So You're a REACCH Graduate Student…

Jodi Johnson-Maynard

Sanford Eigenbrode

2/30/12

Agenda

- Get to know each other
- Our interdisciplinary mission and tools
- REACCH requirements
- REACCH opportunities

What is REACCH?

$20 million, five-year project funded by the National Institute for Food and Agriculture

Regional Approaches to Climate Change for PNW Agriculture

4 institutions, 12 academic/research units, >40 scientists, students and postdocs

Lead Institution: University of Idaho







Beginnings

Globally, demand for food, fuel and fiber is projected to double by 2050.

Meeting this demand will require *cropping intensification,* genetic and technological advances (a Green Revolution 2).

This must be achieved sustainably under diverse drivers of change…

"Business as usual is not an option."
-H. Herren, President Millenium Institute

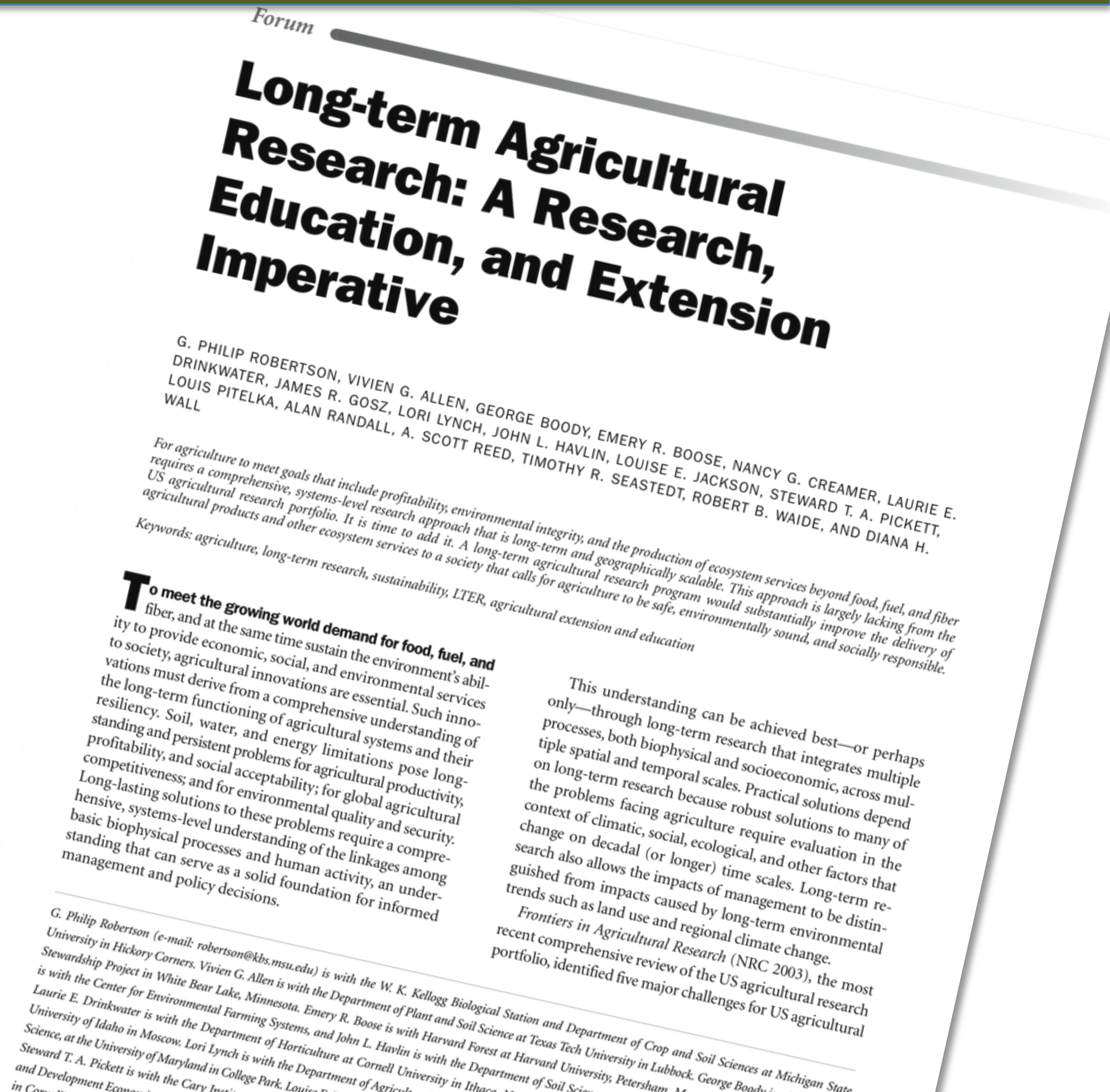
Beginnings

Context:

A new research agenda in agriculture

Robertson et al. 2008

Longer-term, coordinated projects should be supported by the National Institute for Food and Agriculture



Forum

Long-term Agricultural Research: A Research, Education, and Extension Imperative

G. PHILIP ROBERTSON, VIVIEN G. ALLEN, GEORGE BOODY, EMERY R. BOOSE, NANCY G. CREAMER, LAURIE E. DRINKWATER, JAMES R. GOSZ, LORI LYNCH, JOHN L. HAVLIN, LOUISE E. JACKSON, STEWARD T. A. PICKETT, LOUIS PITELKA, ALAN RANDALL, A. SCOTT REED, TIMOTHY R. SEASTEDT, ROBERT B. WAIDE, AND DIANA H. WALL

For agriculture to meet goals that include profitability, environmental integrity, and the production of ecosystem services beyond food, fuel, and fiber requires a comprehensive, systems-level research approach that is long-term and geographically scalable. This approach is largely lacking from the US agricultural research portfolio. It is time to add it. A long-term agricultural research program would substantially improve the delivery of agricultural products and other ecosystem services to a society that calls for agriculture to be safe, environmentally sound, and socially responsible.

Keywords: agriculture, long-term research, sustainability, LTER, agricultural extension and education

To meet the growing world demand for food, fuel, and fiber, and at the same time sustain the environment's ability to provide economic, social, and environmental services to society, agricultural innovations are essential. Such innovations must derive from a comprehensive understanding of the long-term functioning of agricultural systems and their resiliency. Soil, water, and energy limitations pose long-standing and persistent problems for agricultural productivity, profitability, and social acceptability; for global agricultural competitiveness; and for environmental quality and security. Long-lasting solutions to these problems require a comprehensive, systems-level understanding of the linkages among basic biophysical processes and human activity, an understanding that can serve as a solid foundation for informed management and policy decisions.

This understanding can be achieved best—or perhaps only—through long-term research that integrates multiple processes, both biophysical and socioeconomic, across multiple spatial and temporal scales. Practical solutions depend on long-term research because robust solutions to many of the problems facing agriculture require evaluation in the context of climatic, social, ecological, and other factors that change on decadal (or longer) time scales. Long-term research also allows the impacts of management to be distinguished from impacts caused by long-term environmental trends such as land use and regional climate change.

Frontiers in Agricultural Research (NRC 2003), the most recent comprehensive review of the US agricultural research portfolio, identified five major challenges for US agricultural

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Climate Change and PNW Agriculture

The Region's Climate is Changing

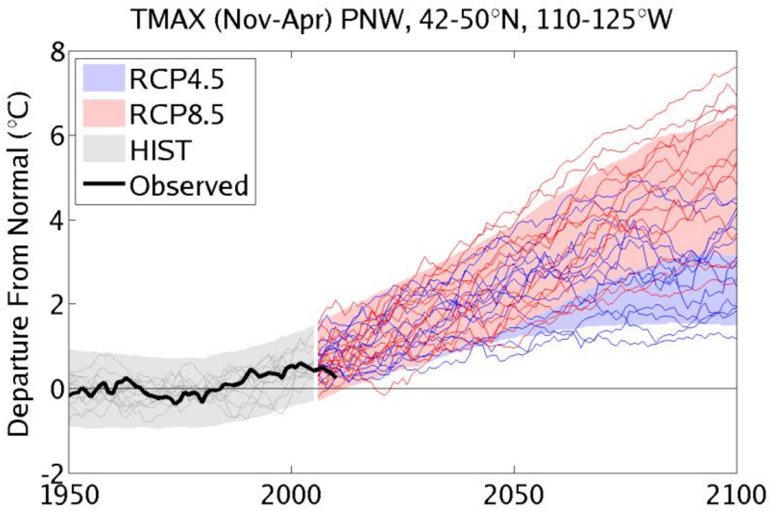
- Historical warming trend of approx. 0.01°C/year
- Climate projections based on different GCMs project doubling of this rate (Mote and Salathé 2009)
- Current agroecological zones predicted to shift
- Downscaled models indicate shifts will be geospatially heterogeneous, requiring different adaptation and mitigation strategies

