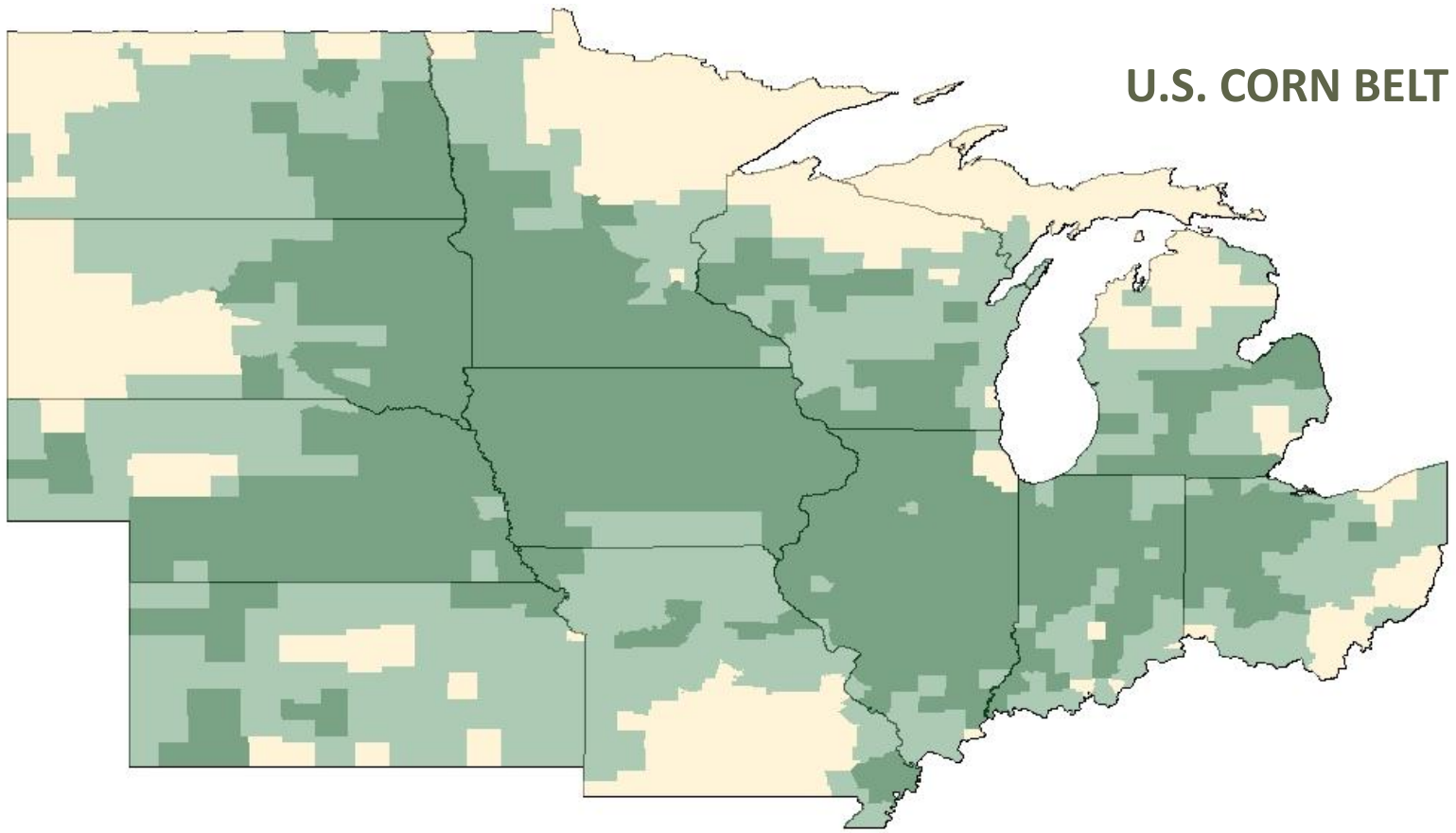
Transforming Climate Variability and Change Information for Cereal Crop Producers in the North Central Region

