# Climate * Water

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Coordinated Agricultural Project (CAP)

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Association of Public & Land Grant Universities,
Experiment Station and Research Directors Annual Meeting

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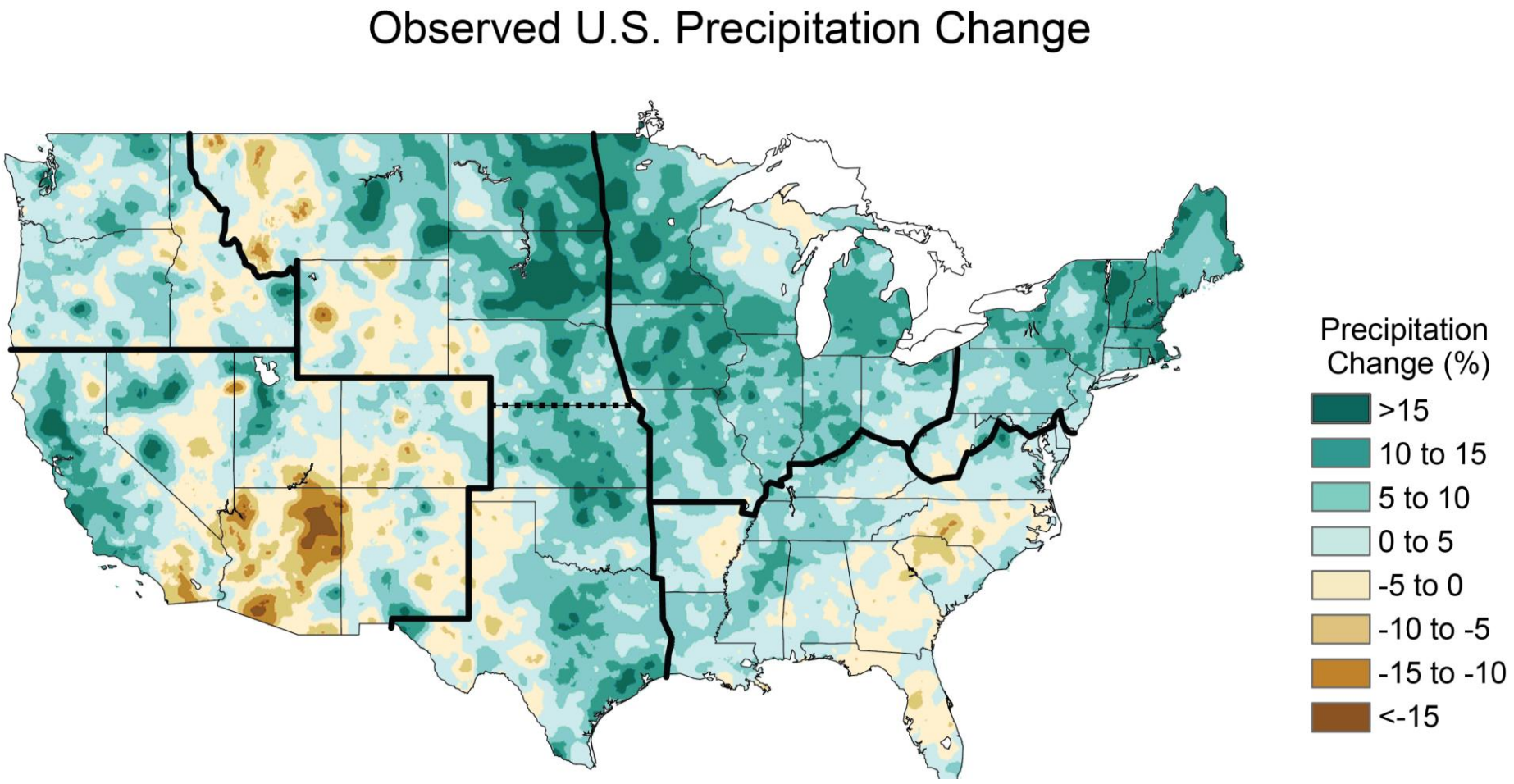
*Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems*
Project Web site: sustainablecorn.org

