Visualizing a Highly-Coordinated, Transdisciplinary Team for Precision Sustainable Agriculture

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1. Problem Framing: *Defining the Sustainability Problem*

Realm of science (*Is it true?*) — Transdisciplinary Research — Realm of practice (*Does it work?*)

(Td project framework: Pohl et al. 2021 *Env Sci Pol*)

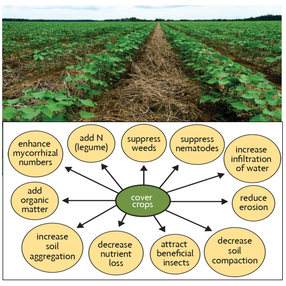
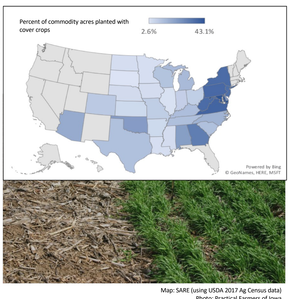


Photo: Steven Kirkpatrick, USDA NRCS
Fig 10.1 in Magdoff & Van Es (2021) SARE

GRAND CHALLENGES
Climate change,
Population growth, Urbanization

The New York Times
Climate Change Threatens the World's Food Supply, United Nations Warns

Photo: Scott Olson/Getty Images



Map: SARE (using USDA 2017 Ag Census data)
Photo: Practical Farmers of Iowa

SCIENTIFIC PROBLEM
The benefits of cover crops for soil, water, nutrient management have been demonstrated, but the short/long term benefits of cover crops in the context of soil, climate, & management (along with farmer mindsets and policy dis-/incentives) are heterogeneous.
Need to understand and predict outcomes.

SOCIETAL PROBLEMS
Nationally, cover crop adoption remains low -- likely due to system knowledge & management demands, complex farmer mindsets & priorities, and varying policy dis-/incentives.

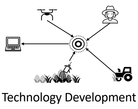
Need to support effective adoption.

Td Problem Framing
Need to develop tailored cover crop knowledge, information, and outreach that supports effective adoption at scale

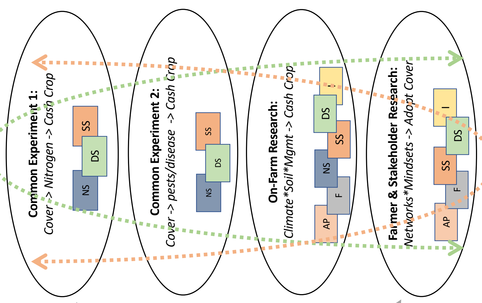
Building a highly-coordinated team

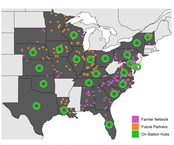
- **Natural Scientists** — Crops, Soil, Water, Climate, Weeds, Insects, Disease, Nutrients
- **Social Scientists** — Ag Econ, Human Ecology, Sustainability Science, Policy Analysis
- **Data Scientists** — Data flow & integration, Modeling, Tech development, Decision tools
- **Ag Professionals** — Extension, Farmer organizations, Cover crop councils, NRCS
- **Farmers** — Corn, Soy, Cotton
- **Industry** — Agriculture & Technology
- **Educators** — Agronomic systems, Ecosystem services, Experiential learning, Multi-institutional

2. Analyzing the Problem: *Producing new knowledge*

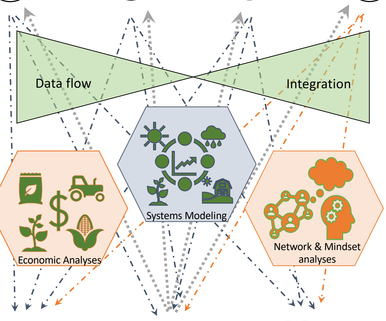


Technology Development

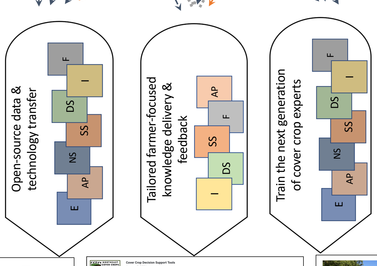


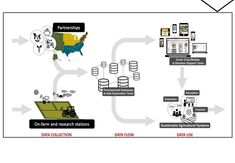


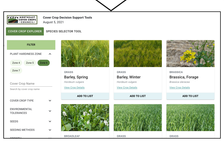
Scope of Inference

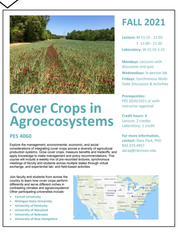


3. Exploring Impact: *Assessing and sharing new knowledge across science & practice*









Concluding Thoughts:

Furthering cover crop adoption requires ***developing scientific knowledge in tandem with societal solutions*** to support farmers in managing cover crops to maximize both short- and long-term benefits.

The future of sustainable agriculture requires:
(a) highly-coordinated teams committed to practicing transdisciplinarity — the key characteristics are openness, translation, and co-creation
(b) co-designed, values-driven, open-source technologies that mediate coordination and collaboration across complex networks
(c) partnerships in service to the public good.

References:

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