

The Architecture of Integration: Coordinated Agricultural Projects

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Agriculture & Natural Resources Science for Climate Variability and Change:
Transformational Advancements in Research, Education, and Extension Symposium

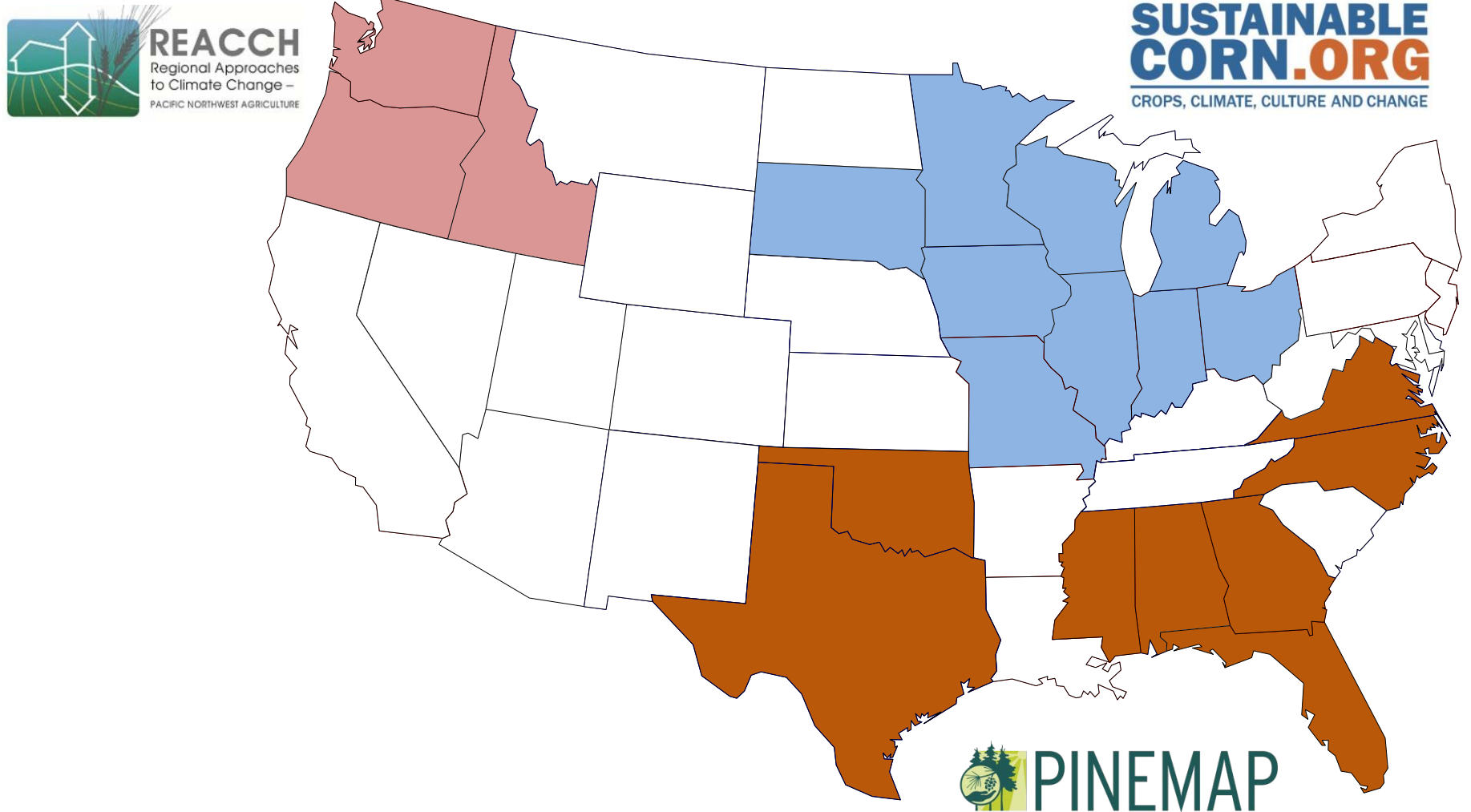
Session #5. Translating Climate Science into Actionable Knowledge: The Role of the Social Sciences

ASA, CSSA, SSSA International Annual Meeting Cincinnati, Ohio
2012 October 21-24

U.S. agriculture is increasingly impacted by the effects of a changing climate



- 3 Coordinated Agricultural Projects (CAP)
- 115 PI's across 20 states



New Opportunities and Challenges

The integration of science is essential to:

1. Address **complex**, difficult problems
2. Identify processes and structures needed to answer complex questions
3. Create new knowledge
4. **Bi-directional** testing & evaluation of new knowledge with stakeholders
5. Prepare the next generation of scientists

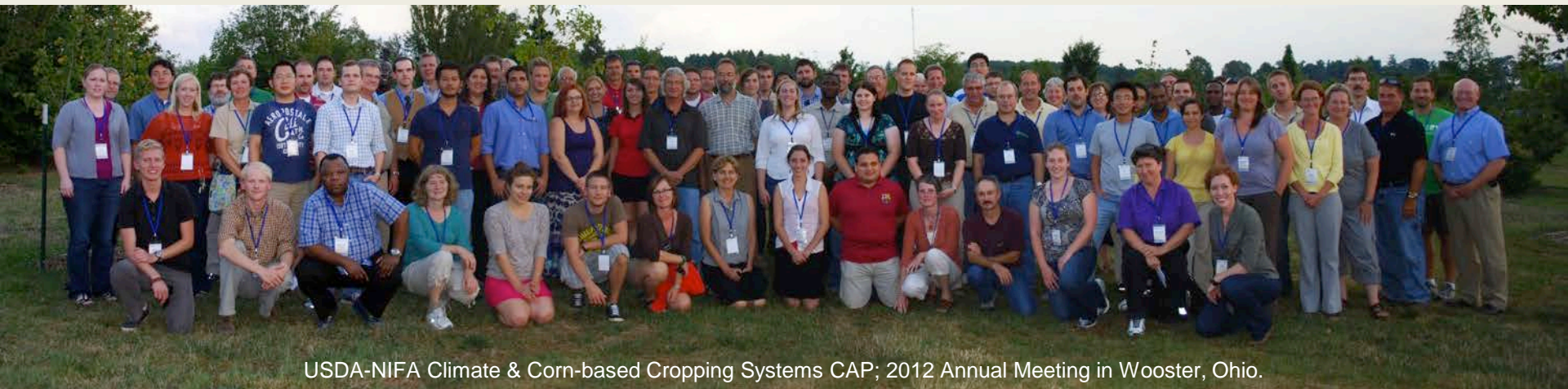


February 2012 Pendleton, Oregon

Directing three separate projects while working to integrate science goals, learn from each other, and finding ways to connect our teams.

