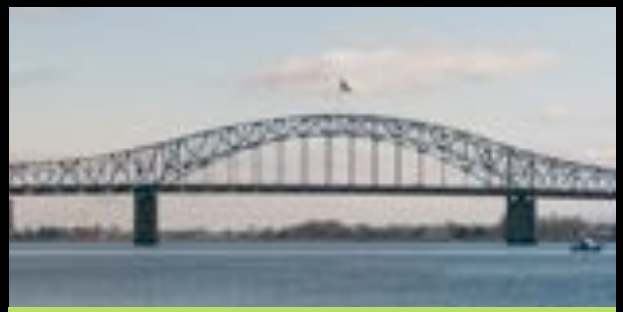
1. Diversity of input
2. Incorporation of stakeholder perspectives
3. Production of informational tools and resources
4. Learning among researchers
5. Learning among stakeholders and incorporation of science in decisions

Actionable science demands effective boundary spanning

1. Invest in long term partnerships



2. Communicate about team vision & research goals



3. Integrate stakeholder input

4. Reward extension & engagement activities

THANK YOU!

Web resources:

http://bioearth.wsu.edu/

http://csanr.wsu.edu

http://agclimate.net

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Supplementary Slides

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Core Take Away Lesson:

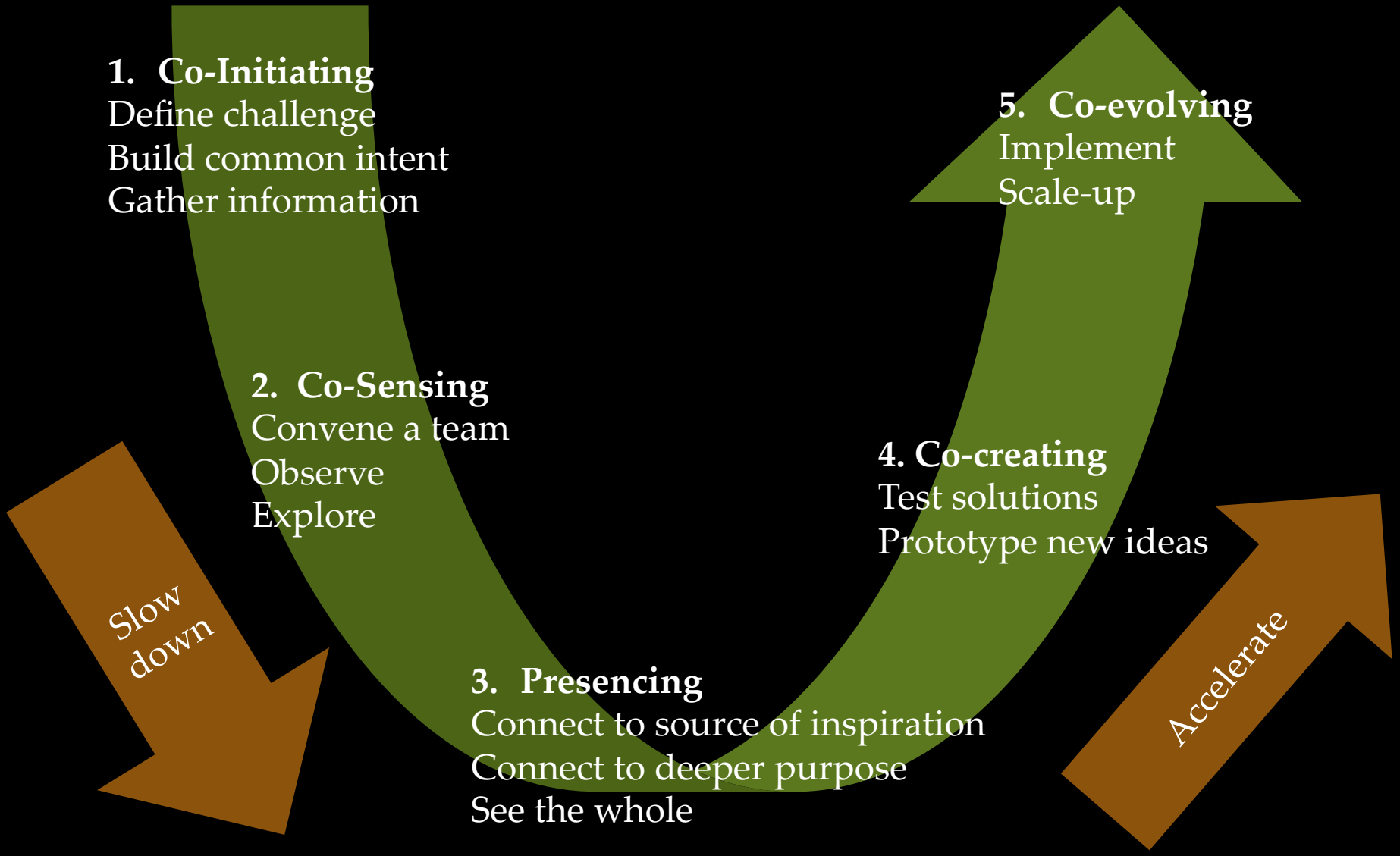
Input from decision makers is key to informing the **assumptions** we build into models, **scenarios** we test and **spatial scales** and **time horizons** at which we provide outputs.