USDA NIFA

United States Department of Agriculture
National Institute of Food and Agriculture

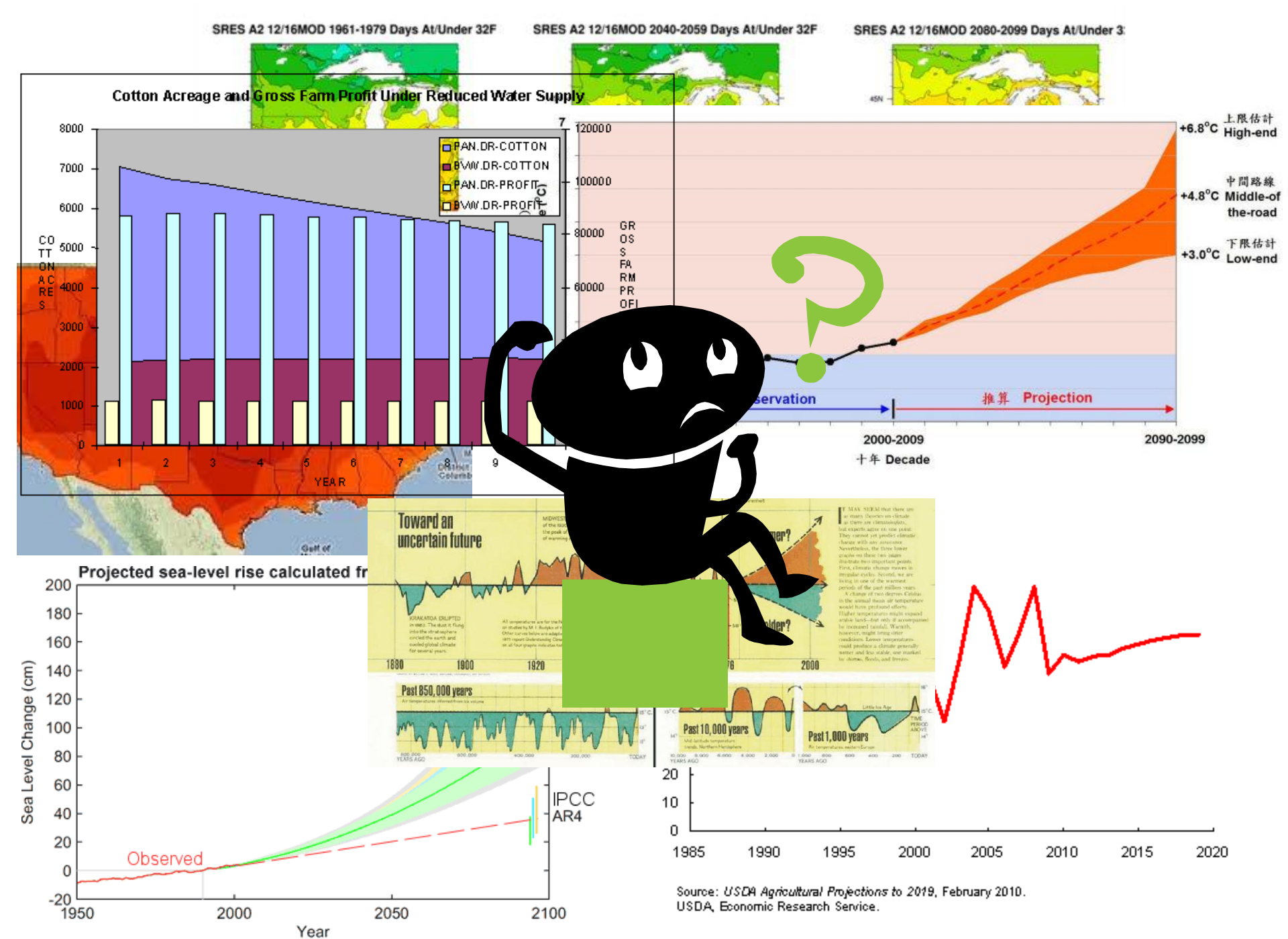
PROJECT LEAD:
Linda Stalker Prokopy, PhD
Purdue University