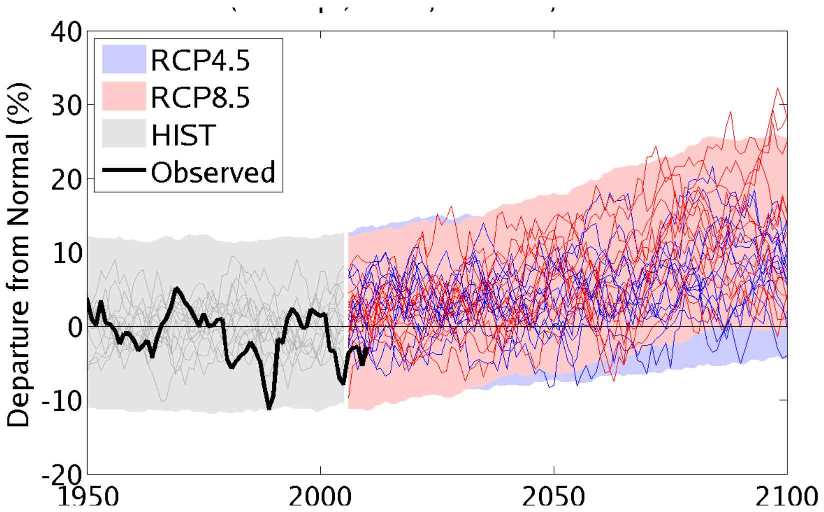
Regional Expertise in Climate Change

- All three institutions have climate expertise
- OCCRI, UI EPSCoR 2, PNW Climate Science Center, NOAA RISA, Climate Friendly Farming (WSU)