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

SUSTAINABLE CORN.ORG CROPS, CLIMATE, CULTURE AND CHANGE

# Water is the visible impact of extreme and variable climate conditions

# Geography matters

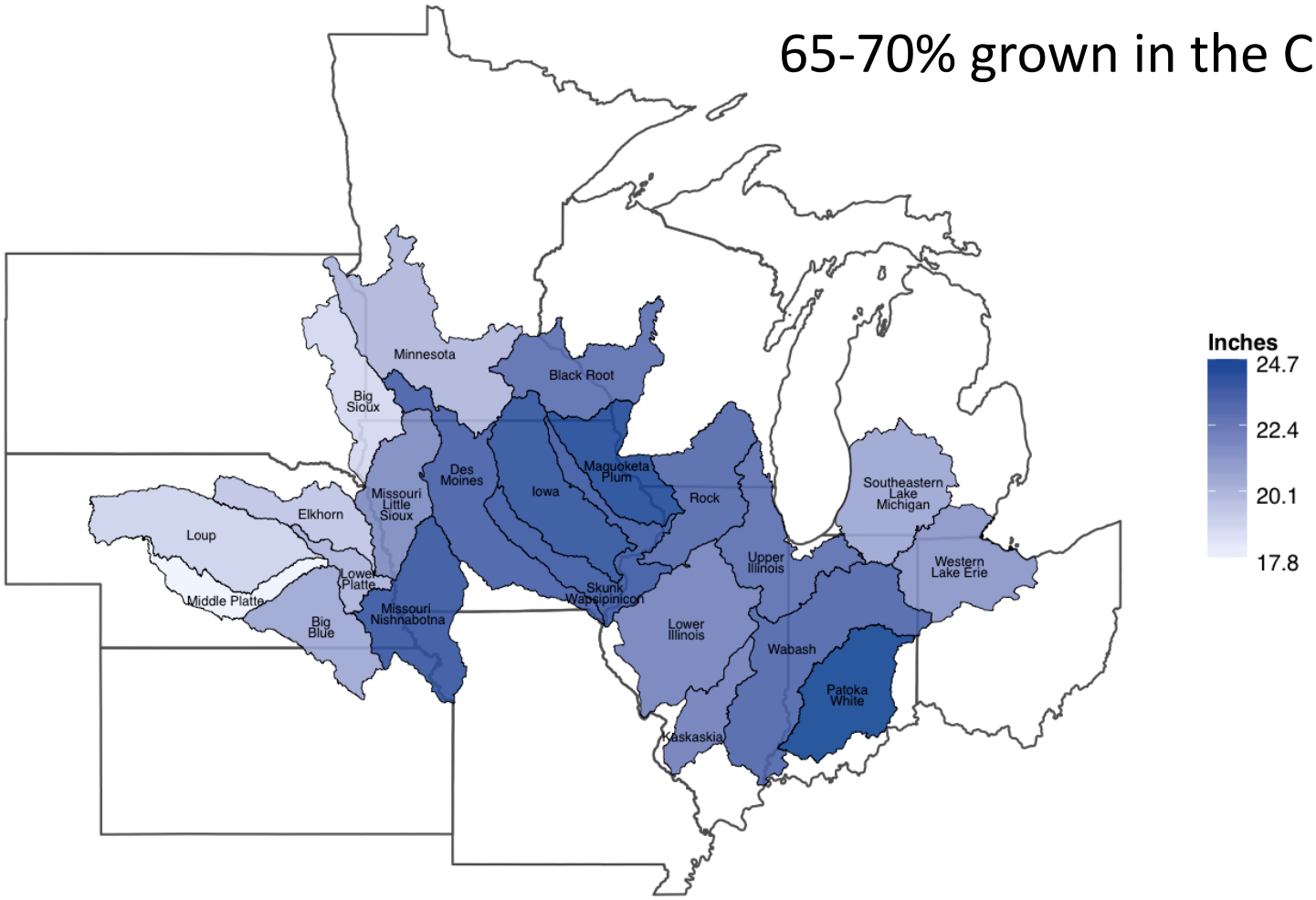



Annual total precipitation changes for 1991 to 2012 compared to 1901 to 1960
(Third US Climate Assessment report, Melillo et al. 2014)

# ~400,000 US farms grow corn; ¼ of all harvested crop acres

~$80 billion commodity  US world leader in production

65-70% grown in the Corn belt




Corn belt median seasonal precipitation (April 1-Sept 30  1971-2011)


United States Department of Agriculture
National Institute of Food and Agriculture

Agriculture & Weather Variability in the Corn belt: A Survey of Corn belt Farmers Statistical Atlas  2013
Arbuckle, Loy, Hobbs, Wright Morton, Tyndall