U.S. CORN BELT
Major Corn Growing Area
Minor Corn Growing Area
Crop data from National Agricultural Statistics Service (NASS)
U.S. 2007 Census of Agriculture
Major corn areas harvested over 60,000 acres of corn
Minor corn areas more than 5,000 acres of corn
Map created by Adam Reimer, October 2011

The Problem

- Highly dependent on favorable temperatures and appropriate precipitation patterns
- Climate variability limits season-to-season predictability and lessens ability to maintain viable farm operations
- Producers need enhanced information for decision making




SRES A2 12/16MOD 1961-1979 Days At/Under 32F
SRES A2 12/16MOD 2040-2059 Days At/Under 32F
SRES A2 12/16MOD 2080-2099 Days At/Under 3
Cotton Acreage and Gross Farm Profit Under Reduced Water Supply
PAN.DR-COTTON
BVW.DR-COTTON
PAN.DR-PROFIT
BVW.DR-PROFIT
COTTON ACRES
GROSS FARM PROFIT
YEAR
+6.8°C 上限估計 High-end
+4.8°C 中間路線 Middle-of the-road
+3.0°C 下限估計 Low-end
2000-2009
2090-2099
十年 Decade
推算 Projection
Toward an uncertain future
Past 850,000 years
Past 10,000 years
Past 1,000 years
Projected sea-level rise calculated fr
Sea Level Change (cm)
Observed
IPCC AR4
Year
Source: USDA Agricultural Projections to 2019, February 2010.
USDA, Economic Research Service.

Project Goals – Five Year Plan

Improve the resilience and profitability of farms amid variable climate change through:

Concurrently

- Developing a knowledge base of past and future biophysical and economic impacts
- Understanding stakeholder needs
- Designing decision support tools
- Preparing training materials and delivery approaches
- Pilot testing tools, methods and outreach
- Disseminating across 12 state region

U2U Team

- State climatologists
- Crop modelers
- Agronomists
- Economists
- Social scientists
- RCC staff
- NOAA staff