Beginnings

PNW Climate Projections: CMIP 5

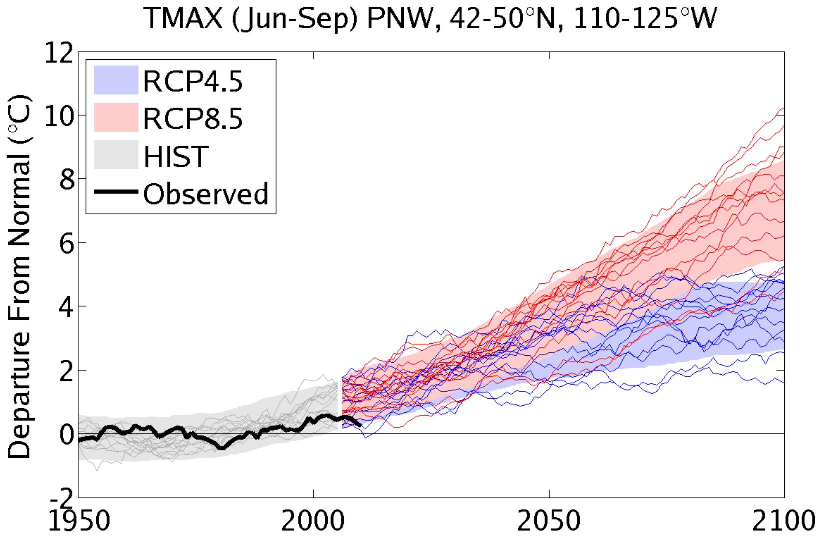


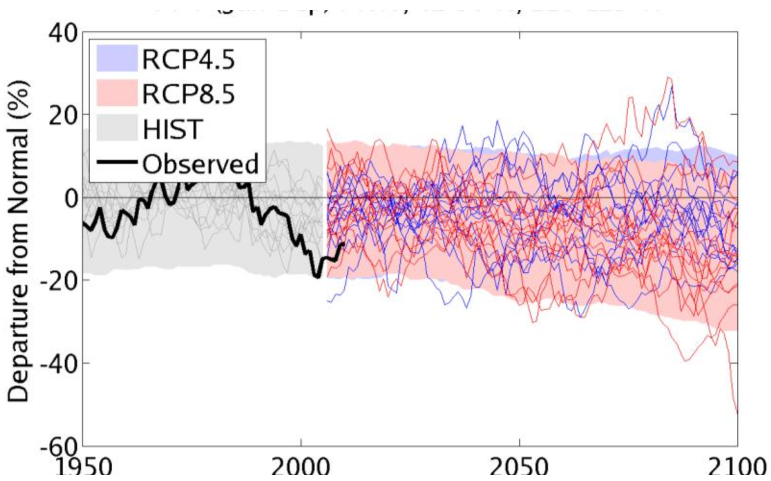


Abatzoglou

Beginnings

PNW Climate Projections: CMIP 5

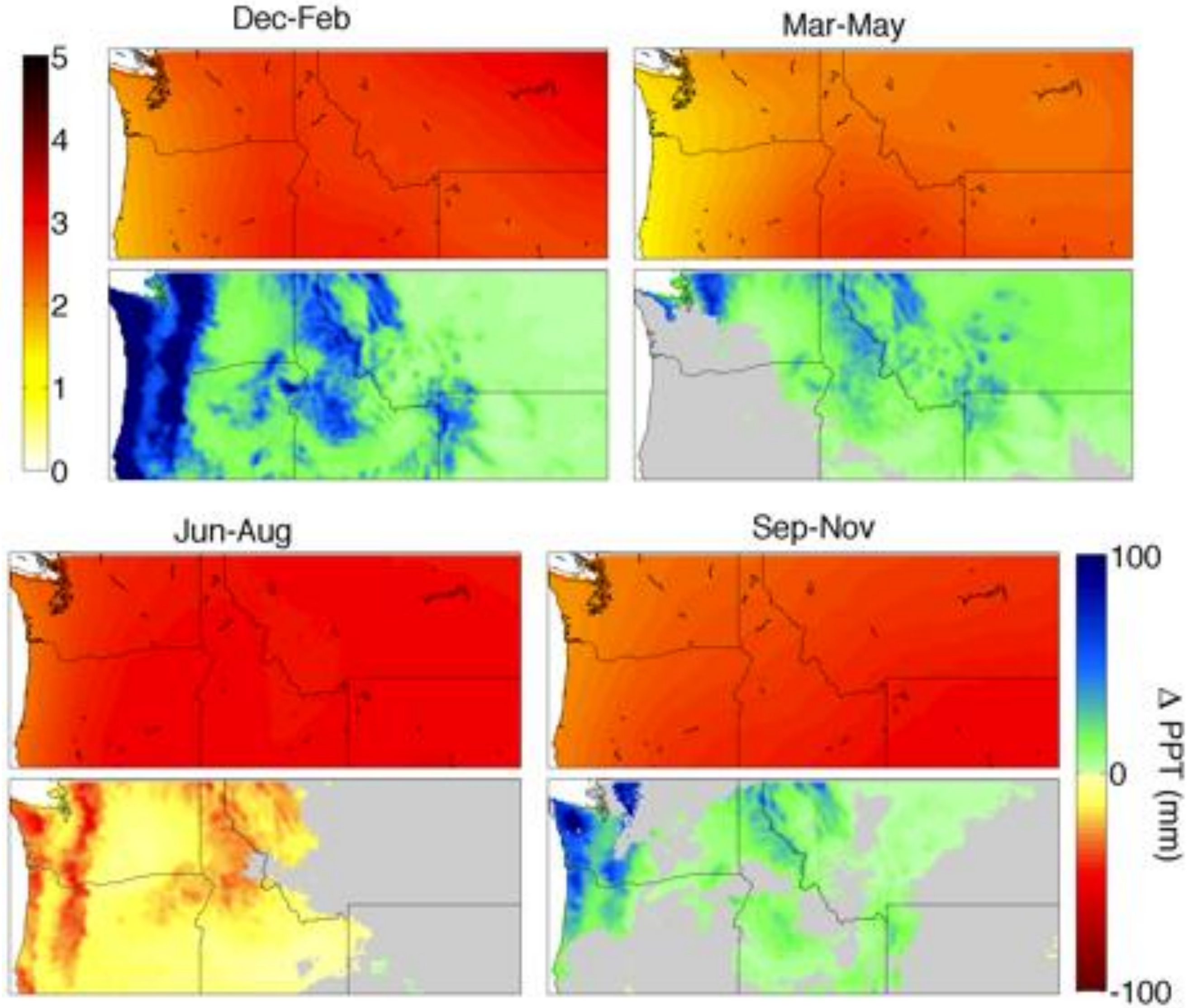




Abatzoglou

Beginnings

"Downscaled" projections of change from current (1979-2010) to mid century (2046-2065), 7-model ensemble



J. Abatzoglou, in prep

Beginnings

Vision and Approach

Mission

Enhance the sustainability of Inland Pacific Northwest (IPNW) cereal production systems under ongoing and projected climate change while contributing to climate change mitigation

Goals

- ✓ Develop and implement sustainable agricultural practices for existing and projected agroecological zones
- ✓ Contribute to climate change mitigation consistent with NIFA's 2030 targets
- ✓ Promote adoption of science-based agricultural approaches to climate change adaptation and mitigation
- ✓ Increase scientists, educators, and extension professionals prepared to address climate change-related issues in agriculture
- ✓ Develop the regional capacity for continued, long-term research in sustainable production under climate change

Vision and Approach

RESEARCH

1. Create a framework integrating biophysical and socioeconomic aspects of the system.
2. Establish a baselines and monitor soil carbon and nitrogen and GHG emissions from PNW cereal systems.
3. Compare current and alternative production practices for N and C use efficiency, GHG emissions and agronomics.
4. Determine social and economic factors influencing adoption of agricultural practices related to climate change adaptation and mitigation.
5. Assess effects of climate change and alternative practices on crop protection and beneficial organisms.