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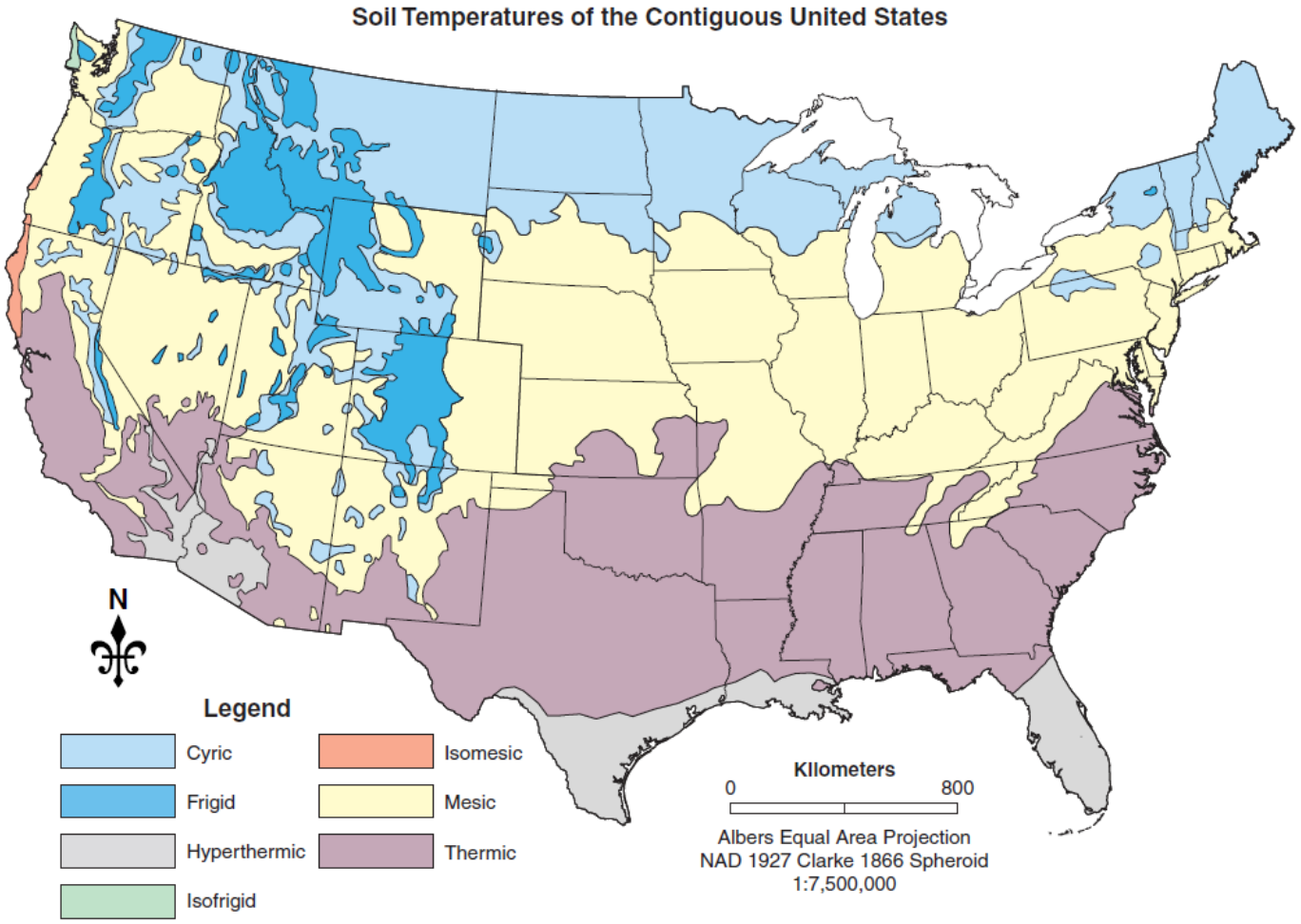
CROPS, CLIMATE, CULTURE AND CHANGE

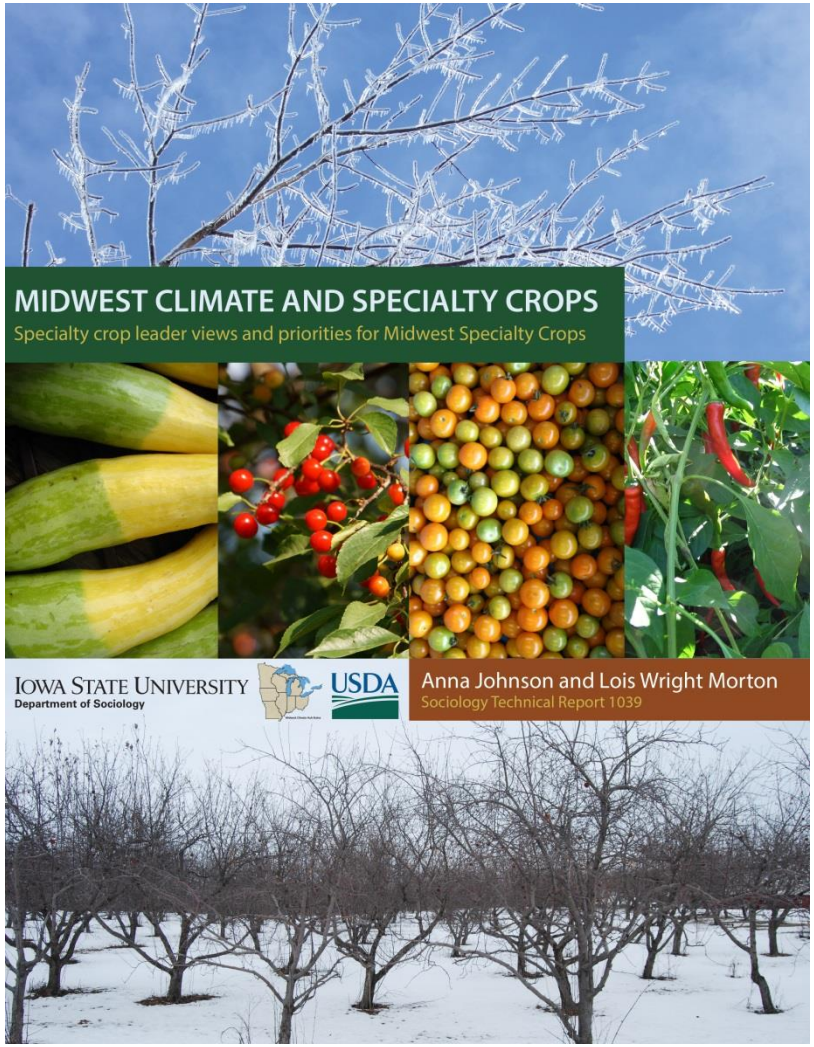
# Water * temperature interactions affect cropping systems

