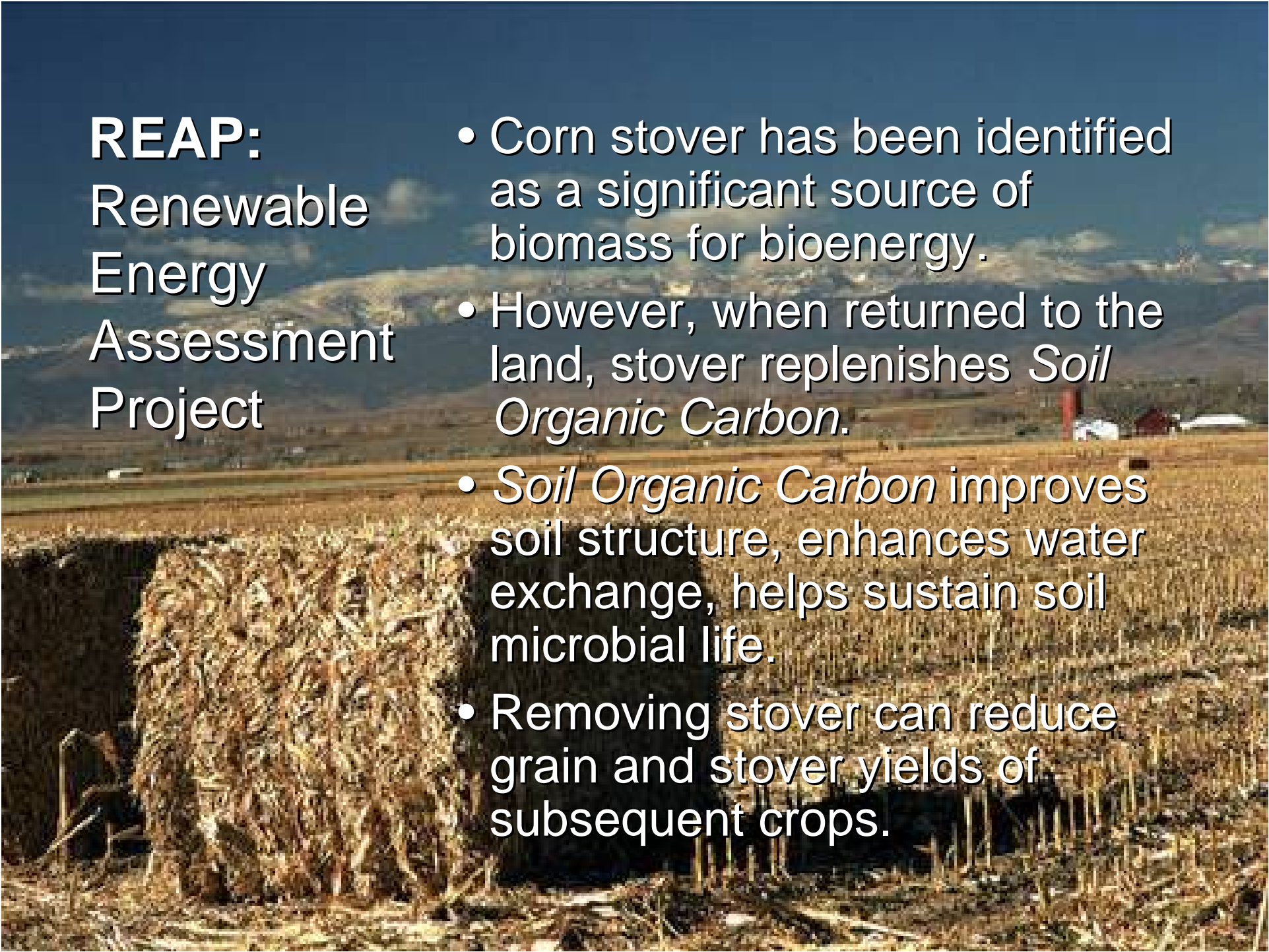


USDA-ARS Carbon Cycle Research

John M. Baker, St. Paul, MN





REAP: Renewable Energy Assessment Project

- Corn stover has been identified as a significant source of biomass for bioenergy.
- However, when returned to the land, stover replenishes *Soil Organic Carbon*.
- *Soil Organic Carbon* improves soil structure, enhances water exchange, helps sustain soil microbial life.
- Removing stover can reduce grain and stover yields of subsequent crops.