MICHIGAN STATE UNIVERSITY

PURDUE UNIVERSITY

UW Extension Cooperative Extension

ILLINOIS

HIGH PLAINS REGIONAL CLIMATE CENTER

MRCC Midwestern Regional Climate Center

MICHIGAN

IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

SDSU

Overarching Characteristics

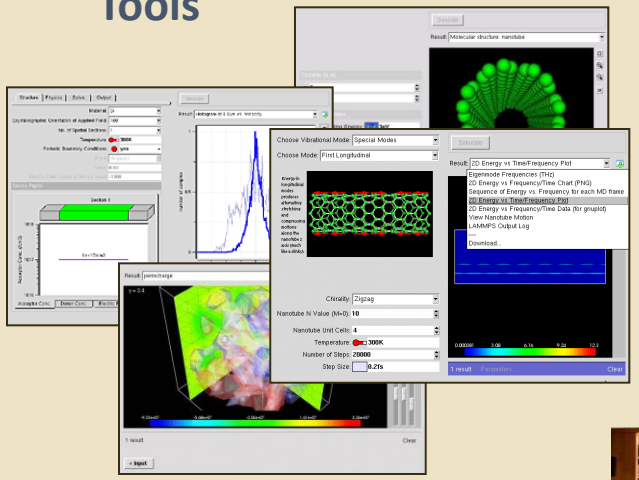
Ongoing dissemination and feedback

Process, output, outcome, and impact evaluation

HUBzero™ technology

HUBzero™ Technology

Tools



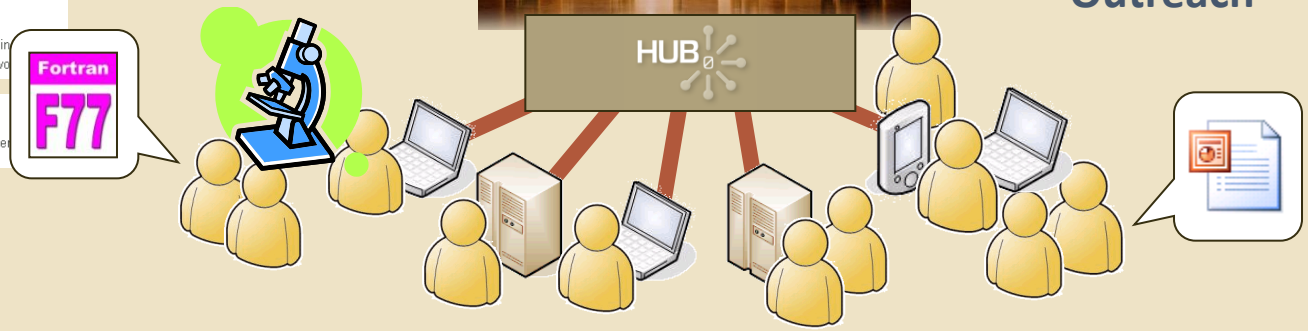
Supporting Resources

Reviews

★★★★★ james k fodor said:
26 Jan, 2006 10:24 AM
This is a great learnin
Simply because it wo

★★★★★ Jing Guo said:
26 Jan, 2006 09:12 AM
It's an excellent mate

Research



Outreach

Reviews

★★★★★ james k fodor said:
26 Jan, 2006 10:24 AM
This is a great learning module
Simply because it would help

★★★★★ Jing Guo said:
26 Jan, 2006 09:12 AM
It's an excellent material to lear

Need for Improved Information





Current predictive tools and models do not meet producer needs:

- No systematic climate outlook and prediction data for corn/soybean systems in Midwest
- Existing tools and models do not incorporate economic outcomes

Objective 1 -- Better understand contributions of anomalous weather to crop productivity, and implications for farm management

Key Issues

Impact/interaction of weather and climate on:

- Timing of nitrogen application and crop yields
- Soil moisture and resulting fieldwork opportunities
- Planting date and crop yields
- Crop cultivar maturity requirements
- End of season crop dry-down rates
- Economic feasibility of longer-term investments (i.e. irrigation, tiling)

Specific Modeling Tasks

Outcomes:

- Develop 4-km gridded crop models across 12-state region
- Identify impact of climate and management decisions on crop yields and farm profitability

- Crop simulations using 3 models
  - Validate using site-specific climate, soil, and agronomic data
  - Use newly developed NLDAS-derived gridded datasets
  - Model output cross-comparisons (DSSAT, Hybrid Maize, ISAM)
- Four farm case studies under various climate scenarios
  - Use Purdue Crop/Livestock Linear Program (PCLP)
  - Evaluate how crop mix, rotation, and other practices affect profitability and capital investment decisions

Need to Understand Stakeholders

"Study the people and their problems and when you are able to know them they will know you. If you do not have their support and cooperation there is something wrong. Find the reason and if you are at fault, endeavor to correct the error."

-- T.J. Talbert, The Extension Worker's Code, 1922

- Little is known about what type of information stakeholders would like and how they would like to receive it.
- Preliminary data suggests that producers are unclear if climate change will affect how their farms are operated.