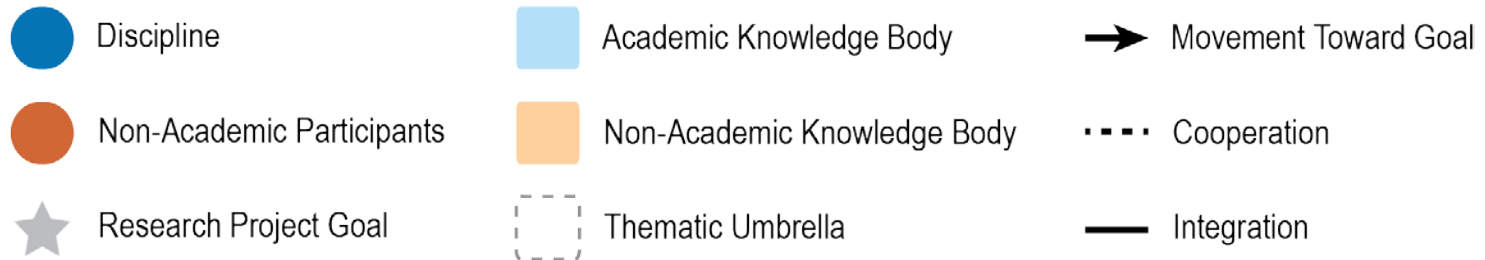
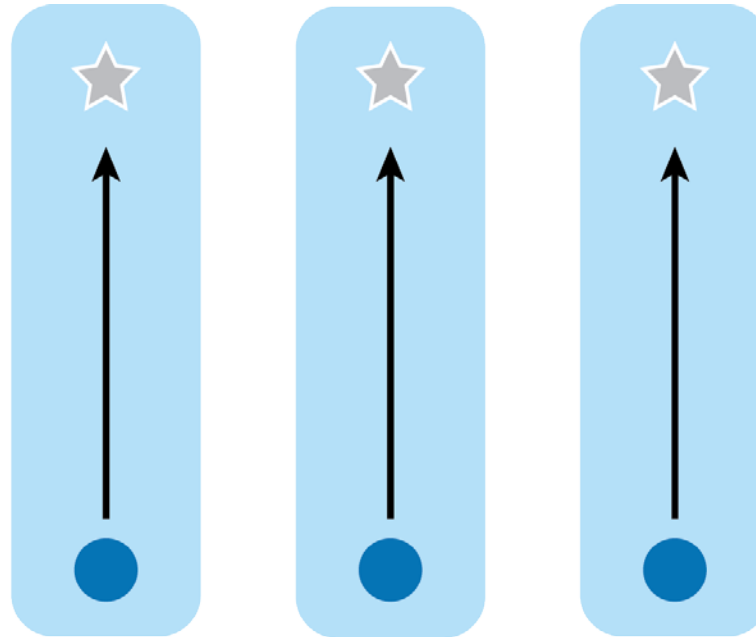
Team Integration Architectures

Are highly complex and diverse with similarities and differences. Understanding these architectures provide operational guidance to leadership and offer a valuable **platform** for exploration, innovation, and achieving the practical work of the team.



USDA-NIFA Climate & Corn-based Cropping Systems CAP; 2012 Annual Meeting in Wooster, Ohio.

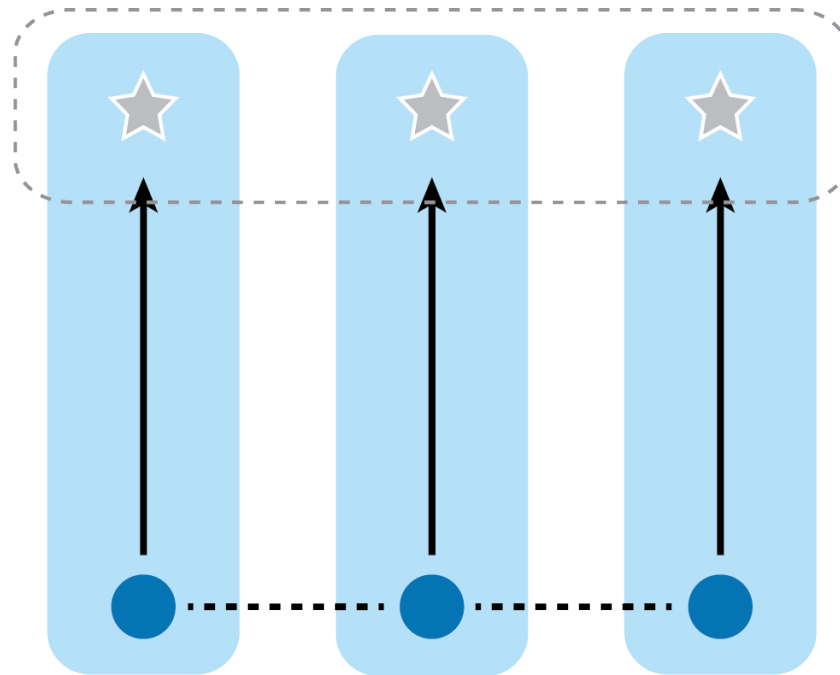
The trend to classify cross-disciplinary research is useful to generate dialogue that illustrates relationships