Vision and Approach

Education and Extension

6. *Introduce climate and agriculture themes into K-12, undergraduate and graduate curricula.*

7. *Work closely with stakeholders in project design and execution. Ensure project findings are relevant and communicated effectively.*

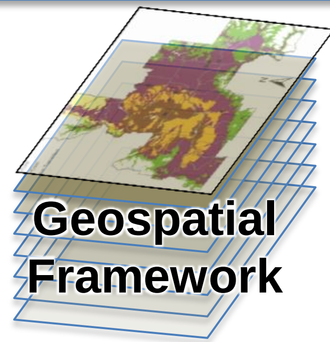
Capacity Building

8. *Develop the regional capacity for continued, long-term research, education, and extension efforts to mitigate and adapt to climate change.*

REACCH Integration

Extension

- Stakeholder Committee
- Diverse Delivery Platforms
- Cross-Project Specialist
- Stakeholder Data Collection



Education

- K-12 Teacher Engagement
- Team-Based Graduate Ed.
- Minority Involvement

Research

Integrated Conceptual Framework

Economic ↔ Cropping Systems ↔ Climate

Monitoring and Experiments

- Baselines and Monitoring
- Alternative Cropping Systems
- Social and Economic
- Pests, Weeds, Diseases

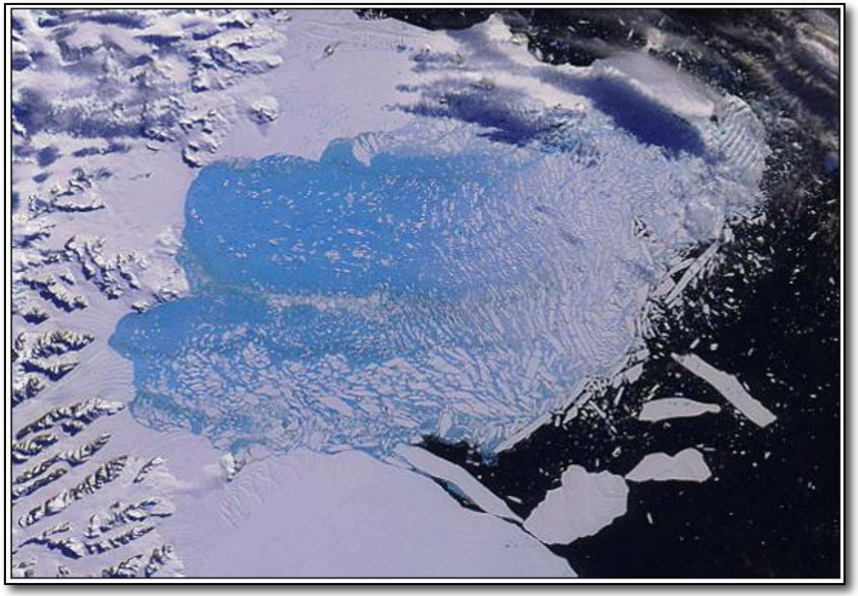
Motivation – Drivers

"Interdisciplinary thinking is rapidly becoming an integral feature of research as a result of four powerful 'drivers':

Motivation – Drivers

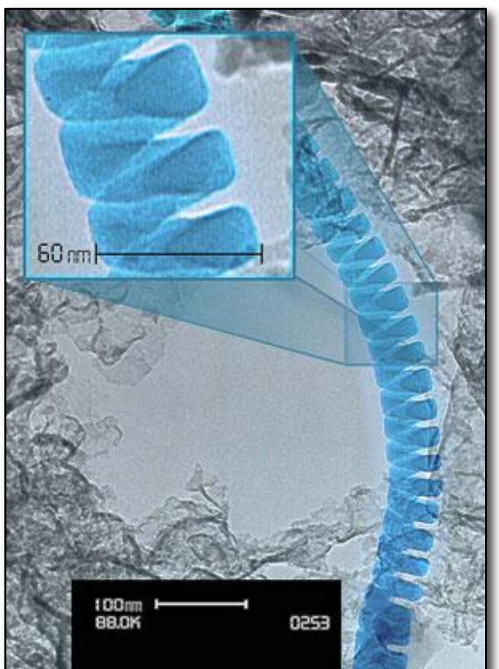
The inherent complexity of nature and society

The desire to explore problems and questions that are not confined to a single discipline



Motivation – Drivers

The need to solve societal problems



The power of new technologies."