Objective 2 -- Understand the use and value of climate information in agricultural decision making, determine effective dissemination methods

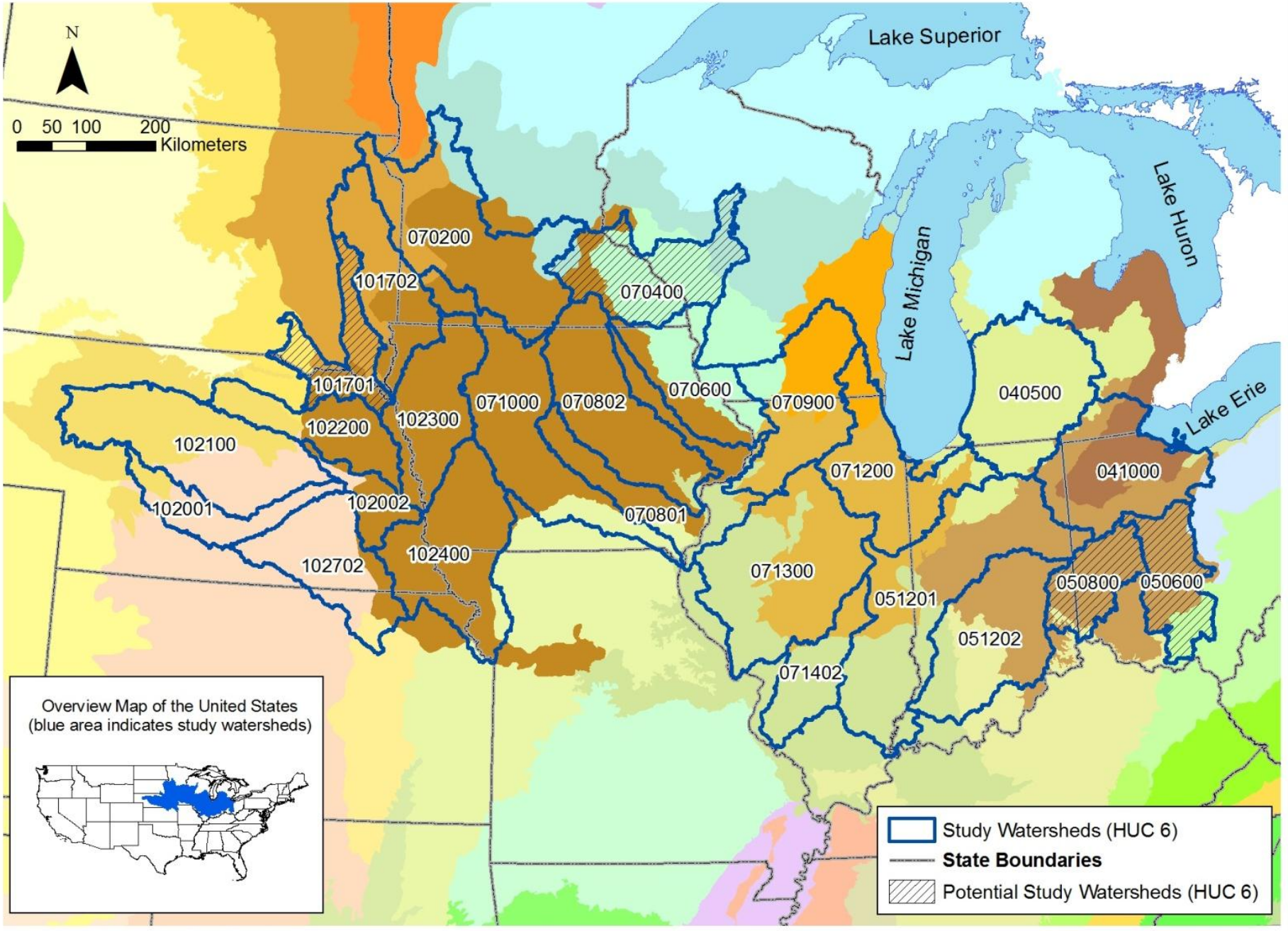
Specific Survey Tasks

Outcomes:

- Understand the use and value of climate information for farmers
- Determine effective methods for disseminating usable climate knowledge

Tasks:

- Cereal crop producer survey
  - Collaborative effort with CS-CAP (Iowa State)
  - Deploy in Jan. 2012 with assistance from NASS
  - Survey 19,000 farmers in 21 watersheds


