

Data Management for Regional Transdisciplinary Agricultural Research: Approach and Implementation

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The Sustainable Corn Team

- USDA-NIFA funded "Climate and Corn-based Cropping Systems Coordinated Agricultural Project" (2011-2016)
- 140 scientists, staff, and students
- 9 states and 11 institutions†
- Transdisciplinary team spanning 19 disciplines from biophysical to social-economic

Team Goal

Identify adaptive and mitigative strategies for Midwest corn-based cropping systems to climate change. Emphasis is on understanding C, N, and water footprints of widely established and novel management practices that address sustainability and system resilience.

Research

- 35 agricultural research sites; see Fig. 1. Includes 55 treatments, 95 data variables, 100 management metadata.
- 5000 farmer survey
- 160 farmer interviews

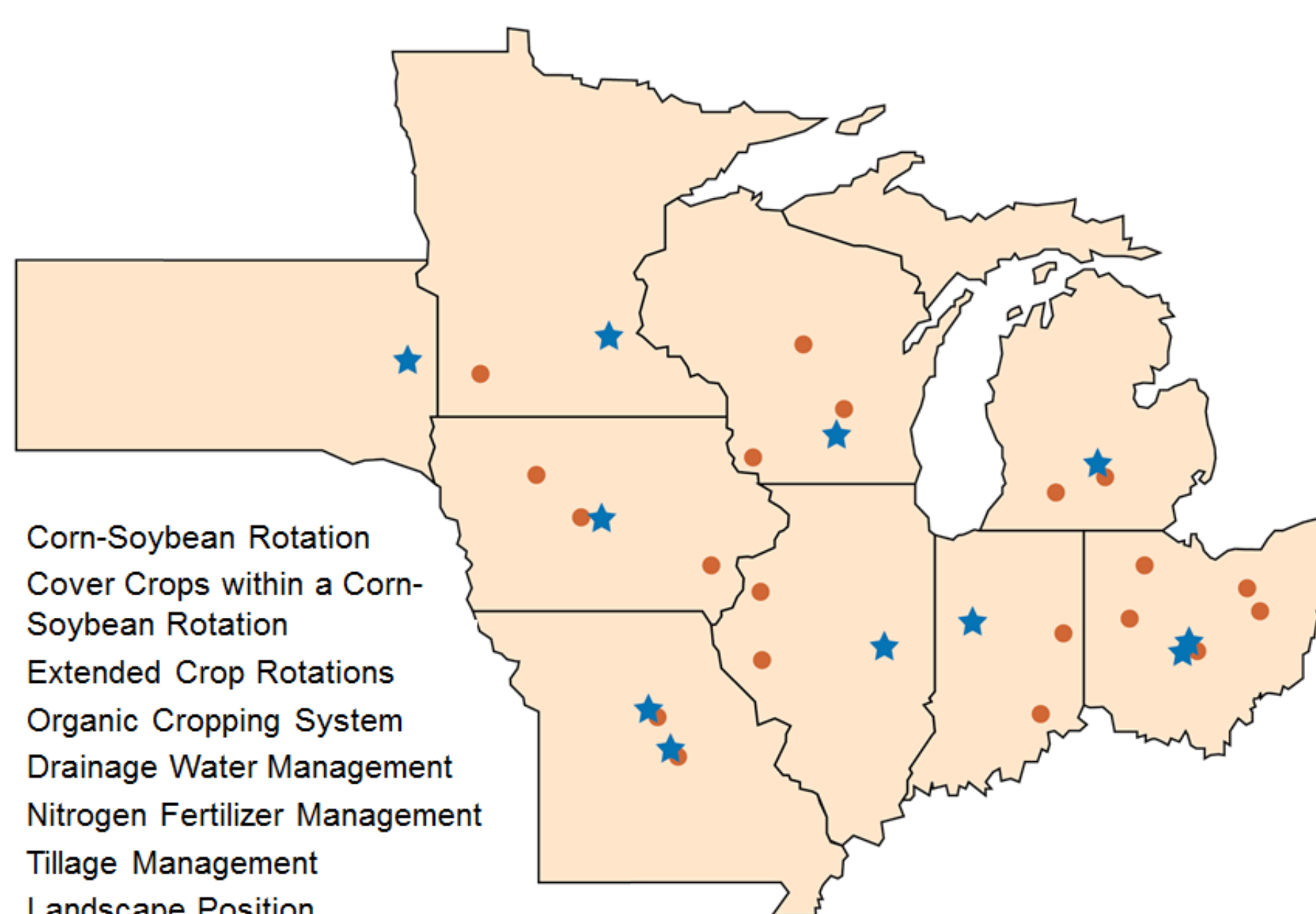


Fig. 1. Field Research Sites (orange circles, n=35). Some locations have multiple experimental plots.

- Corn-Soybean Rotation
- Cover Crops within a Corn-Soybean Rotation
- Extended Crop Rotations
- Organic Cropping System
- Drainage Water Management
- Nitrogen Fertilizer Management
- Tillage Management
- Landscape Position