– *Facilitating Interdisciplinary Research*, NAS, p. 40

Motivation – Responses

Universities and Colleges

- Interdisciplinary curricula
- Structures to encourage collaboration among investigators

Federal and State Agencies

- Funding opportunities
- Internal structures

Private Institutions

Industry

Motivation – Approaches

Applied

- How can CDR efforts be developed?
- How can they be facilitated?
- What problems undermine CDR efforts, and how can these be avoided?
- What impact will new technology have on the conduct of CDR (e.g., new cybercollaborative tools, enhanced capacity for data storage, access, manipulation, and synthesis)?

Motivation – Challenges

The challenges to CDR are manifold:

- The academic reward system (NAS 2005)
- Lack of conducive institutional culture (Klein 2010)
- Lack of training opportunities (Rosa and Machlis 2002)
- Disciplinary chauvinism (Schoenberger 2001)
- Turfism (Morse, et al. 2007)
- Group dynamics (Jakobsen, et al. 2004)
- Communication …

Motivation – Challenges

toolbox

"At the heart of interdisciplinarity is communication—the conversations, connections, and combinations that bring new insights to virtually every kind of scientist and engineer." (*Facilitating Interdisciplinary Research*, NAS, p. 19)

Motivation – Challenges

The Call for Improving Communication among Collaborators Crossing Disciplines

- Human organizations – Likert (1932)
- Academic culture – Snow (1959)
- Transprofessional health science – Frank (1961)
- Universities – Jantsch (1970)
- The sciences – Klein (1996, et ante), NAS (2005)
- Construction engineering – Chan et al. 2002
- Natural resource sciences – Heemskerk et al. (2003), Morse et al. (2007)

Employing Philosophical Dialogue in Collaborative Science

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Integrated research across disciplines is required to address many of the pressing environmental problems facing human societies. Often the integration involves disparate disciplines, including those in the biological sciences, and demands collaboration from problem formulation through hypothesis development, data analysis, interpretation, and application. Such projects raise conceptual and methodological challenges that are new to many researchers in the biological sciences and to their collaborators in other disciplines. In this article, we develop the theme that many of these challenges are fundamentally philosophical, a dimension that has been largely overlooked in the extensive literature on cross-disciplinary research and education. We present a "toolbox for philosophical dialogue," consisting of a set of questions for self-examination that cross-disciplinary collaborators can use to identify and address their philosophical disparities and commonalities. We provide a brief user's manual for this toolbox and evidence for its effectiveness in promoting successful integration across disciplines.

Keywords: interdisciplinary research, collaborative research, philosophy

Increasing human populations and per capita resource consumption have engendered pressing problems that threaten ecosystem function, ecosystem services, the sustainability of production, and the health and well-being of human populations. Solutions to these problems require the expertise of biologists, but their complexity necessitates integrated efforts involving other disciplines. For example, research to improve sustainability and biodiversity conservation involves ecology, agriculture, sociology, soil science, hydrology, and economics (Palmer et al. 2005). In public health, issues such as AIDS prevention require the collaboration of sociology, anthropology, behavioral science, clinical medicine, bioinformatics, and evolutionary biology (Stillwaggon 2005). Research that crosses traditional disciplinary boundaries (described here as "cross-disciplinary") poses challenges that can be new to scientists, depending on the depth and breadth of integration among disciplines.

First, collaborators must determine the appropriate level of cross-disciplinary integration, from a continuum that includes multidisciplinary, interdisciplinary, and transdisciplinary work (box 1). A suitable level of integration will depend on the problem to be addressed and on the mutual understanding of the disciplines involved. If interdisciplinary or transdisciplinary efforts are required, participants must work together from problem formulation and hypothesis development to data analysis, interpretation, presentation, and application. An emerging literature addresses the obstacles and challenges to integrated, cross-disciplinary research, which include delineating social, biological, and physical aspects of complex problems; identifying commensurable spatial and temporal scales of measurement; identifying interpersonal and group-related dynamics that affect cross-disciplinary collaboration; and adjusting institutional and educational structures to facilitate such collaboration (Benda et al. 2002, Giampietro 2003, Heemskerk et al. 2003, Rhoten 2003, Jakobsen et al. 2004, Lélé and Norgaard 2005, NAS 2005).