REAP: Renewable Energy Assessment Project

Sustainability Challenge

How to harvest corn stover without depleting *Soil Organic Carbon* and still contribute significant amounts of biomass for biofuels production



REAP: Renewable Energy Assessment Project

ARS Research Infrastructure



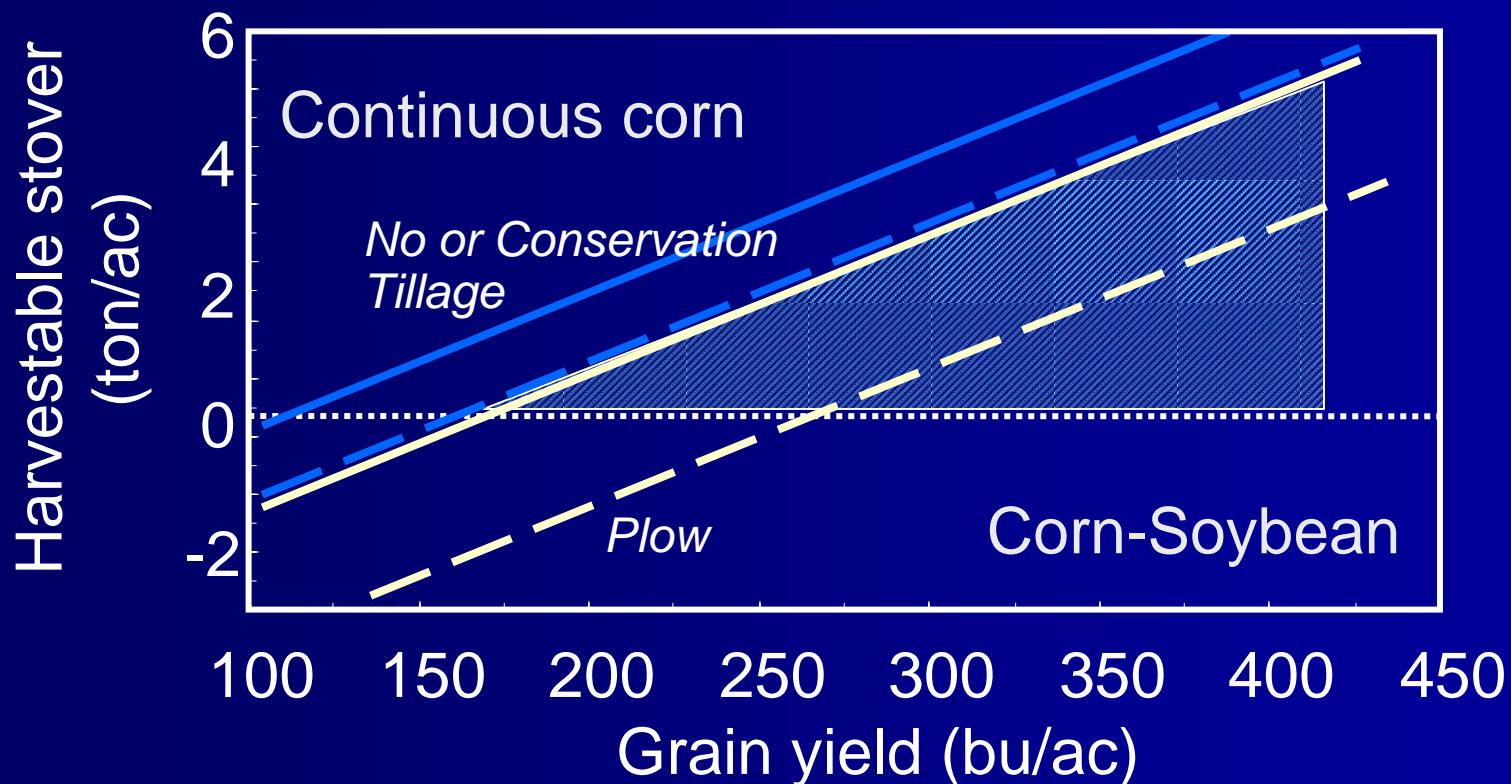
REAP Team Locations

- Nation-wide network of coordinated research teams.
- Historic watersheds, long-term experiments, and databases.
- Interdisciplinary approach including bio-physical sciences, modeling, and economics.
- Excellent collaborations with universities, industry, and other Agencies.

Principal contacts: Wally.Wilhelm@ars.usda.gov, Doug.Karlen@ars.usda.gov.