## shifts in the US mesic-frigid boundary




The science of variable climate and agroecosystem management 2014. L.W. Morton
*Journal Soil & Water Conservation* 696:207A-212A

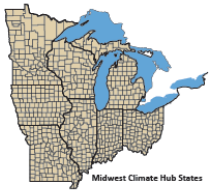
**Midwest Climate and Specialty Crops:**
**Specialty crop leader views and priorities for Midwest specialty crops (2014)**




Midwest Climate Hub
Priority areas for specialty crops

1. Pest and disease
2. Marketing and risk
3. Water
4. Climate and weather
5. Farming as a livelihood
6. Labor
7. Changes in operations
8. Changing opportunities & vulnerabilities
9. Production-consumer-research nexus

USDA




This research, North Central Fruit, Vegetable and Wine Growers' Assessment of Soil and Water Vulnerability Under Changing Climate Conditions and Extreme Weather Events funded by USDA-Agricultural Research Service (ARS) Midwest Climate Hub.

Johnson, A. and L.W. Morton 2015. Midwest Climate & Specialty Crops. Midwest Climate Hub Sociology Technical Report 1039. Iowa State University Ames, IA

# Some of the underlying issues associated with climate, water and agriculture

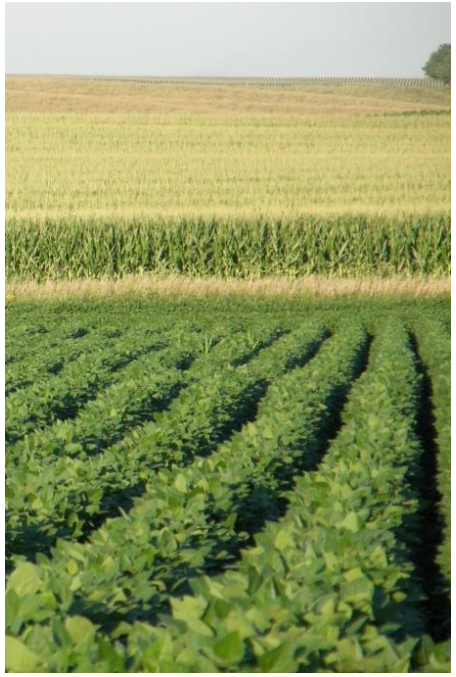
*How much change can specific cropping systems absorb and still retain core functions: productivity, profitability &ecosystem integrity?

*What are the characteristics of specific cropping systems that offer increased capacity to adapt to changing and variable climates?

*What characteristics reduce and limit capacity to adapt and mitigate water challenges under increasingly variable and unpredictable climatic conditions?

Land Grant University science is critical if we are to build a knowledge base, effectively address water*climate issues and develop strategies and capacities that help our stakeholders adapt to risk and uncertainties associated with continual change