In addition to these formidable operational difficulties, cross-disciplinary collaborations entail combining the some-

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Thinking of Biology

...uestions designed to draw out collaborating scientists'

Probing questions

Is basic research inherently disciplinary research, or can cross-disciplinary research address basic research questions?

How do basic and applied research relate to each other in the traditions of your discipline and in the current team project?

Should your collaborative research project emphasize applied over basic research?

Is there a role for advocacy in research?

What kinds of data constitute scientific evidence?

In your research, do you combine different types of research approaches?

How are your methods related to those used by other members of your team?

Is a hypothesis required for research to be considered science?

How does the spatial or temporal scale of your research approach compare and interact with the scales of your team's research approaches?

What is required to ensure that measurements are valid?

...hat is required to ensure that empirical data confirm ...theoretical proposal?

...eplication necessary for confirmation?

... unreplicated results that are confirmed by a ...bination of methods qualify as knowledge?

...at ways do your research conclusions address or ...orate uncertainty?

...t way or ways is your research objective?

...e integrate values into research and still remain ...e?

...hink it is valid to use one's personal perspec... ...me a research question or hypothesis?

...ctive research be scientific?

...sible to conduct scientific research without ... is that accomplished?

...ider questions about when hypotheses ...owledge to be value questions?

...values as an ineliminable part of scientific ... can they be managed to avoid biasing ...ts and interpretations?

...duction of values into the research ...t to advocacy?

...ent properties of the system or subject ...reducible?

...hich a subject is investigated ...the subject of study part of a larger ...d be considered)?

...spatial, temporal) ... ...degree ca...

The Toolbox Approach

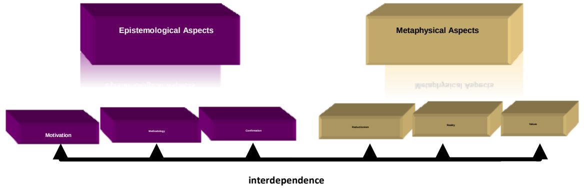
A workshop based on the Toolbox

– Toolbox
  - A table of philosophical prompts that illuminate fundamental research assumptions
  - These distinctions are broadly about the world (i.e., *metaphysical*) and about the investigator (i.e., *epistemological*)
  - Each broad category is divided into three sub-categories
  - Within each sub-category is a “Core Question” that announces the theme and several “Probing Statements” that develop the theme

The Toolbox Approach

Toolbox excerpt

Metaphysics



<u>IV. Reality</u>

Core Question: *Do the products of scientific research more closely reflect the nature of the world or the researchers' perspective?*

17. Scientific research aims to identify facts about a world independent of the investigators.

Disagree *Agree*

1 2 3 4 5 I don't know N/A

18. Scientific claims need not represent objective reality to be useful.

Disagree *Agree*

1 2 3 4 5 I don't know N/A

19. Models invariably produce a distorted view of objective reality.

Disagree *Agree*

1 2 3 4 5 I don't know N/A

20. The subject of my research is a human construction.

Disagree *Agree*

1 2 3 4 5 I don't know N/A

21. The members of this team have similar views concerning the reality core question.

Disagree *Agree*

1 2 3 4 5 I don't know N/A

The Toolbox Approach

Procedures

- Participants review the philosophical structure that underlies the Toolbox (e.g. Eigenbrode et al. 2007).
- Each completes the Toolbox using the Likert scales.
- The team engages in a 1.5 to 2-hour workshop to share their responses to Toolbox prompts and discuss viewpoints.

- Each completes the Toolbox again after the session.
- Each completes a post-workshop questionnaire.