N
0 50 100 200
Kilometers
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
070200
101702
070400
101701
071000
070802
070600
070900
040500
102200
102300
102100
071200
041000
102001
102002
070801
102400
102702
071300
050800
050600
051201
051202
071402
Overview Map of the United States
(blue area indicates study watersheds)
Study Watersheds (HUC 6)
State Boundaries
Potential Study Watersheds (HUC 6)

Specific Survey Tasks

Outcomes:

- Understand the use and value of climate information for farmers
- Determine effective methods for disseminating usable climate knowledge

Tasks:

- Cereal crop producer survey
- "Advisor" survey in four states

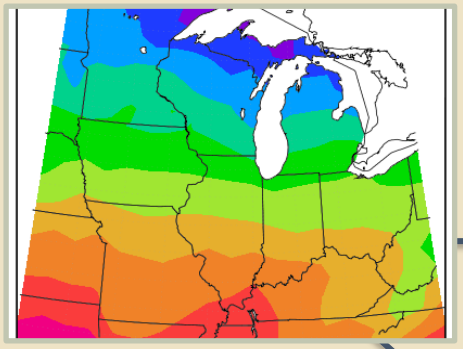
} Concurrently

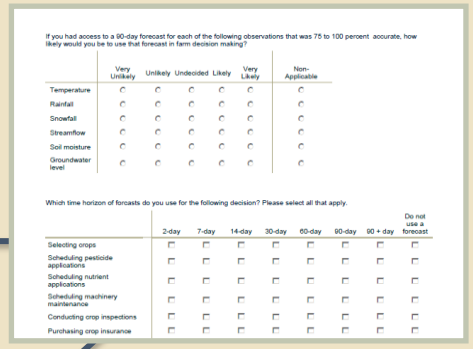
- Stakeholder network analysis
- Follow-up focus groups
- Native American farmer survey

Types of Survey Questions

- What type of climate information do you currently use?
- What type of information would you like? And in what format?
- Who do you talk to about farm planning?
- Who do you trust for information?
- Climate change / climate variability awareness/beliefs

Develop Decision Support Tools





If you had access to a 90-day forecast for each of the following observations that was 75 to 100 percent accurate, how likely would you be to use that forecast in farm decision making?

	Very Unlikely	Unlikely	Undecided	Likely	Very Likely	Non-Applicable
Temperature	○	○	○	○	○	○
Rainfall	○	○	○	○	○	○
Snowfall	○	○	○	○	○	○
Streamflow	○	○	○	○	○	○
Soil moisture	○	○	○	○	○	○
Groundwater level	○	○	○	○	○	○

Which time horizon of forcasts do you use for the following decision? Please select all that apply.

	2-day	7-day	14-day	30-day	60-day	90-day	90 + day	Do not use a forecast
Selecting crops	☐	☐	☐	☐	☐	☐	☐	☐
Scheduling pesticide applications	☐	☐	☐	☐	☐	☐	☐	☐
Scheduling nutrient applications	☐	☐	☐	☐	☐	☐	☐	☐
Scheduling machinery maintenance	☐	☐	☐	☐	☐	☐	☐	☐
Conducting crop inspections	☐	☐	☐	☐	☐	☐	☐	☐
Purchasing crop insurance	☐	☐	☐	☐	☐	☐	☐	☐

- Using data from ag-climate models and information about stakeholder needs, appropriate DSTs will be identified and developed.
- We will work closely with stakeholder groups and the U2U Advisory Committee to do this.

Not clear yet what tools will be needed!

DST Example: Fertilizer Management

- Inputs:
  - Data provided by user such as farm location and type of fertilizer
  - Data from the HUB automatically generated from farm location:
    - climate projections
    - expected field days
    - crop yield patterns
    - economic and market information
- Outputs:
  - Tool presents possible results in physical and economic units with uncertainty measures.