Adaptation of Bloom's Taxonomy with examples related to stakeholder engagement

Complexity

Levels of Intellectual Behavior	Examples of Outcomes
Knowledge	*Name potential stakeholders, identify project goals*
Comprehension	*Articulate roles for stakeholders in research*
Application	*Formulate questions for stakeholders*
Analysis	*Consider stakeholder recommendations, explore opportunities to inform decisions*
Evaluation	*Assess engagement process*
Synthesis	*Develop tools, evolve new research directions*

Theory U: Organizational learning



USEFUL-TO-USABLE PARADIGM SHIFT

Paradigm 1: Predict, Then Act

Best estimate of future, management plans & policies designed accordingly.

Asks, what is most likely to happen in the future?

Places unrealistic demands on modeling and climate science

Paradigm 2: Seek Robust Solutions

Vulnerabilities identified, make decisions that perform well across a range of futures.

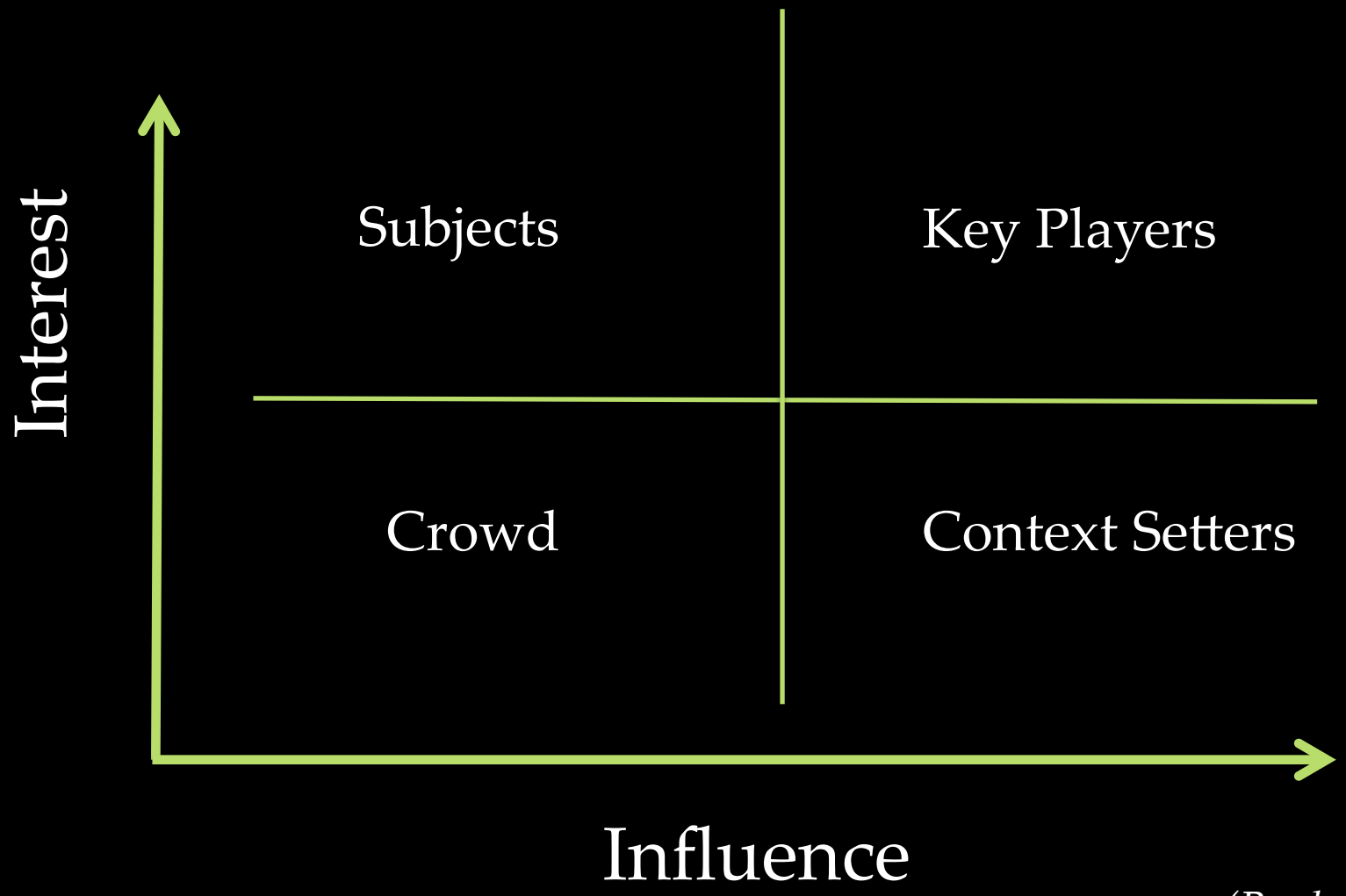
Asks, *what are possible unintended consequences of decisions?*