REAP: Renewable Energy Assessment Project

Harvestable corn stover amount by different soil management practices and grain production levels



REAP: Renewable Energy Assessment Project

Corn stover removed from fields also has a nutrient replacement cost

Element	Amount in stover	Value
	lbs/ton	\$/ton
Nitrogen	16.0	8.00
Phosphorus	1.6	1.52
Potassium	13.5	2.29
Total cost		\$11.81



Cover Cropping



Springtime in a cover-cropped field



Springtime in a conventional field





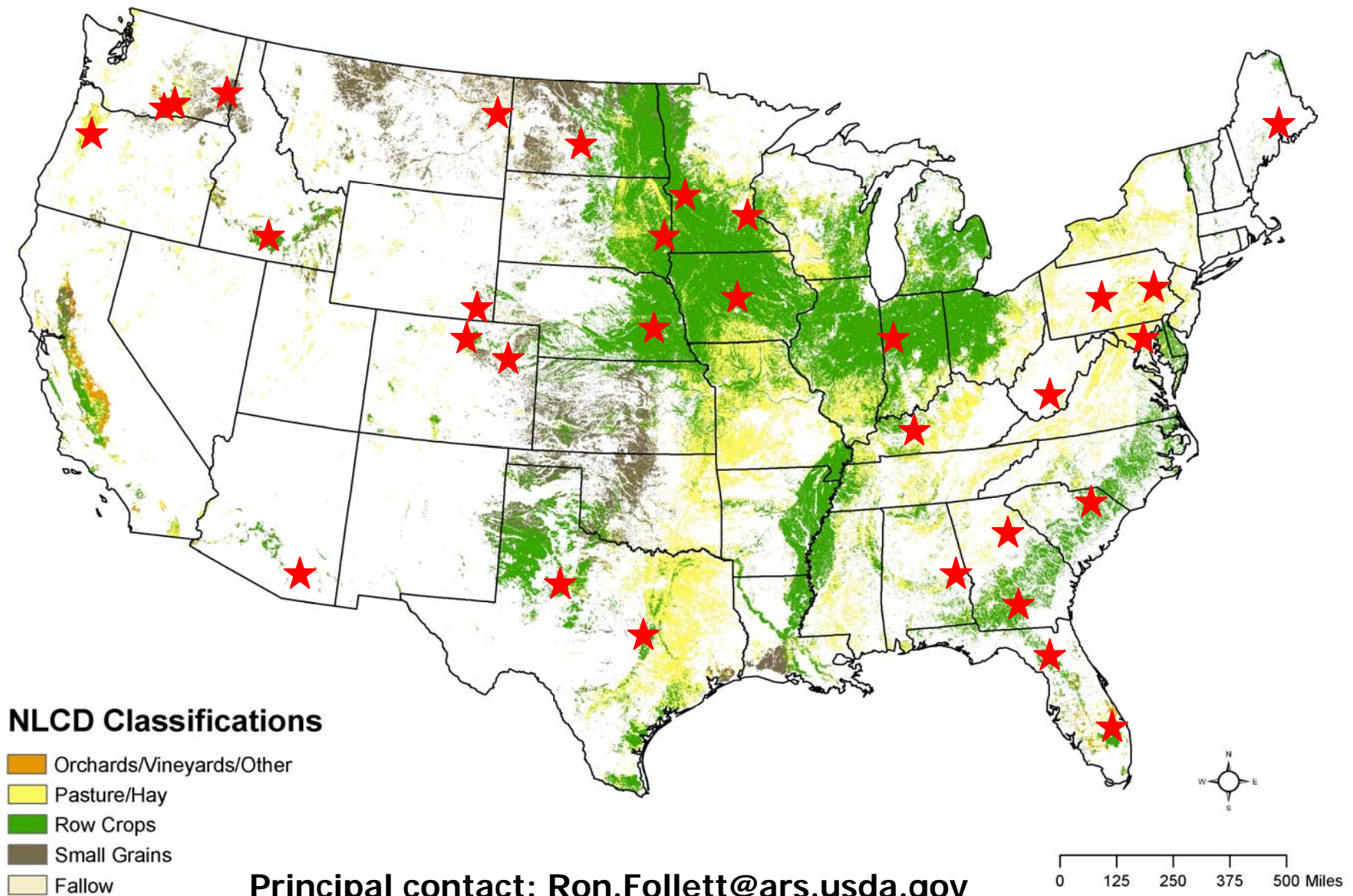


Companion Cropping

GRACENET Multi-location Project Objectives

- 1. Evaluate the soil C status and direction of change of soil C in existing typical and alternative agricultural systems.
- 2. Determine net GHG emission (CO₂, CH₄ and N₂O) of current agricultural systems in existing typical and alternative agricultural systems.
- 3. Determine the environmental effects (water, air and soil quality) of the new agricultural systems developed to reduce GHG emission and increase soil C storage.