Development of Delivery System

- The tool is not enough! People need to know it's there and how to use it!
- We plan to develop an interactive delivery system including:
  - Training materials
  - Recorded and real-time webinars
  - Fact sheets
  - Job aids
  - Printed materials

Pilot Testing

How effective are decision support tools and outreach materials?

Pilot States

- Work with Extension educators to deliver tools and information
- Evaluation:
  - Knowledge and skills of Extension staff
  - Survey participants at training sessions
  - Survey producers across pilot states

Broad Dissemination of Information

- Disseminate validated training materials, tools and Extension programs across 12 state region

- Regional workshop to train Extension educators and subsequent funds to disseminate in their state



http://www.AgClimate4U.org

driNET DROUGHT RESEARCH INITIATIVE NETWORK

Search

Login | Register

Home | My HUB | Resources | Members | Support | Projects | About

Help!

- OVERVIEW
- DECISION SUPPORT TOOLS
- PUBLICATIONS AND PRESENTATIONS
- ADVISORY COMMITTEE
- TEAM
- FUNDING
- CONTACT US
- INFORMATION FOR PROJECT PERSONNEL

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers

Introduction

Agricultural crops contribute about $150 billion annually to the U.S. economy, most of which comes from the intensely cultivated corn-belt region of the Midwest (USDA-ERA, 2010). Successful crop production in this area is highly dependent on favorable temperatures and appropriate precipitation patters, making the viability of this industry subject to increasingly variable climate patterns.

Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers, is an **integrated research and extension project** that seeks to improve the resilience and profitability of farms in the North Central Region amid variable climate change through the development and dissemination of improved decision support tools, resource materials, and training. The goal is to help producers make better long-term plans on what, when and where to plant, and also how to manage crops for maximum yields and minimum environmental damage.

Objectives

During the span of this 5-year project, the U2U team will complete tasks associated with 5 objectives that together will improve the usability of climate information for the agricultural community and lead to more sustainable farming operations.

First the team will produce research on the biophysical and economic risks and impacts of different climate scenarios on corn/soybean yields and farm profitability in the North Central Region (objective 1). Simultaneously, research will be conducted to understand how producers use climate information, evaluate producers' and advisors' climate information needs, and assess effective methods for disseminating usable knowledge to the agricultural community (objective 2).

Based on these findings, decision support tools (DSTs) and training materials will be developed to effectively deliver climate information to stakeholders (objective 3). DSTs, training materials, and implementation approaches for corn/soybean producers will then be piloted in Indiana, Iowa, Nebraska, and Michigan (objective 4). After several iterations with stakeholders to ensure the usability and utility of the tools, the program will be extended to all twelve states in the region (objective 5).

U2U: A systems approach addressing agriculture climate change

U2U Investigators

- ***Purdue University***: Linda Prokopy (Lead), Otto Doering, Ben Gramig, Dev Niyogi, Carol Song
- ***Iowa State University***: Roger Elmore, Chad Hart, Lois Morton, Gene Takle
- ***Michigan State University***: Jeff Andresen
- ***South Dakota State University***: Dennis Todey
- ***University of Illinois***: Jim Angel, Steve Hilberg, Atul Jain
- ***University of Michigan***: Maria Lemos
- ***University of Minnesota***: Tom Bartholomay
- ***University of Missouri***: Pat Guinan, Ray Massey
- ***University of Nebraska***: Cody Knutson, Martha Shulski
- ***University of Wisconsin***: Tom Blewett

FOR MORE INFORMATION CONTACT:

Linda Prokopy, PhD
Project Director, U2U
Purdue University
lprokopy@purdue.edu

Melissa Widhalm
Project Manager, U2U
Purdue University
mwidhalm@purdue.edu

VISIT US ONLINE:

http://www.AgClimate4U.org

This project was supported by Agriculture and Food Research Initiative Competitive Grant no. 2011-68002-30220 from the USDA National Institute of Food and Agriculture.

United States Department of Agriculture
National Institute of Food and Agriculture