Accounts for complexity and uncertainty in earth systems & human behavior

(Weaver et al., 2013)

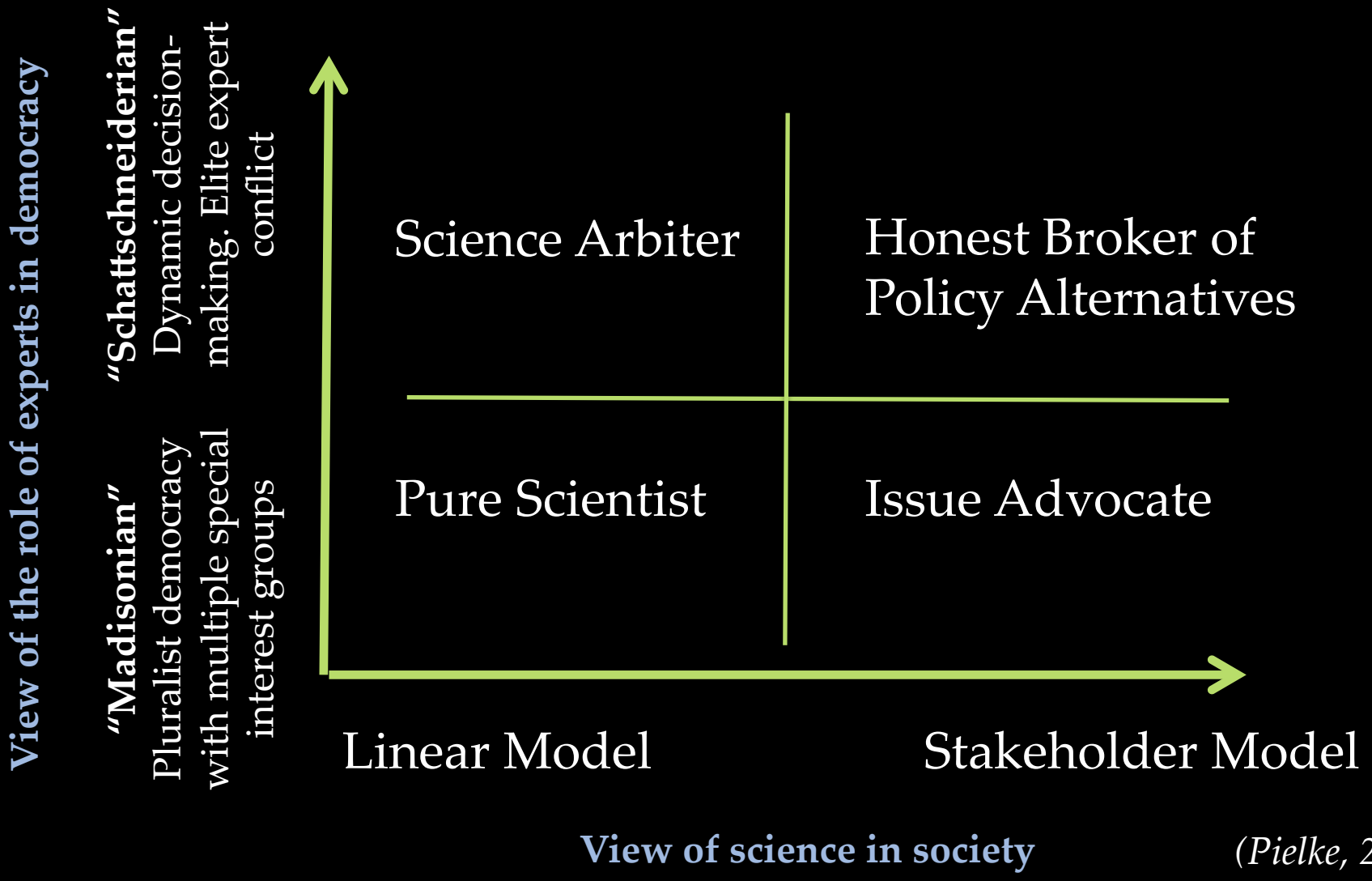
Lessons about Team management: Animal Matrix types