# Key Challenges

1. Fragmentation in how we engage water science

2. Regional exchange & learning

3. AES directors are key investors

4. US water resource science needs cohesive leadership and partners

# 1.Fragmentation in how we engage water science

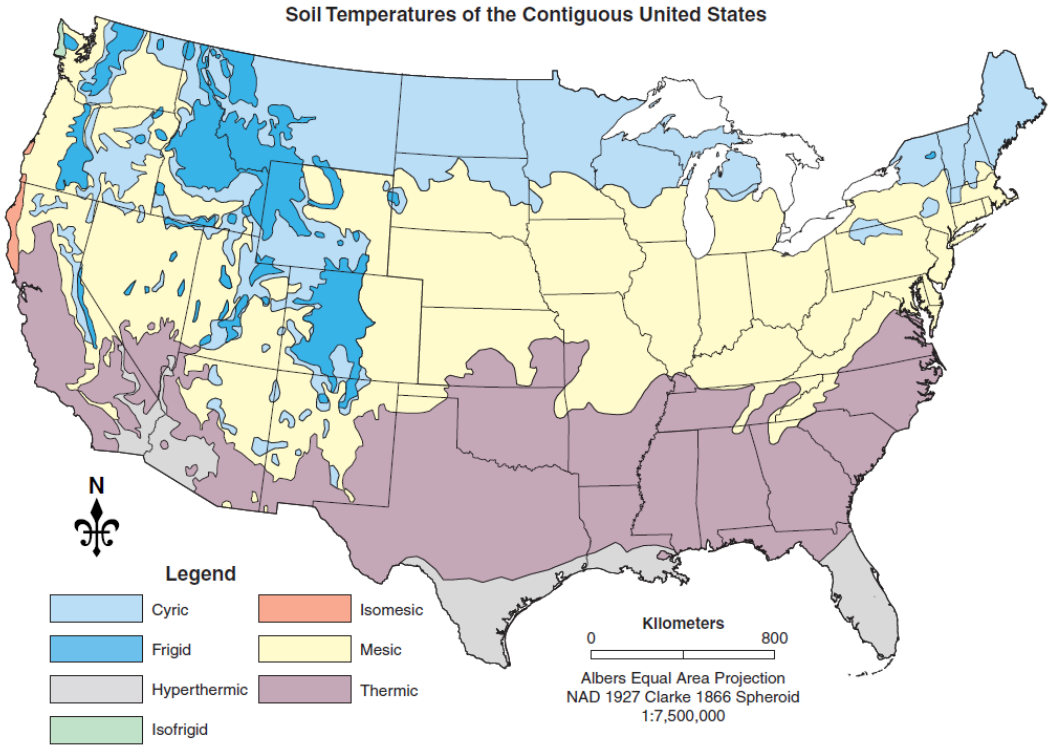
The water cycle has no social, geo-political boundaries

Ecosystems and agriculture are intimately connected

Coupled human-natural systems

# 2. Regional exchange & learning

What one region has learned could be critical science for another entering/experiencing drought or flooding/excess water




shifts in the US mesic-frigid boundary

# 3. AES & research directors are key investors

…able to construct collaborative partnerships to leverage and expand scarce financial, institutional and human resources across geography

1) Coupled human-natural systems research
2) Long term observational experiments
3) Shared data for synthesis and integration

# 4.US water resource science needs cohesive leadership and partners

Plan to guide
priority investments
in US water resources

# Multi-pronged agenda for sustainable agricultural systems research

1. Institutional infrastructure; shared data bases
2. Field & landscape level trials across geography & crops (innovation & standardized protocols)
3. Sociology and economics (primary & secondary data)
4. Synthesis and integration of data; modeling climate, water, and humans (coupled human-natural systems)
5. Purposeful feedback loops among scientists, farmers, industry, policy-makers, & non-governmental organizations

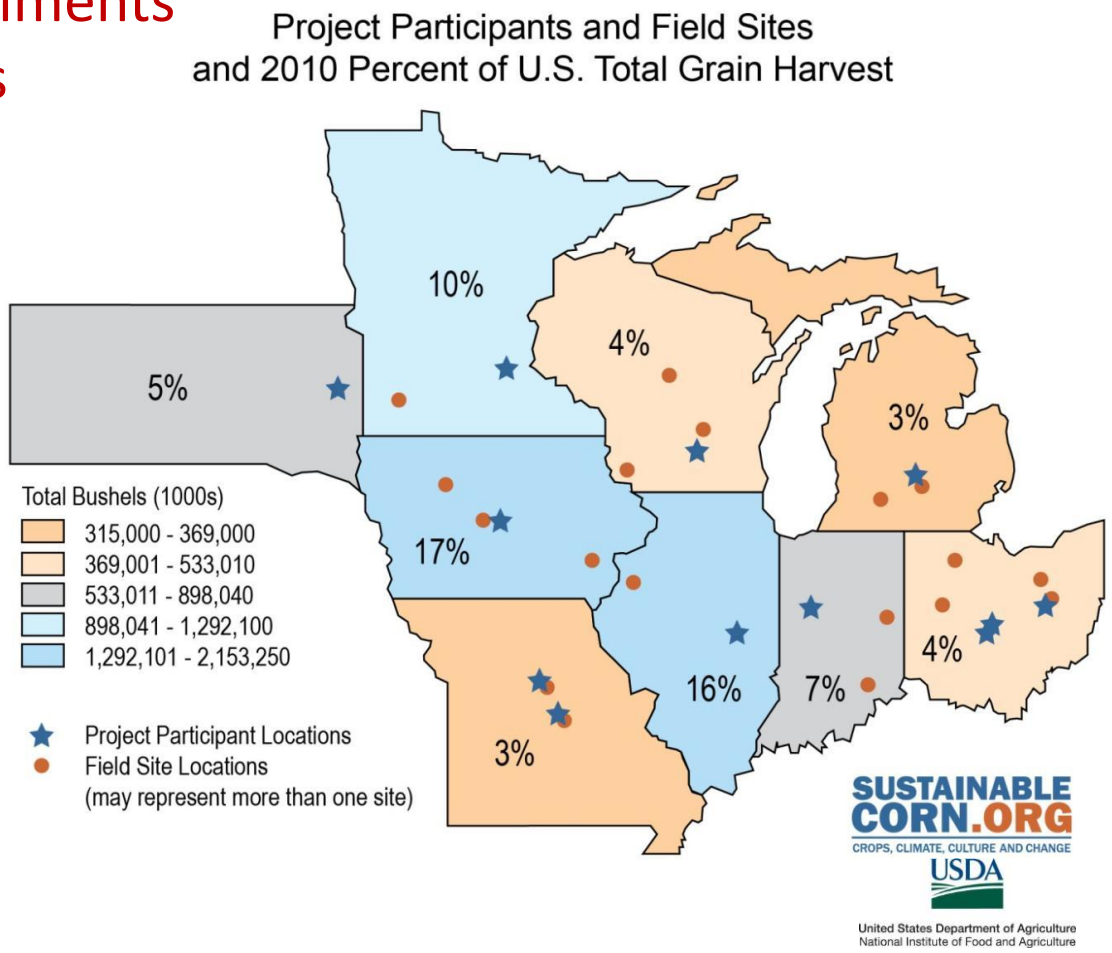
# a microcosm of what is possible among Land Grant Universities