Tress, Tress, & Fry 2004


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Multidisciplinary





 Discipline

 Non-Academic Participants

 Research Project Goal


 Academic Knowledge Body

 Non-Academic Knowledge Body

 Thematic Umbrella

 Movement Toward Goal

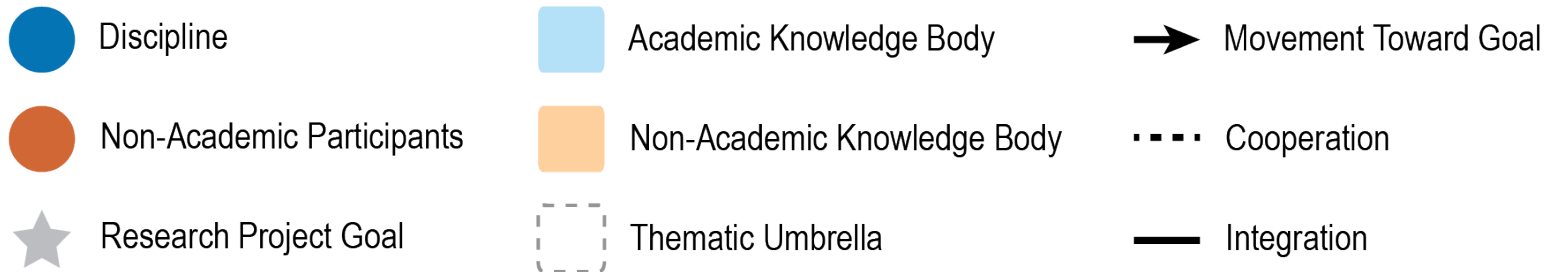
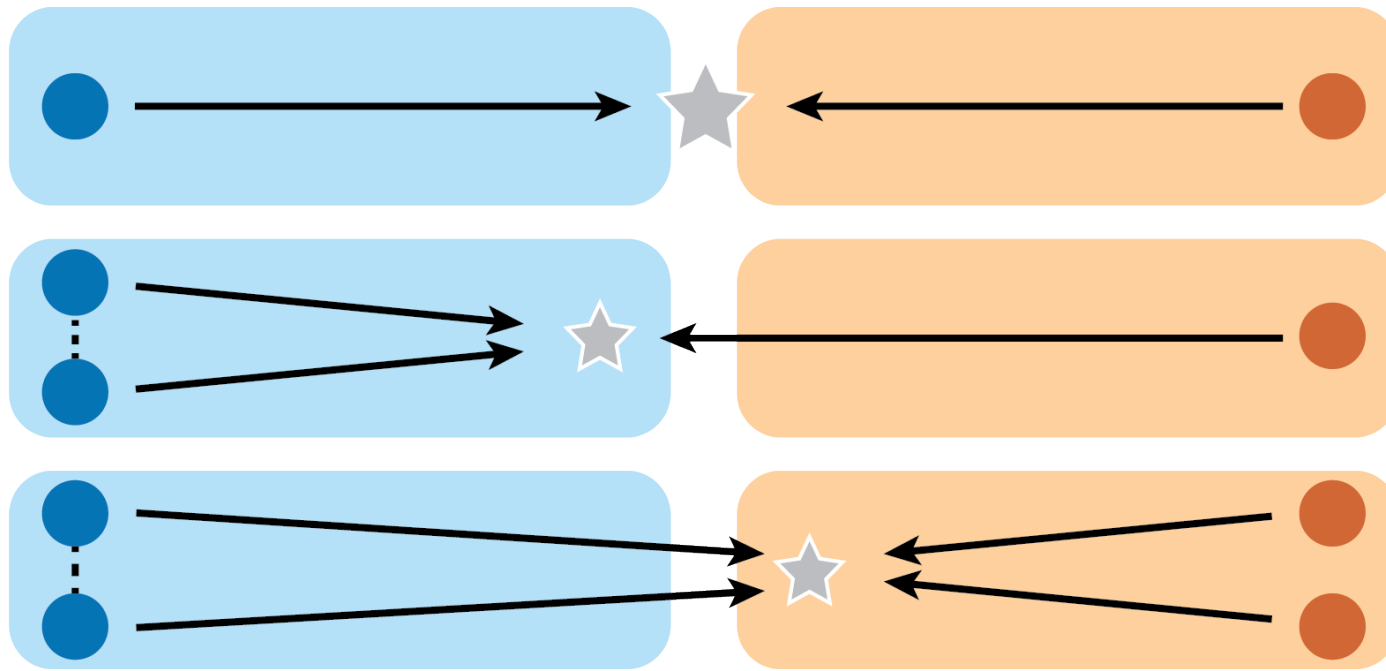
 Cooperation

 Integration

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Participatory

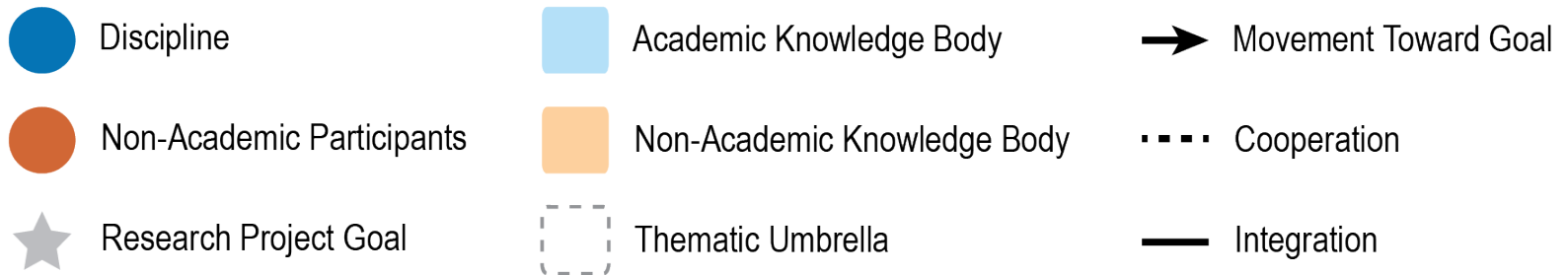
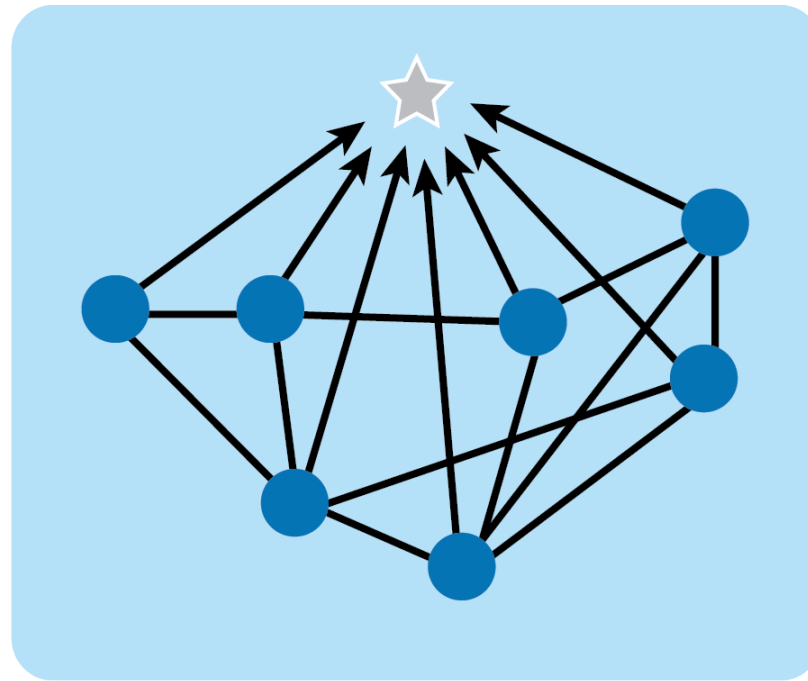