USDA ARS GRACEnet Units





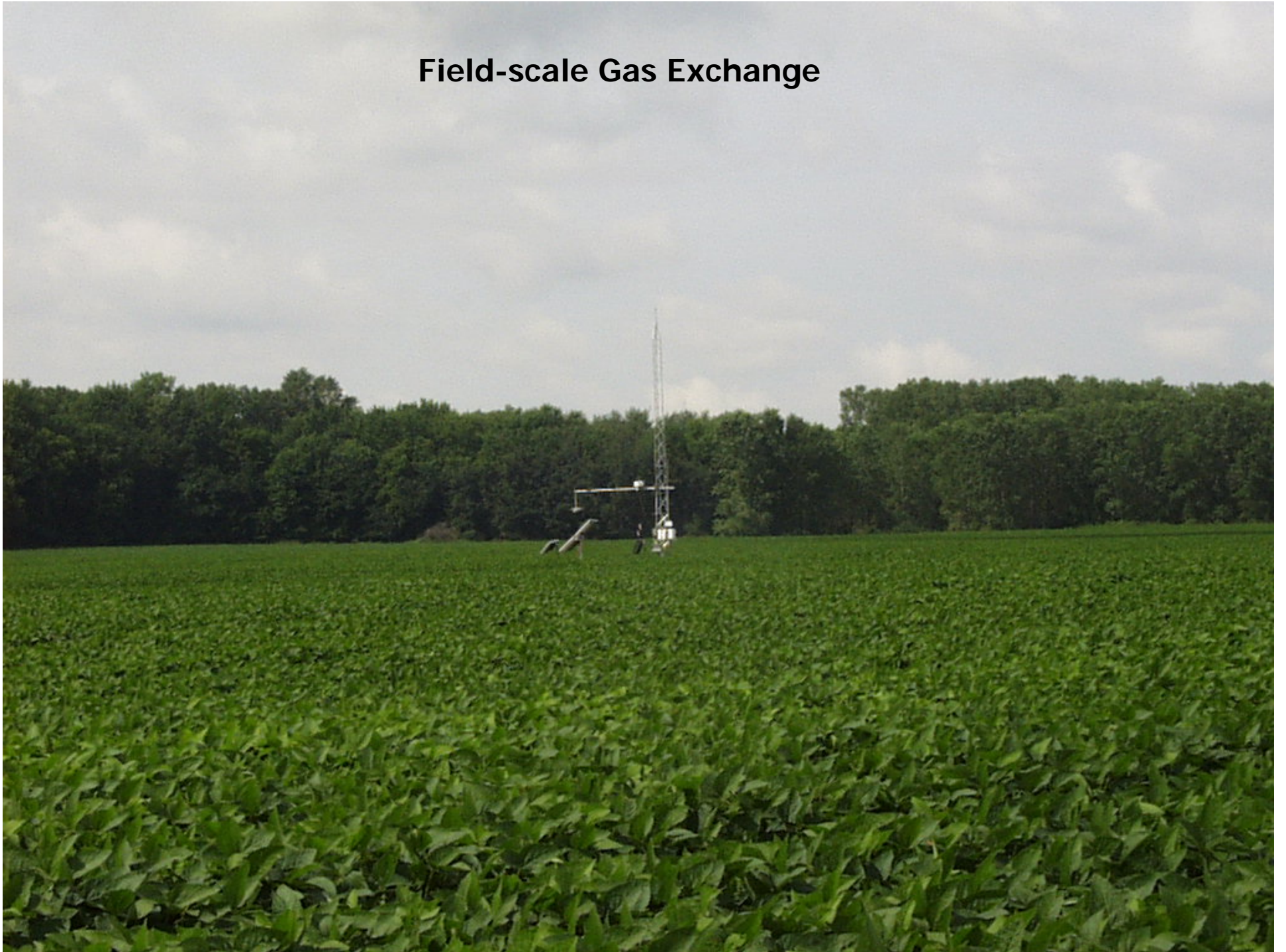
Soil Carbon Sampling





Trace Gases (N_2O , CH_4)

Field-scale Gas Exchange





Challenges and New Opportunities from Agriculture

- Continued traditional outputs for an increasing world population:
 - Food, feed, and fiber
- Ecosystem services:
 - Control erosion
 - Sequester carbon
 - Wildlife habitat
 - Water quality & quantity
- Replenish SOC & plant nutrients.
- Feedstocks for biofuels.