Climate Change, Mitigation & Adaptation in Corn-based Cropping Systems  Coordinated Agricultural Project (CAP)

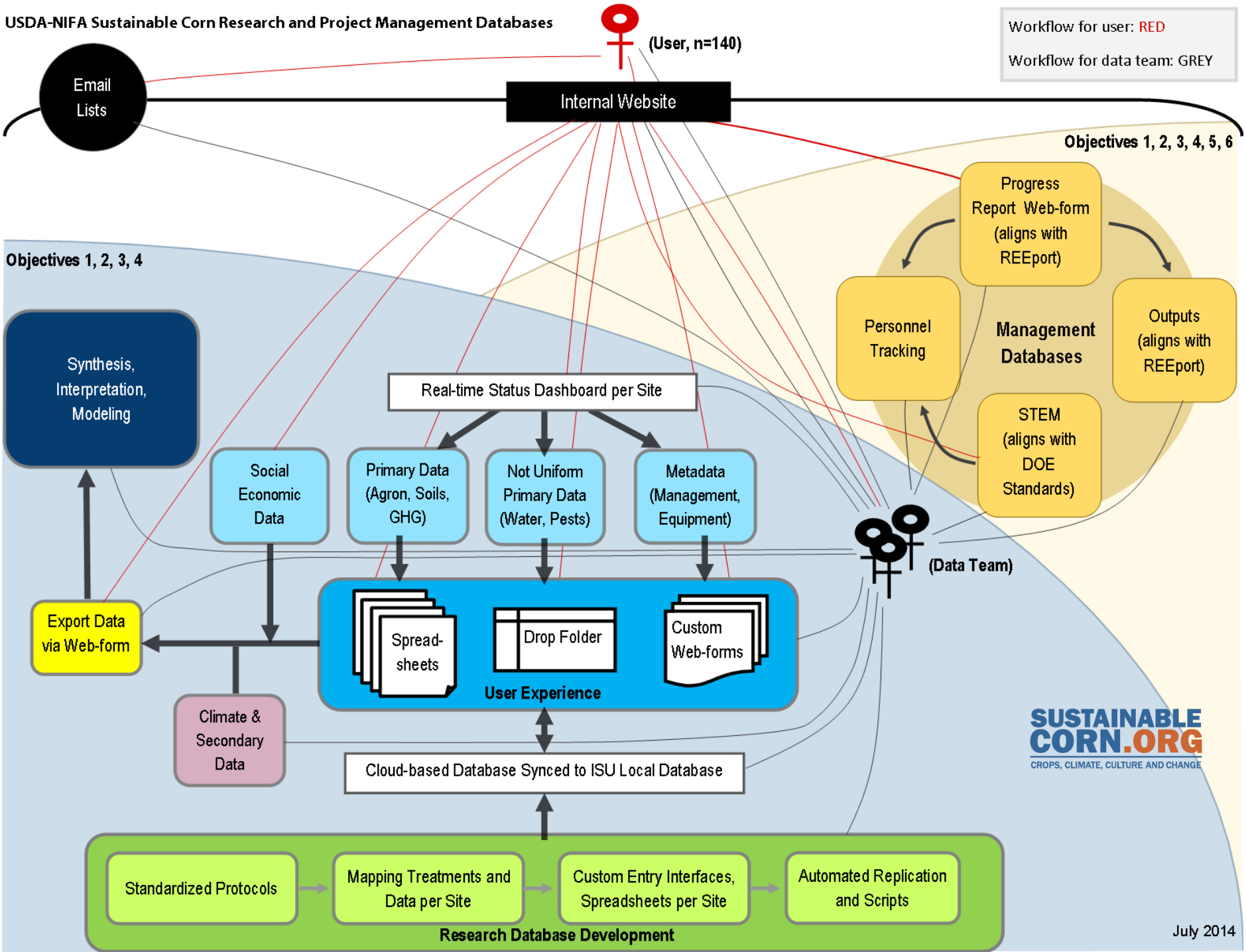
36 research sites, field experiments
14 sites, GHG measurements

9 Upper Midwest states
10 Land Grant Universities
USDA-ARS
~140 faculty, graduate students, post docs, & technical staff

~200 farmers
Advisory board of industry, NGO, agencies, farmers & educators




The 11 institutions comprising the project team include the following Land Grant Universities and USDA Agricultural Research Service (ARS): 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 Wisconsin, and USDA-ARS Columbus, Ohio.