CLASSIFICATION OF STAKEHOLDERS BASED ON INTEREST AND INFLUENCE



(Reed et al., 2009)

CLASSIFICATION OF ROLES FOR SCIENTISTS IN DECISION-MAKING

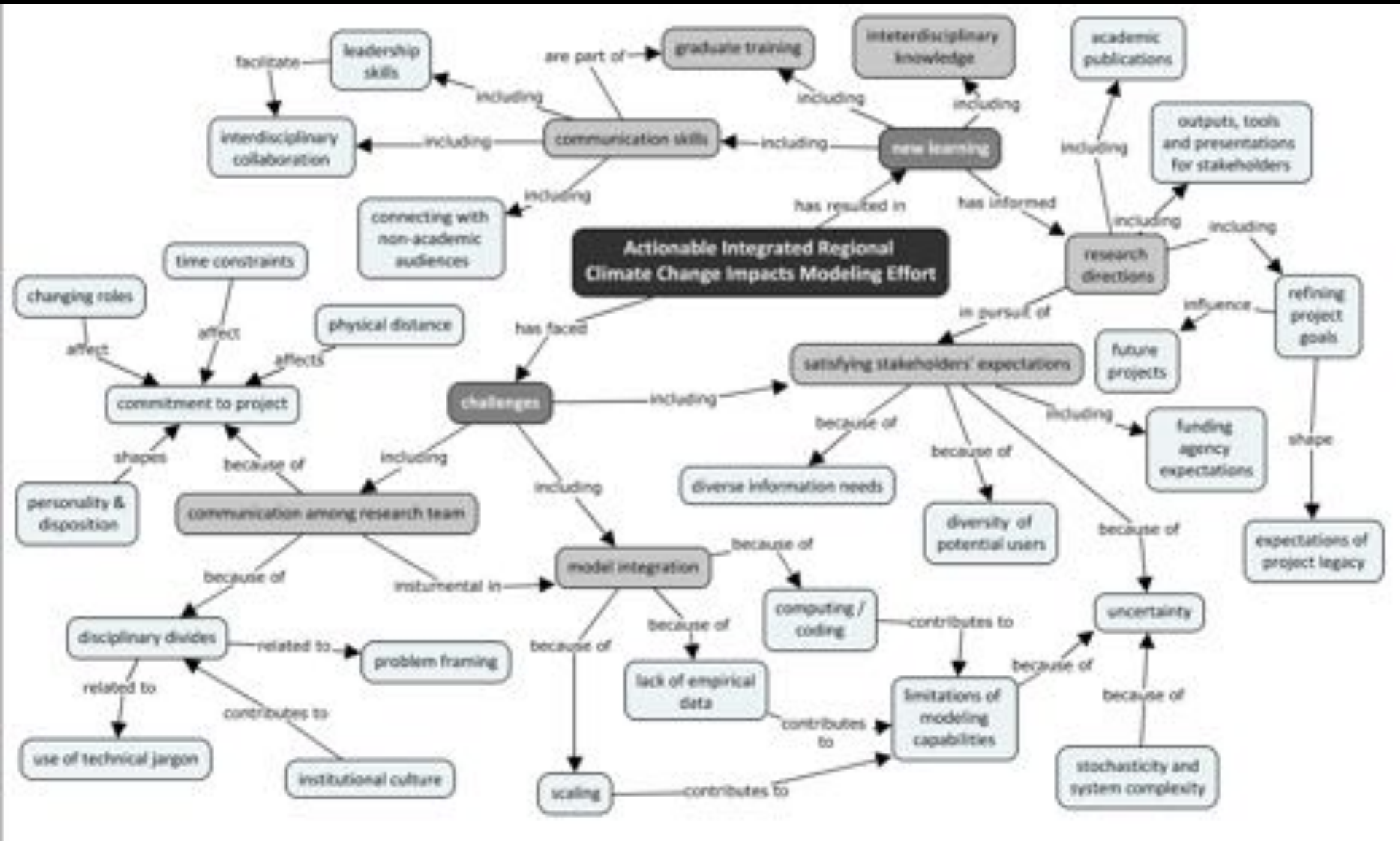


(Pielke, 2007)