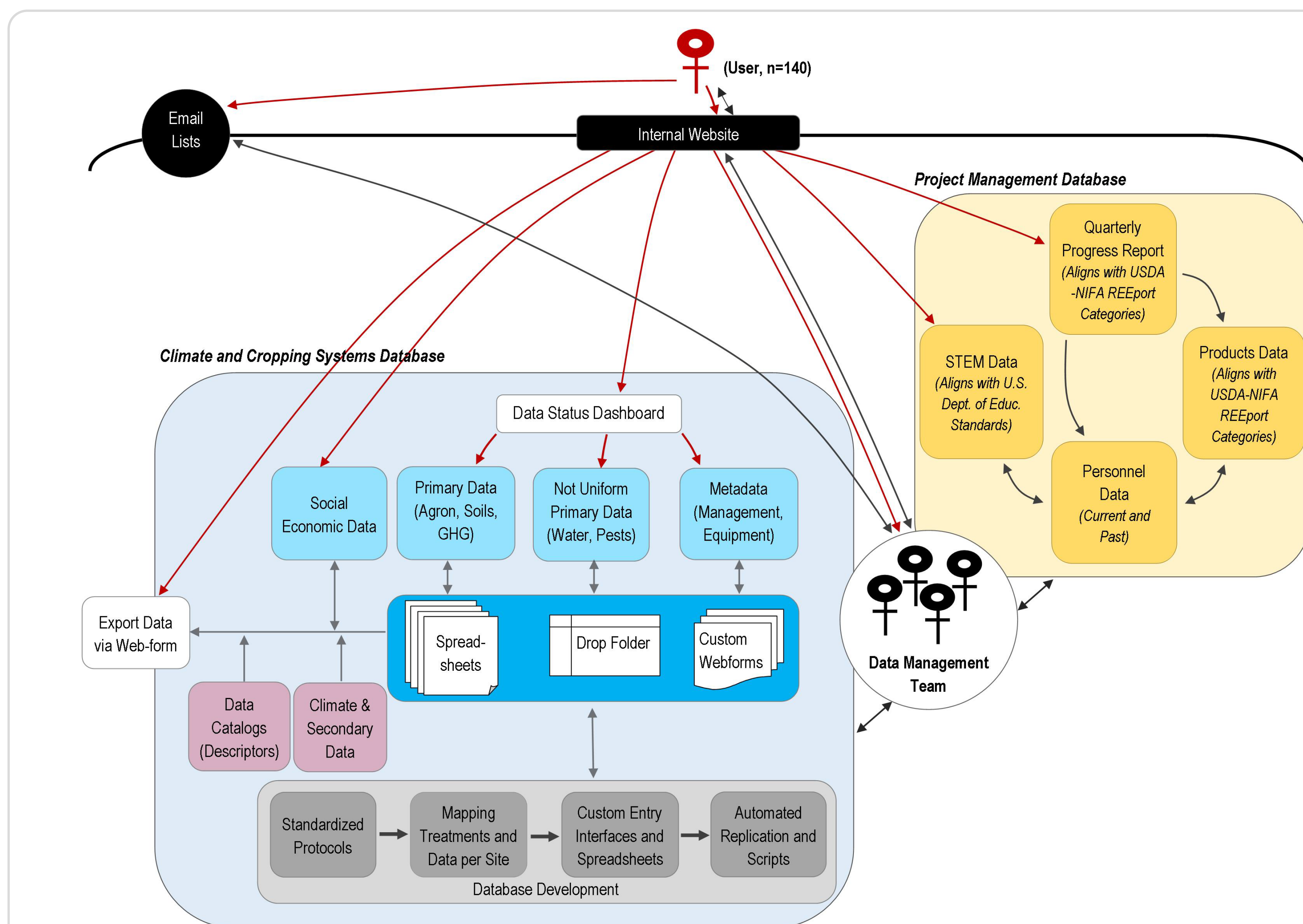


Fig. 2.

Workflow describing the team's research and project databases.

Highlights one-directional workflow (red lines) and expectation of team members (users) contrasted with the multi-directional workflow (grey lines and arrows) and expectation of data personnel. Research and project management databases utilize similar approaches and technology although only the research component is discussed here.

Fig. 3.

Example of customized web interface.

Collaborators enter, edit, and delete field management information (metadata). This approach forces structure from the initial entry phase.

Fig. 4.

Data Dashboard. Status of data entry per research site and type of variable.

This dashboard has been simplified by eliminating research site and variable identifiers. This web interface dynamically generates mini progress bars based on the amount of data uploaded versus the amount of data expected which is derived from entered metadata. Four status options exist per variable including: data have been entered (green), missing data (blue), did not collect (yellow), and not entered yet (red).

Key:	has data	periods	did not collect	no entry / empty												
SITEID	AGR1	AGR2	AGR3	AGR4	AGR5	AGR6	AGR7	AGR8	AGR9	AGR10	AGR11	AGR12	AGR13	AGR14	AGR15	AGR16
ALL SITES	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_7	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_8	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_9	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_10	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_11	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_12	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
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SITE_14	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_15	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SITE_16	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Database

- Serves the needs of researchers for entering, editing, accessing, and exporting data sets.
- Emphasis placed on finding a solution that allows team to self-manage and is flexible for data types collected at different frequencies and for site variation.
- Development began in 2011 with functions released as built.
- Team centralized research database ("Climate and Cropping Systems Database") is accessible through internal team website (Fig. 2).
- Data management is handled using a combined model incorporating a traditional relational database and leveraging of the Cloud (Google). This approach mixes best technical approach while meeting needs of real users.

Technical Strengths

- Centralized identity management
- Data versioning and provenance (audit trail exists)
- Interactive editing of content via Wiki website
- Customized interfaces via scripts (Fig. 3)
- Data downloading, aggregation, and quality control via scripts
- Data formatting and standardization via interfaces

Data and Research Cycle Strengths

- Faster spin-up and accessibility of data to researchers
- Limited loss of data and supporting information
- Transparent data status via Data Dashboard (Fig. 4)
- Project work groups can discover data easily
- Improved transparency and reproducibility of findings
- Synthesis of data occurs during funded period of project and not post
- Increased outputs by team to funder (USDA-NIFA)

Paper out this month!

Herzmann, D., L.J. Abendroth, and L.D Bunderson. 2014. Data management approach to multidisciplinary agricultural research and syntheses. J. Soil Water Cons. 69(6):188A-193A.



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