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Interdisciplinary

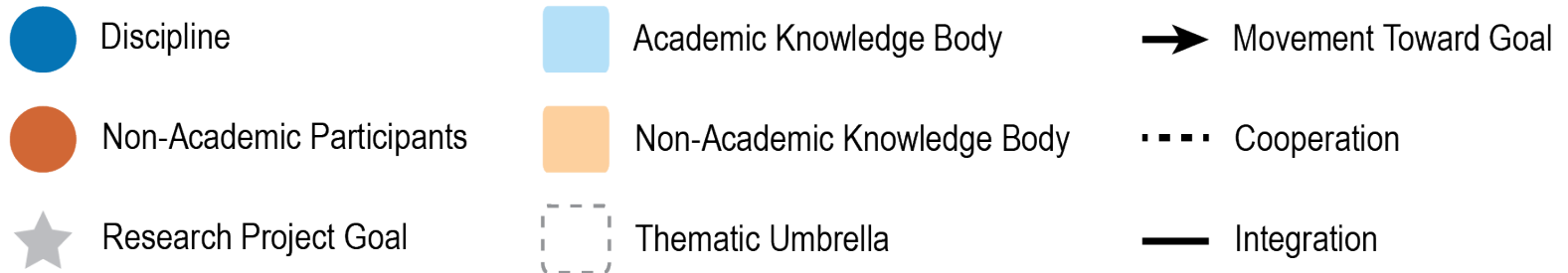
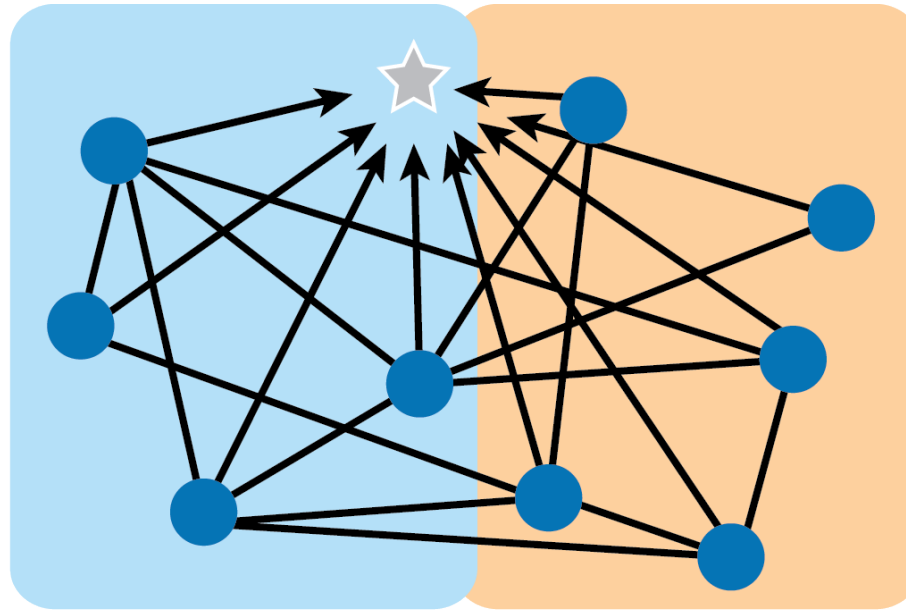


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Transdisciplinary



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Categorization serves as a start...

Terminology and framework provides a useful start but doesn't represent complexity of large projects like the USDA-NIFA Climate CAP's

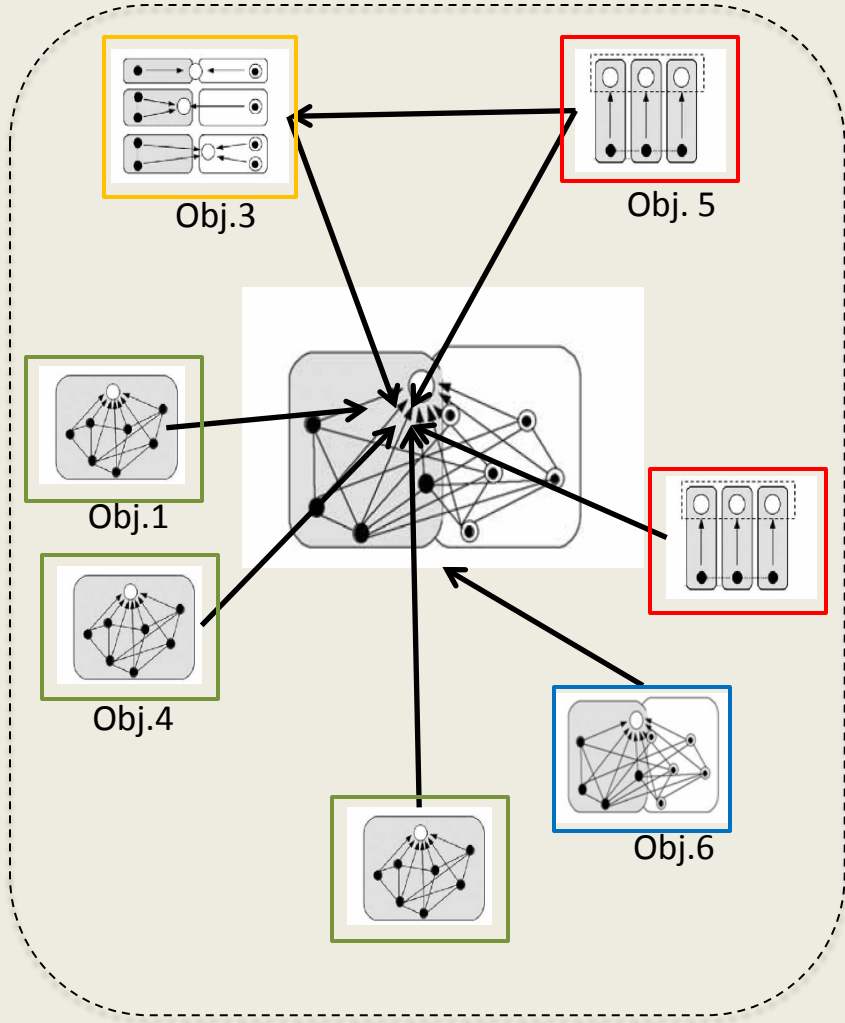


Big Project Integration Architecture

- Each project and each team's collaboration is unique
- These collaborative structures are dynamic throughout project life

disciplinary - Within one academic discipline - Disciplinary goal setting - No cooperation with other disciplines - Development of new disciplinary knowledge and theory	
multidisciplinary - Multiple disciplines - Multiple disciplinary goal setting under one thematic umbrella - Loose cooperation of disciplines for exchange of knowledge - Disciplinary theory development	
participatory - Involves academic researchers and non-academic participants - Exchange of knowledge, knowledge bodies not integrated - May be disciplinary or multidisciplinary - Not necessarily research, goal may be academic or not	
interdisciplinary - Crosses disciplinary boundaries - Common goal setting - Integration of disciplines - Development of integrated knowledge and theory	
transdisciplinary - Crosses disciplinary and scientific/academic boundaries - Common goal-setting - Integration of disciplines and non-academic participants - Development of integrated knowledge and theory among science and society	
● discipline ● non-academic participants ○ goal of a research project → movement towards goal — cooperation — integration	- - - thematic umbrella □ academic knowledge body □ non-academic knowledge body

© Tress 2005



How to cultivate and enhance team capacity to accomplish big science?

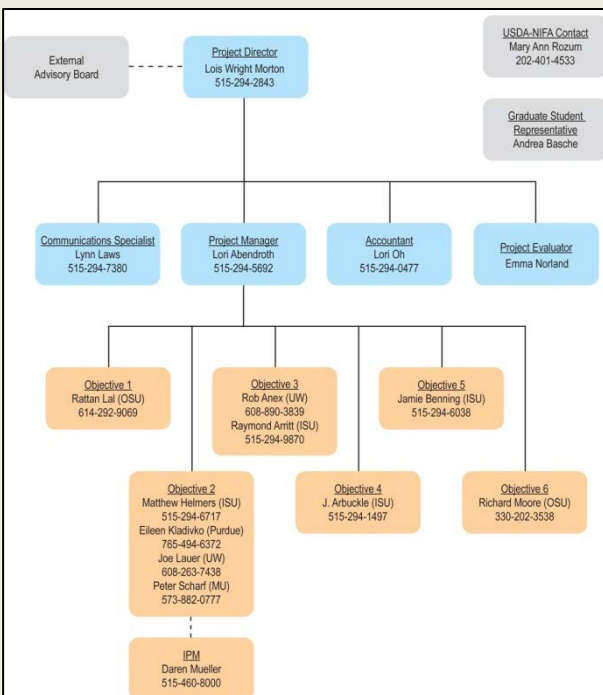


Create a team structure that:

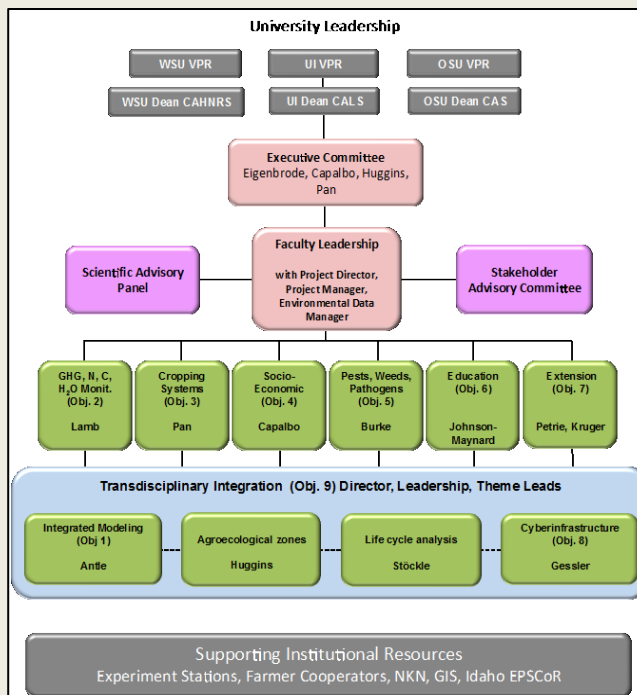
- Functionally **meets objectives and goals** specific to the team
- Has clear connections and lines of **accountability** between and across individuals
- Places individuals into specific **working groups** based on their expertise
- Places individuals in **“gaps”** - key roles to help bridge and connect working groups
- **Boundaries, but flexible**

Traditional Organizational Charts

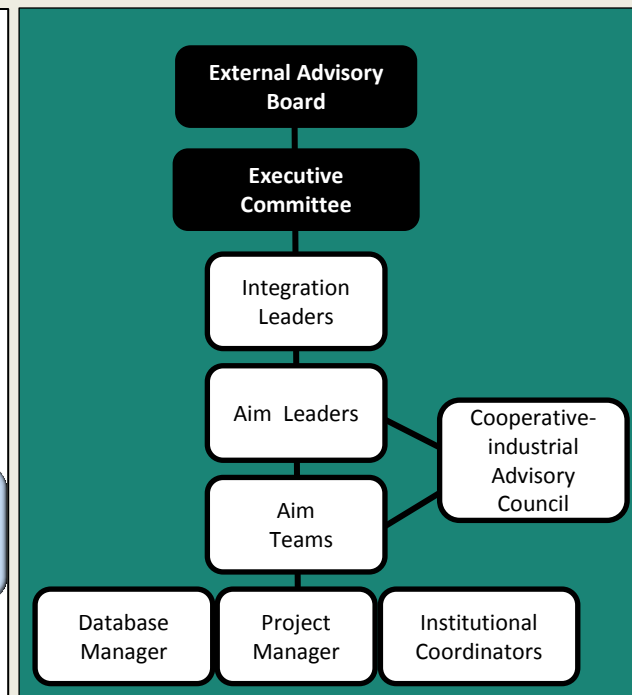
CSCAP Organizational Chart



REACCH Organizational Chart



PINEMAP Organizational Chart



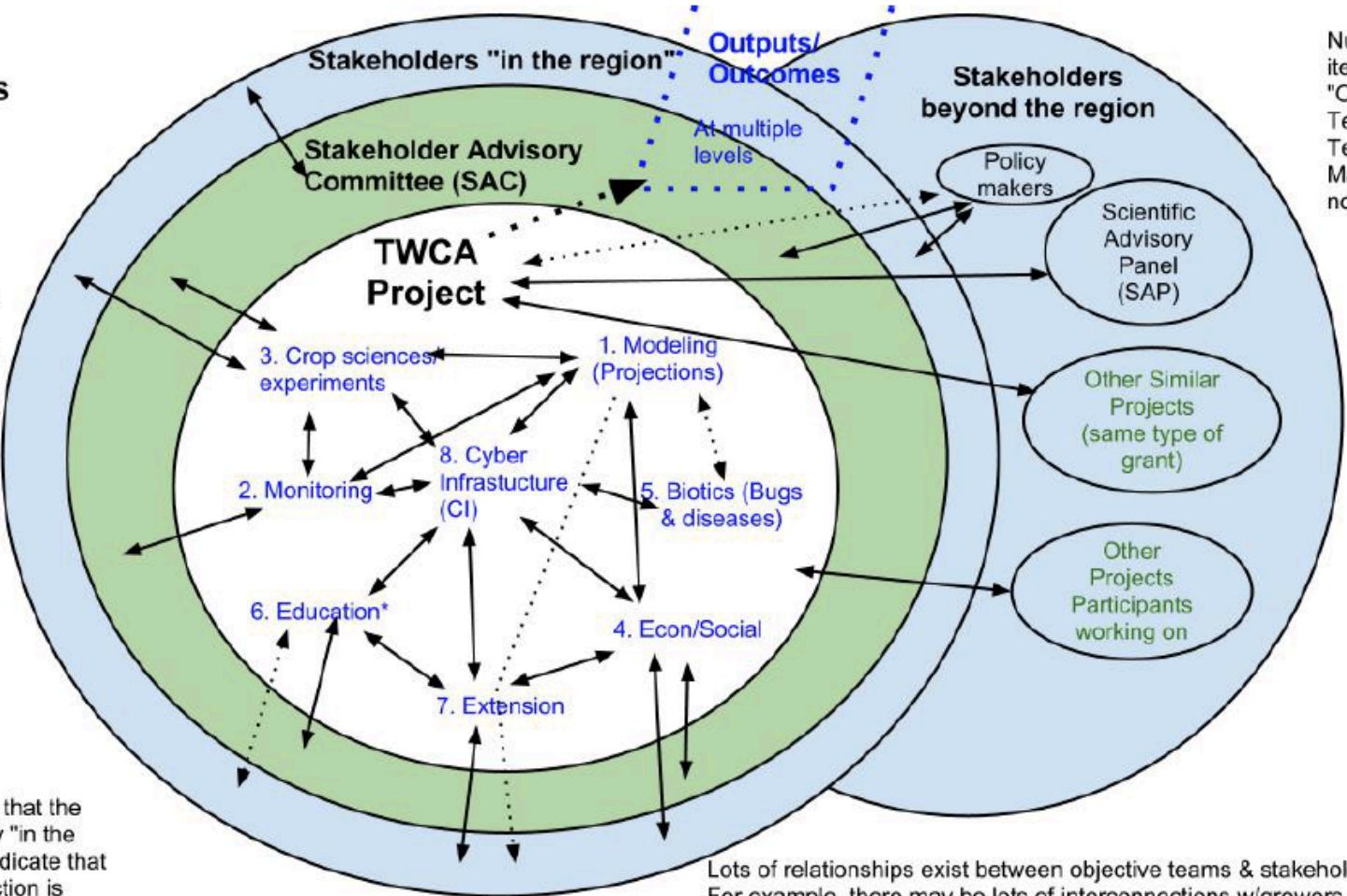
Organizational Reality

Interactions emerge dynamically within a project

Figure 3. TWCA Connections

TWCA Connections (Feb, 2012)

The connections shown in this diagram are primarily about communication and interaction, with associated potential for integration/TD activities throughout the duration of the project. However, some lines begin to point to "outputs" as well, such as modeling tools to assist with farm management and recommended guidelines



Numbered items are called "Objective Teams." Team 9, Project Management, is not shown.