The Toolbox Approach

Insights

- Nearly 70 Toolbox workshops conducted

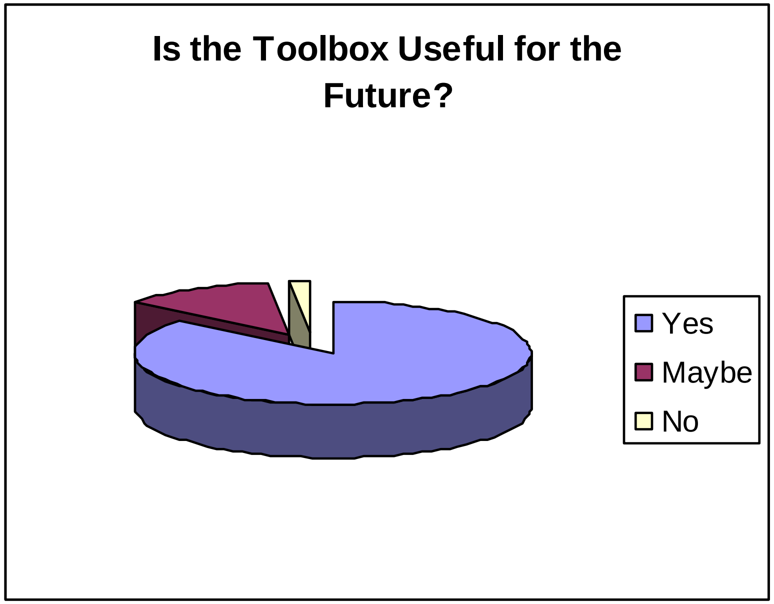
  Different Group Types: Working collaborative research teams, student research teams, administrative teams, graduate classes, undergraduate REU groups, *ad hoc* groups

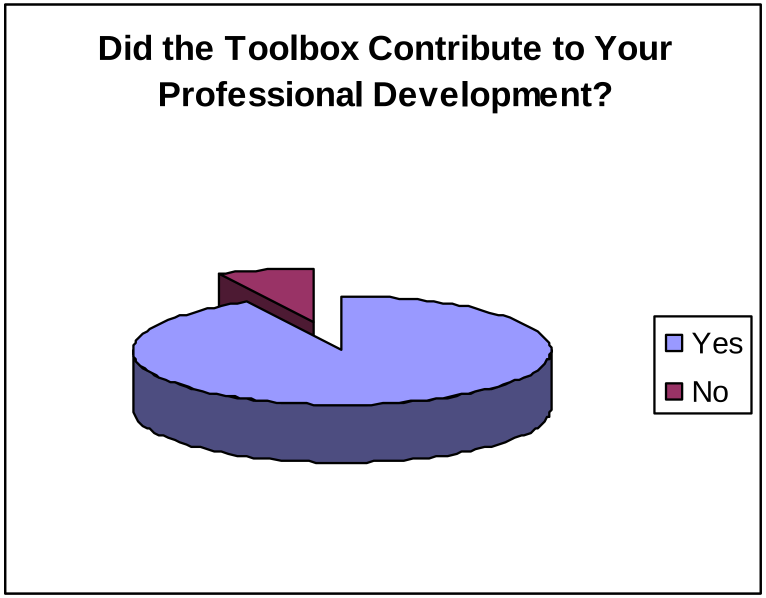
  Different Locations: UI, WSU, UW, Nevada, Michigan State (BEACON), Cornell, Ohio State, UC Davis, etc.

- Our NSF project has been *exploratory*, aiming to assess the complex connections between philosophy and CDR as revealed by the Toolbox Approach
- Insights gained have been *epistemic* and *social scientific*

Insights - Exit Survey Analysis

Toolbox participants were asked to fill out online questionnaires evaluating their Toolbox experience. Responses were coded. Two results on immediate interest were …





Next Steps, 2 - Integrating

toolbox

Issues and Approaches

Disciplinary Power Issues (Schoenberger 2001)

Gender Issues (?)

Communication in CDR

Group Processes (e.g. Senge 1990)

Organization and Structure (NAS 2005)

Philosophical Concerns (Toolbox)

Cognitive Issues (e.g. Newell 1998, Repko 2008, Klein 2005)

REACCH Requirements

- Committee Structure

  - Advisor plus one other REACCH faculty member

- Attendance

  - Workshops, seminars, objective team and annual meetings

Requirements

- Required Extension or Education based product

    -interdisciplinary

    -team based

    -take advantage of students and faculty from different disciplines

Requirements

Required Courses

- Carbon and Nitrogen cycling course (Nitrogen Cycling in Earth's Surface- WSU)
- Spatial Statistics/AEZ

  -Soils/NATRS 468; SoilS 568 GIS and Spatial Analysis- WSU

  -Geography 385 GIS Primer- UI

  -Geography 407/507 Spatial Analysis- UI

Opportunities within REACCH

- Seminar series
- Workshops to help you build skill sets
- Data management tools
- Mentor undergraduates through REU
- Potential exchanges with KBS and other CAPs
- Leadership and communication skills
    - -Representative to leadership committee
- Networking

REACCH
Regional Approaches to Climate Change –
PACIFIC NORTHWEST AGRICULTURE

Group work

- Ideas for future seminars and workshops
- Nominations for representative to leadership meetings
- Fall graduate student meeting