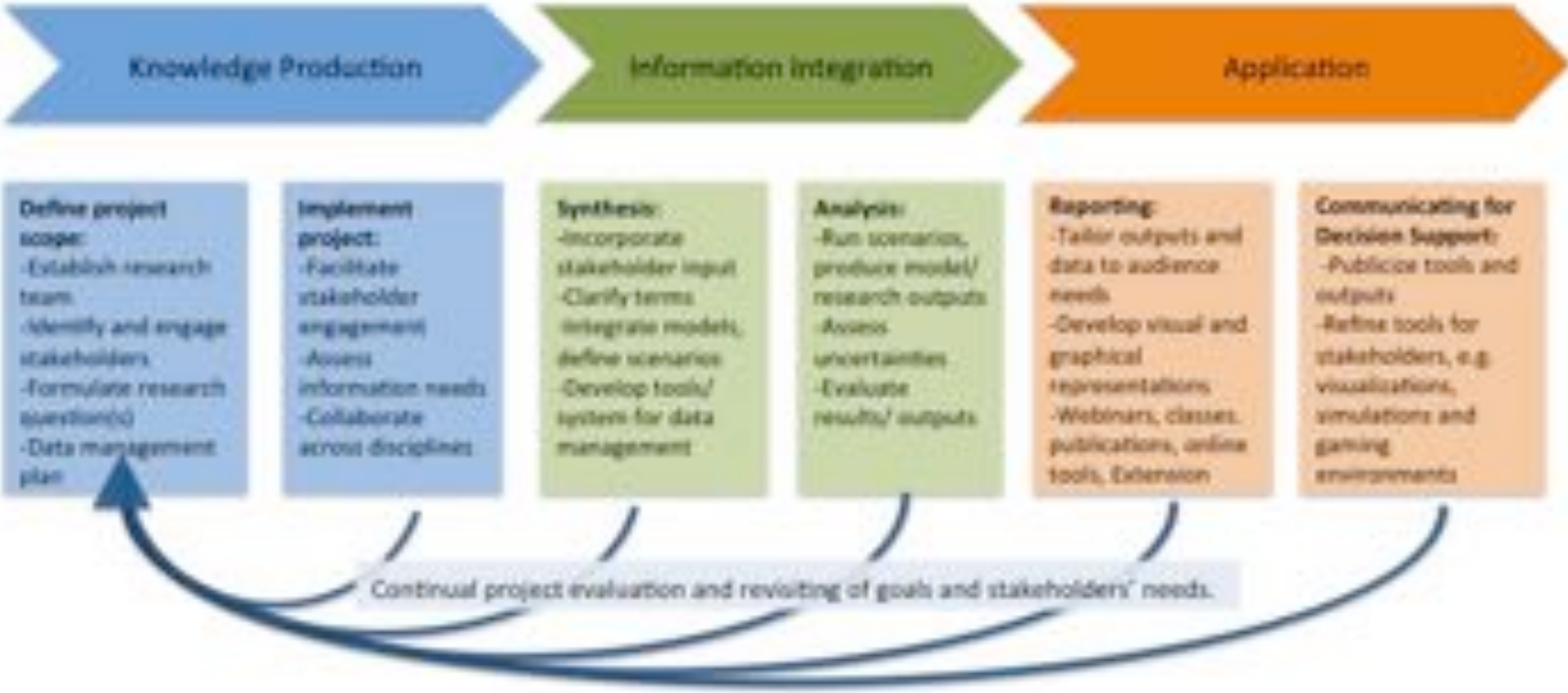
Overview of BioEarth's issue-based workshops

Topic	Date	Location
Carbon and Nitrogen Management	February 2013	Seattle
Water Supply	February 2013	Seattle
Rangeland Management	February 2014	Richland
Atmospheric Issues	February 2014	Seattle
Forest Management	June 2014	Olympia
Water Quality	March 2015	Vancouver

BioEarth Researchers' Collective Mental Model (2015)



Defining a usable climate science value chain



Future Research Directions

- Design and evaluate educational tools for stakeholders
- Investigate impacts of training researchers in interdisciplinary team management
- Increase understanding of specific decisions stakeholders make and how climate impacts models might inform them
- Assess opportunities incentivize and support stakeholder engagement