Dotted lines indicate that the activity will be mostly "in the future." Solid lines indicate that at least some interaction is already happening.

* Project members from all teams will provide input into the Education Team; this drawing does not include all the lines for those connections.

Lots of relationships exist between objective teams & stakeholders. For example, there may be lots of interconnections w/growers - some from current project, some from history of ongoing relationships. Similar relationships exist to "other projects" that people work on. (Almost no one is "full time")

Ways to Document & Understand Team Processes and Integration

Multiple data sources available to identify areas of integration and discover where, when, and how future integration can be encouraged:

- Surveys
- Focus groups
- Qualitative interviews
- Archival analysis of meeting activities and action items/or lack of
- External evaluator observations
- Social Network Analysis
- Ethnography

Baseline Team Assessment

- Online survey of project participants
- Pre-existing multi, interdisciplinary relationships

Collaboration questions modified from the Transdisciplinary Research on Energetics and Cancer Initiative, published in American Journal of Preventive Medicine, 2008

	Never	Once or twice a year	Quarterly	Monthly	Weekly
a. Read journals or publications outside your primary, secondary, or third disciplines (listed in response to Question #2)	12.4%	21.5%	19.8%	28.9%	17.4%
b. Attended meetings or conferences outside your primary, secondary, or third disciplines	38.8%	45.5%	12.4%	3.3%	0.0%
c. Participated in working groups or committees with the intent to learn from researchers in other disciplines	24.8%	40.5%	20.7%	12.4%	1.7%
d. Submitted grant proposals, <u>other than the CSCAP</u> , in partnership with colleagues or others outside your primary, secondary, or third disciplines	51.2%	36.4%	10.7%	1.7%	0.0%
e. Received grant funding awards, <u>other than the CSCAP</u> , in partnership with colleagues or others outside your primary, secondary, or third disciplines	57.0%	36.4%	6.6%	0.0%	0.0%
f. Obtained new insights into your own work through discussion with colleagues from other disciplines	10.7%	26.4%	23.1%	18.2%	21.5%
g. Modified your own work or research agenda as a result of discussions with colleagues from other disciplines	18.2%	32.2%	28.1%	18.2%	3.3%
h. Established links with colleagues from other disciplines that led to or may lead to future collaborative work	14.0%	47.1%	18.2%	14.9%	5.8%

Baseline Key Findings & Next Steps

1. **Learn** about each other's science
2. Find **connections** among our sciences
3. **Ask complex questions** that our sciences, when integrated, might answer
4. Create **clusters** of individuals willing to ask new questions and seek new solutions

Greenhouse Gases and Agriculture
Dr. Michael Castellano, Iowa State University

Greenhouse gases (GHG) include an array of widely occurring and non-oxidized chemical compounds. On a mass basis, each GHG has a different impact of heat in the atmosphere. Global warming potential (GWP) is a relative measure that characterizes the warming capacity of these different GHGs. GWP compares the amount of heat trapped by a given mass of a specific GHG to an equivalent mass of carbon dioxide (CO₂) over a 100-year time period. For example, the global warming potential (GWP) for nitrous oxide (N₂O) is 298. This means that 1 kg of N₂O has the same warming potential as 298 kg of CO₂ over a period of 100 years.

Atmospheric GHG emissions from corn production are dominated by CO₂, N₂O, and methane (CH₄). Methane (CH₄) and N₂O are potent greenhouse gases, with GWP values of 25 and 298, respectively. In total, these gases account for approximately 90% of U.S. agricultural GHG emissions. Emissions of carbon dioxide (CO₂), CH₄, and N₂O from corn production include: soil, fertilizer, and machinery and other production of fuel gases.

Soil GHG emissions are the largest source of GHG emissions from corn production. Soil GHG emissions are affected by soil properties, agricultural practices for 11-12% of total global anthropogenic GHG emissions. In the U.S., soil GHG emissions account for 10% of total anthropogenic GHG emissions and are projected to increase by 10-20% by 2050. Soil GHG emissions from agricultural soil management in the region (IAD) have not changed a lot since 1980. N₂O production from agricultural soil management in the region (IAD) has increased by 10-20% since 1980.

The International Panel on Climate Change has identified improved agricultural soil management as the most important method to reduce GHG emissions from agriculture. Sustainable soil management practices have been identified that high yields (increased), coupled with high nitrogen fertilizer use efficiency, may be a pathway to reduced GHG emissions from agricultural soil management. However, more research is needed to understand the mechanisms that underlie these practices and how they can be implemented in a way that is both profitable and sustainable.

References:
Castellano, M., et al. (2014). Greenhouse Gas Emissions from Corn Production in the United States. *Journal of Soil and Water Conservation*, 69(1), 1-10.
Castellano, M., et al. (2015). Greenhouse Gas Emissions from Corn Production in the United States. *Journal of Soil and Water Conservation*, 70(1), 1-10.
Castellano, M., et al. (2016). Greenhouse Gas Emissions from Corn Production in the United States. *Journal of Soil and Water Conservation*, 71(1), 1-10.

For more information, contact:
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Climate Change Beliefs, Concerns and Support for Adaptation and Mitigation among Corn Belt Farmers
Dr. J. Gordon Arbuckle, Jr., Iowa State University

Agriculture is both vulnerable to global climate change and a significant source of the greenhouse gases (GHGs) that are driving climate change. Because climate change impacts are likely to be unevenly distributed, it is important to understand the beliefs, concerns, and support for adaptation and mitigation among farmers in the Corn Belt. This infographic provides a baseline of farmer beliefs, concerns, and support for adaptation and mitigation among Corn Belt farmers. The infographic is based on data from a survey of 1,000 Corn Belt farmers conducted in 2014. The survey asked farmers about their beliefs about climate change, their concerns about the impacts of climate change on their farms, and their support for various adaptation and mitigation strategies. The infographic is divided into three main sections: Beliefs, Concerns, and Support. The Beliefs section shows that 78% of farmers believe that climate change is occurring, and 65% believe that it is caused by human activities. The Concerns section shows that 85% of farmers are concerned about the impacts of climate change on their farms, with the most common concerns being changes in precipitation patterns, increased drought, and increased soil erosion. The Support section shows that 65% of farmers support government action to address climate change, and 55% support government action to support research and development of new technologies to reduce GHG emissions from agriculture.