USDA-NIFA Sustainable Corn Research and Project Management Databases
(User, n=140)
Workflow for user: RED
Workflow for data team: GREY
Email Lists
Internal Website
Objectives 1, 2, 3, 4, 5, 6
Progress Report Web-form (aligns with REEport)
Personnel Tracking
Management Databases
Outputs (aligns with REEport)
STEM (aligns with DOE Standards)
Objectives 1, 2, 3, 4
Synthesis, Interpretation, Modeling
Real-time Status Dashboard per Site
Social Economic Data
Primary Data (Agron, Soils, GHG)
Not Uniform Primary Data (Water, Pests)
Metadata (Management, Equipment)
(Data Team)
Export Data via Web-form
Spread-sheets
Drop Folder
Custom Web-forms
User Experience
Climate & Secondary Data
Cloud-based Database Synced to ISU Local Database
SUSTAINABLE CORN.ORG
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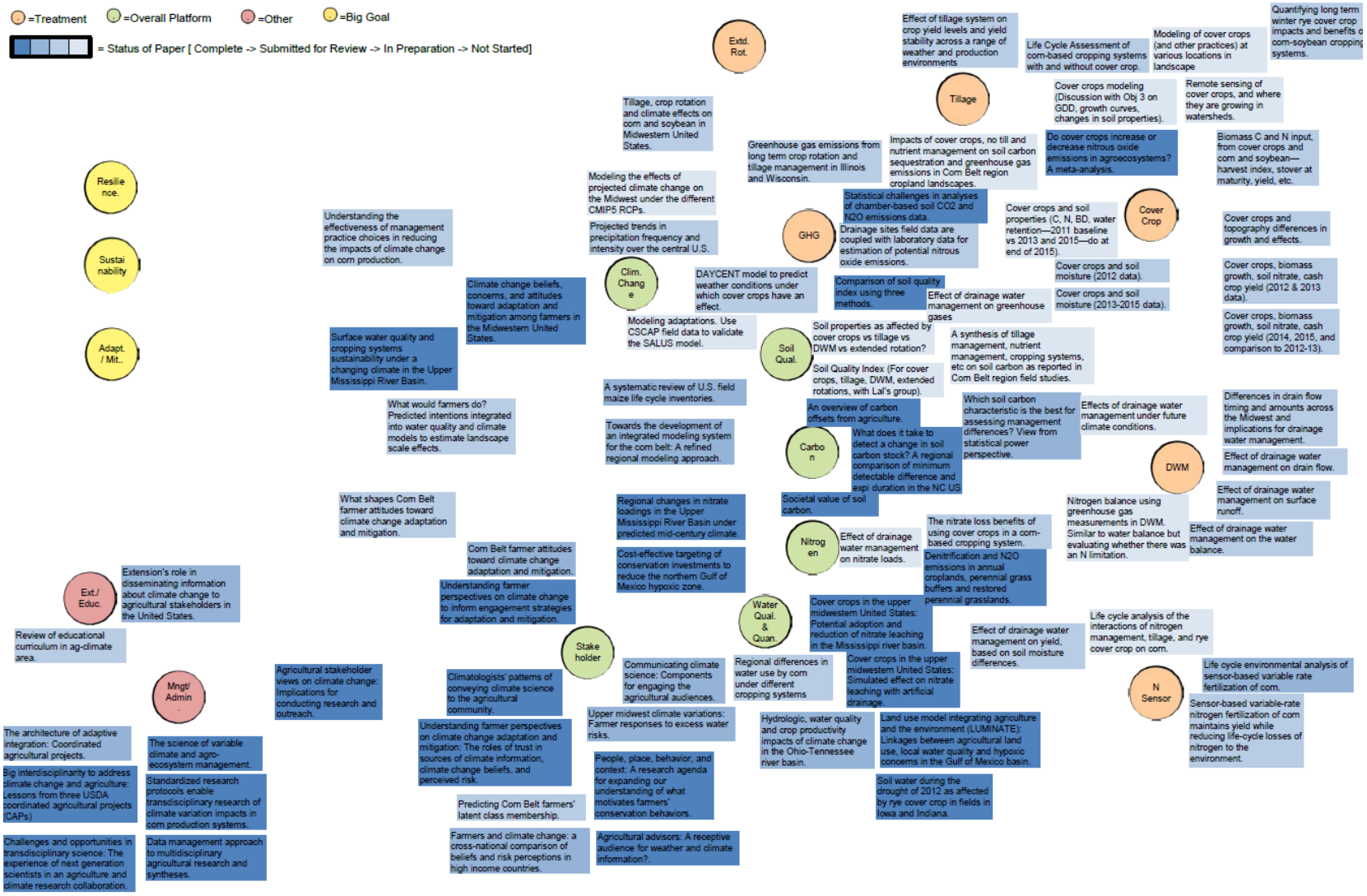
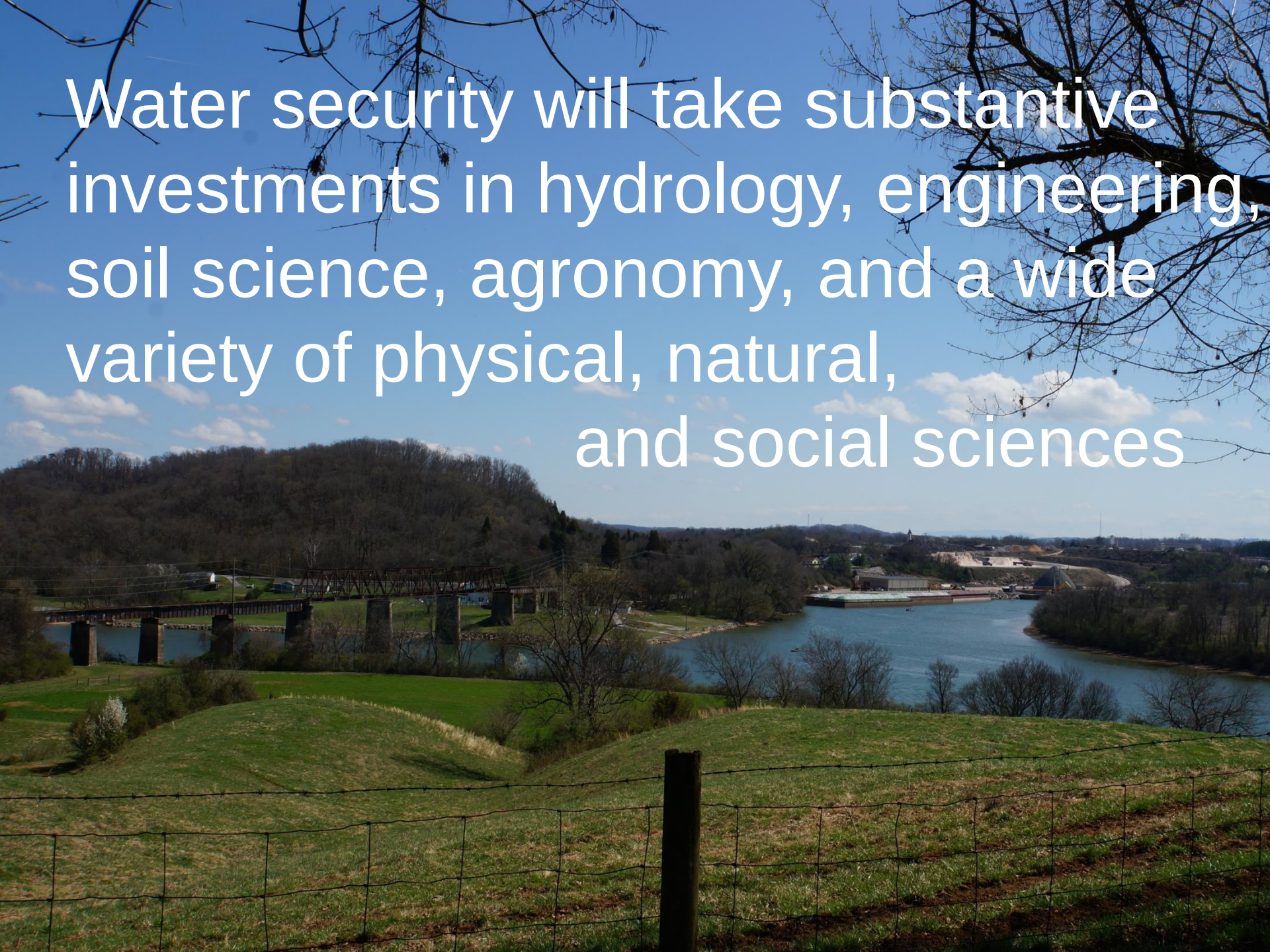
Standardized Protocols
Mapping Treatments and Data per Site
Custom Entry Interfaces, Spreadsheets per Site
Automated Replication and Scripts
Research Database Development
July 2014

# Synthesis & integration of sciences

## 203 papers; 82 are integrative in nature




Water security will take substantive investments in hydrology, engineering, soil science, agronomy, and a wide variety of physical, natural,
and social sciences