References:
Arbuckle, J.G., et al. (2015). Climate Change Beliefs, Concerns and Support for Adaptation and Mitigation among Corn Belt Farmers. *Journal of Soil and Water Conservation*, 70(1), 1-10.

For more information, contact:
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Drainage Water Management
Dr. J. Bruce Burkhart, Purdue University

Subsurface tile drainage, which is used to remove excess water from saturated soils, is an important component of crop production in the Midwest. However, tile drainage has been shown to contribute to increased nitrogen losses from the soil. Drainage water management (DWM) is a practice that can be used to reduce nitrogen losses from the soil. DWM involves installing a water control structure in a drainage tile line to allow water to flow through the tile when the soil is saturated and to prevent water from flowing through the tile when the soil is not saturated. This practice can reduce nitrogen losses from the soil and improve crop yields. The infographic provides information about the benefits of DWM, the types of DWM structures that are available, and the steps involved in installing a DWM structure. The infographic also includes a photo of a DWM structure being installed in a field.

References:
Burkhart, J.B., et al. (2014). Drainage Water Management: A Review. *Journal of Soil and Water Conservation*, 69(1), 1-10.

For more information, contact:
Dr. J. Bruce Burkhart, Purdue University, West Lafayette, IN 47907, USA. Email: burkhart@purdue.edu



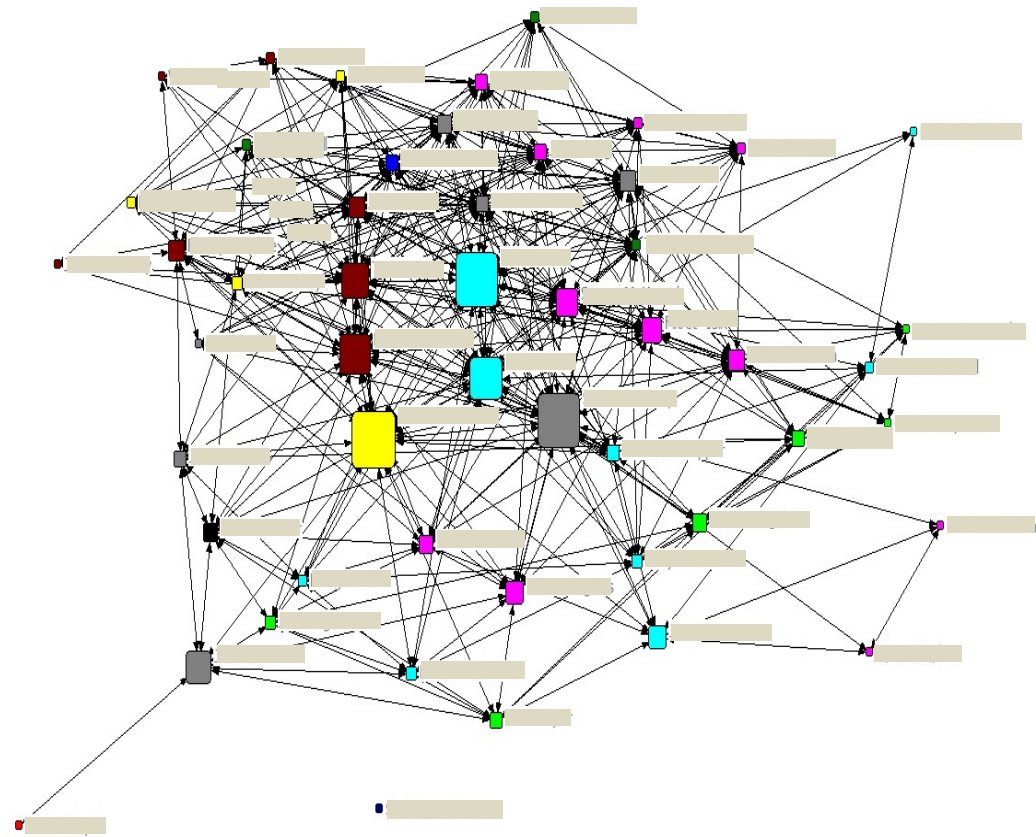
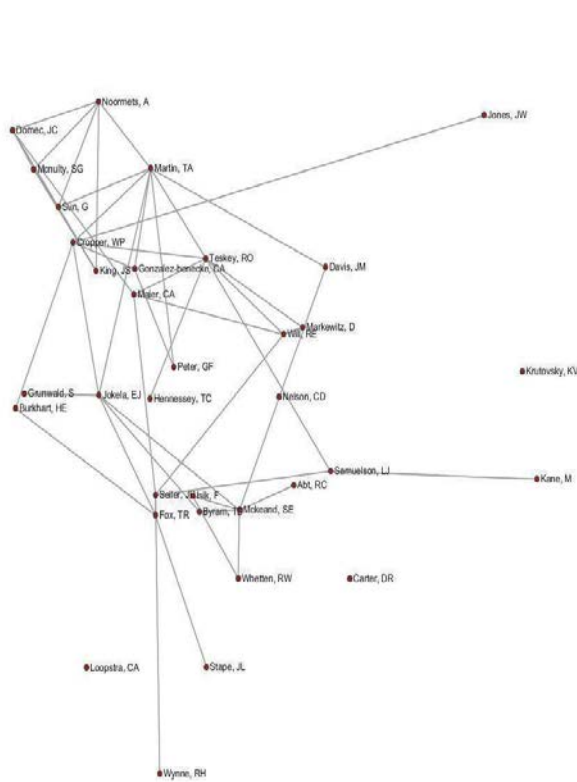
Social Network Analysis (SNA) is a tool that can be used to describe patterns of interactions in a project and to help participants understand and optimize their collaboration.

Sociocentric Network Analysis (SNA) as a Monitoring Tool for Reflection & Learning

1. Collect **data from members**
2. Create social network **diagram**
3. Revealed **patterns**
4. Participatory SNA **perceptions of interactions**
5. Repeat during **project life cycle**

Highlights the strength of existing networks, as well as challenges of integrating across networks and pulling “unconnected” collaborators into the network.

PINEMAP SNA



Survey to gather social network data

REACCH SNA (Connections between individuals)

No awareness: You do not know who this person is.

No direct contact: You know who this person is, but do not have direct contact with them. (You might have met them or seen them at a meeting.)

Communication/Coordination: You share (or have shared) information and/or align activities with this person, to support mutually beneficial goals.

Collaboration: You have actively worked together to set common goals, realize a shared goal, or develop integrated knowledge.

Identified wish/need for future interaction: You think there is an opportunity for cooperation or collaboration with this person, but that hasn't happened yet.

Unification/coadunation. You think there is a merging of identities, structure, and culture. Unification through growth.

1. What interaction have you had with each person?

	No awareness	No direct contact	Communication/Coordination	Collaboration	Unification/coadunation	Need for future interaction
Person A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person E	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Done

Unexplored Territory

Understanding the architecture of integration with our teams, and quantifying or otherwise measuring that structure as we go is helping us venture out into unexplored territory.



Institutional Adaptation

- Institutional change in how we think about and do science, strengthen our capacities to better connect theory, data, and reality
- Integrate science
- Accomplish innovation



Adaptation Needed Across Many Systems

- 1. Resistance** (*status quo; manage to resist change disturbance*)
- 2. Resilience** (*moderate effects but retain form and function after disturbance*)
- 3. Transformation** (*transition to a new system with different structure and function better suited to new conditions*)

Acknowledgements

- Project managers:
 - Lori Abendroth (CSCAP)
 - Dianne Daley Laursen (REACCH)
 - Jessica Ireland (PINEMAP)

- Assessment specialists:
 - Emma Norland (CSCAP)
 - David Meyer (REACCH)
 - Wendy-Lin Bartels (PINEMAP)

Thank You!

SUSTAINABLE CORN.ORG
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THE ISSUE

Corn is essential in America. The highly versatile crop is an economic powerhouse, employing millions and producing food, feed and fuel. American farmers heavily invest their time, land and money in the crop's production. In 2011, 12.3 billion bushels of corn were produced in the United States alone.

Global and domestic demand for corn continues to rise. However, there is increasing uncertainty about how long-term US climate trends are impacting corn-based cropping systems and threatening agricultural investments. In response, farmers are seeking new ways to ensure continued crop productivity while also minimizing environmental impact.

THE PROJECT

This five-year project gathers data from 20 field sites in eight Midwestern states and focuses on ways to best promote the long-term sustainability and productivity of corn-based cropping systems.

A transdisciplinary team is assessing the environmental, economic and social impacts of shifting weather patterns and increasing long-term climate variability on the system. Extension and education programs are working with farmers, teachers and students to connect them with project analyses and promote collaborative learning.

Project Partners

- Iowa State University
- Lincoln University
- Michigan State University
- The Ohio State University
- Purdue University
- South Dakota State University
- University of Illinois
- University of Minnesota
- University of Missouri
- University of Nebraska
- USDA Agricultural Research Service-Columbus, Ohio
- USDA National Institute of Food and Agriculture (USDA-NIFA)

Baseline Monitoring & Innovative Crop Management Team

Regional Data Entered in Central Database

Climate Instability

Model Testing

Systems Analysis & Predictive Modeling

Technical Advisors

SCIENTISTS AND FARMERS WORKING TOGETHER TO CREATE A SUITE OF PRACTICES FOR CORN-BASED SYSTEMS THAT:

- are resilient in times of drought
- reduce soil and nutrient losses under extreme soils and field conditions
- reduce farm fuel and nitrogen losses
- reduce carbon in the soil
- preserve crop and soil resources

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REACCH
Regional Approaches to Climate Change
PACIFIC NORTHWEST AGRICULTURE

Welcome to REACCH!

The Regional Approaches to Climate Change project is a coordinated regional agricultural project, funded by the National Institute of Food and Agriculture to improve the long-term profitability of the cereal production systems of northern Idaho, north central Oregon, and eastern Washington under ongoing and projected climate change, while contributing to climate change mitigation by reducing emissions of greenhouse gases.

REACCH includes efforts in research, extension, and education that integrates diverse elements including climate modeling, cropping systems modeling, economics, agronomy, crop protection, and others in a transdisciplinary manner.

The project is a partnership of four institutions (USDA Agricultural Research Service, University of Idaho, Washington State University, and Oregon State University). More than 50 scientists, students and postdocs are participating. It also includes an educational element by developing programs for K-12, educators and students.

We connect with farmers, industry personnel, and other stakeholders/partners to achieve the adaptation and mitigation goals of REACCH.

Goals of REACCH

- Develop and implement sustainable agricultural practices for cereal production within existing and projected agroecological zones throughout the region as climate changes.
- Contribute to climate change mitigation through improved fertilizer, fuel, and pesticide use efficiency, increased sequestration of soil carbon, and reduced greenhouse gas (GHG) emissions consistent with NAPA's 2030 targets.
- Increase the number of scientists, educators, and extension professionals with the skills and knowledge to address climate change and its interactions with agriculture.
- Develop the regional capacity for continued, long-term research, education, and extension efforts to mitigate and adapt to climate change.
- Address climate change effects with a transdisciplinary research.

SEARCH REACCH

REACCH Member Login

Username:

Password:

Contact REACCH

REACCH News & Events

Agriculture and Climate Change Integrated Projects Panel

Agriculture and Climate Change Integrated Projects

October 1-2, 2012: Pacific Northwest Climate Conference

Upcoming PNCC will include a session on agriculture.

September 14-16, 2012: REACCH Graduate

PINEMAP
Managing the future of Southern pine management in a changing world.

Pine Integrated Network: Education, Mitigation, and Adaptation project (PINEMAP) A Coordinated Agricultural Project funded by the USDA National Institute of Food and Agriculture

RESEARCH | **EXTENSION** | **EDUCATION**

You are here: Home

Welcome to PINEMAP

Pine Integrated Network: Education, Mitigation, and Adaptation project (PINEMAP) is one of three Coordinated Agricultural Projects awarded in 2011 by the USDA National Institute of Food and Agriculture (NIFA).

PINEMAP focuses on the 20 million acres of planted pine forests managed by private landowners in the Atlantic and Gulf coastal states from Virginia to Texas, plus Arkansas and Oklahoma. These forests provide critical economic and ecological services to U.S. citizens. Southeastern forests contain 1/3 of the contiguous U.S. forest carbon and form the backbone of an industry that requires 16% of total industrial uses. 5.5% of the jobs, and 7.5% of the industrial economic activity of the region.

PINEMAP integrates research, extension, and education to enable southern pine landowners to manage forests to increase carbon sequestration, increase efficiency of nitrogen and other fertilizer inputs, and adopt forest management approaches to increase forest resilience and sustainability under variable climates.

Project & News Updates

Climate Change and Southeastern Forests: A New R&E Secondary Module

Improving forest health and productivity in the Southeast: A new R&E secondary module on climate change impacts on southern pine ecosystems. Free reports are available on the web. [View on PINE](#)

Improved Loblolly Pines Better for the Environment, Study Finds

NC State researchers April 17, 2012. [Read More](#)

Creating Better Pine Forest Management for a Changing Climate and Resilient Forest Agriculture Ecosystems

[Read More](#)

Year 1 Annual Report

Download the PINEMAP year 1 annual report summarizing activities and accomplishments for the period of 9/2011-2012. [View Report](#)

Future forests may soak up more

Publications

Modeling the effects of stand development, site quality, and silviculture on leaf area index, litterfall, and forest floor accumulations in loblolly and slash pine plantations

Guarise-Berwick, C.A., E.J. Jelska, and T.A. Martin. 2012. Modeling the effects of stand development, site quality, and silviculture on leaf area index, litterfall, and forest floor accumulations. [Read More](#)

A comparison of three methods to estimate evapotranspiration in two contrasting loblolly pine plantations: Age-related changes in water use and drought sensitivity of evapotranspiration components

Domke, J.C., S. Sun, A. Nussbaum, B. Garza, E. Treasure, E. Conner, J.J. Swanson, S. Mohanty, and J. King. 2012a. A comparison of three methods to estimate evapotranspiration in two contrasting

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