



Carbon Exchange in Rainfed & Irrigated Agricultural Ecosystems



Overall Goals

- Quantify the annual amounts of C exchanged in major rainfed and irrigated agroecosystems in the north-central USA.
- Improve our basic understanding of the biophysical processes that govern C exchange in these ecosystems.

Investigator	Affiliation
Co-Principal Investigators	
Shashi B. Verma	<i>School of Natural Resources, University of Nebraska – Lincoln (UNL)</i>
Kenneth G. Cassman	<i>Agronomy and Horticulture, UNL</i>
Co-Investigators	
Timothy J. Arkebauer	<i>Agronomy and Horticulture, UNL</i>
Achim Dobermann	<i>Agronomy and Horticulture, UNL</i>
Daniel Ginting	<i>Agronomy and Horticulture, UNL</i>
Anatoly A. Gitelson	<i>School of Natural Resources, UNL</i>
Kenneth G. Hubbard	<i>School of Natural Resources and High Plains Climate Center, UNL</i>
Johannes M. Knops	<i>School of Biological Sciences, UNL</i>
Gary D. Lynne	<i>Agricultural Economics, UNL</i>
Derrel L. Martin	<i>Biological Systems Engineering, UNL</i>
Donald C. Rundquist	<i>School of Natural Resources, UNL</i>
Madhavan Soundararajan	<i>Biochemistry, UNL</i>
Andrew E. Suyker	<i>School of Natural Resources, UNL</i>
Elizabeth A. Walter-Shea	<i>School of Natural Resources, UNL</i>
Daniel T. Walters	<i>Agronomy and Horticulture, UNL</i>
Haishun Yang	<i>Agronomy and Horticulture, UNL</i>



Field Research Facility

- **University of Nebraska Agricultural Research & Development Center, Mead, NE**
 - **Three field study sites**
 - **large production fields (about 1/4 section = 65 ha)**
 - **two sites equipped with center pivot irrigation**
 - **Cropping systems:**
 - **rainfed maize-soybean rotation**
 - **irrigated maize-soybean rotation**
 - **irrigated continuous maize**



Field Research Facility

Within each site, six small measurement areas (Intensive Measurement Zones, IMZs, 20 m x 20 m) for detailed process-level studies of soil C dynamics, crop growth and partitioning, soil water, canopy and soil gas exchange, and crop residue decomposition.

Tower Flux Studies



**Landscape-level
(Eddy Covariance)
Measurement of CO₂
and Other Fluxes**

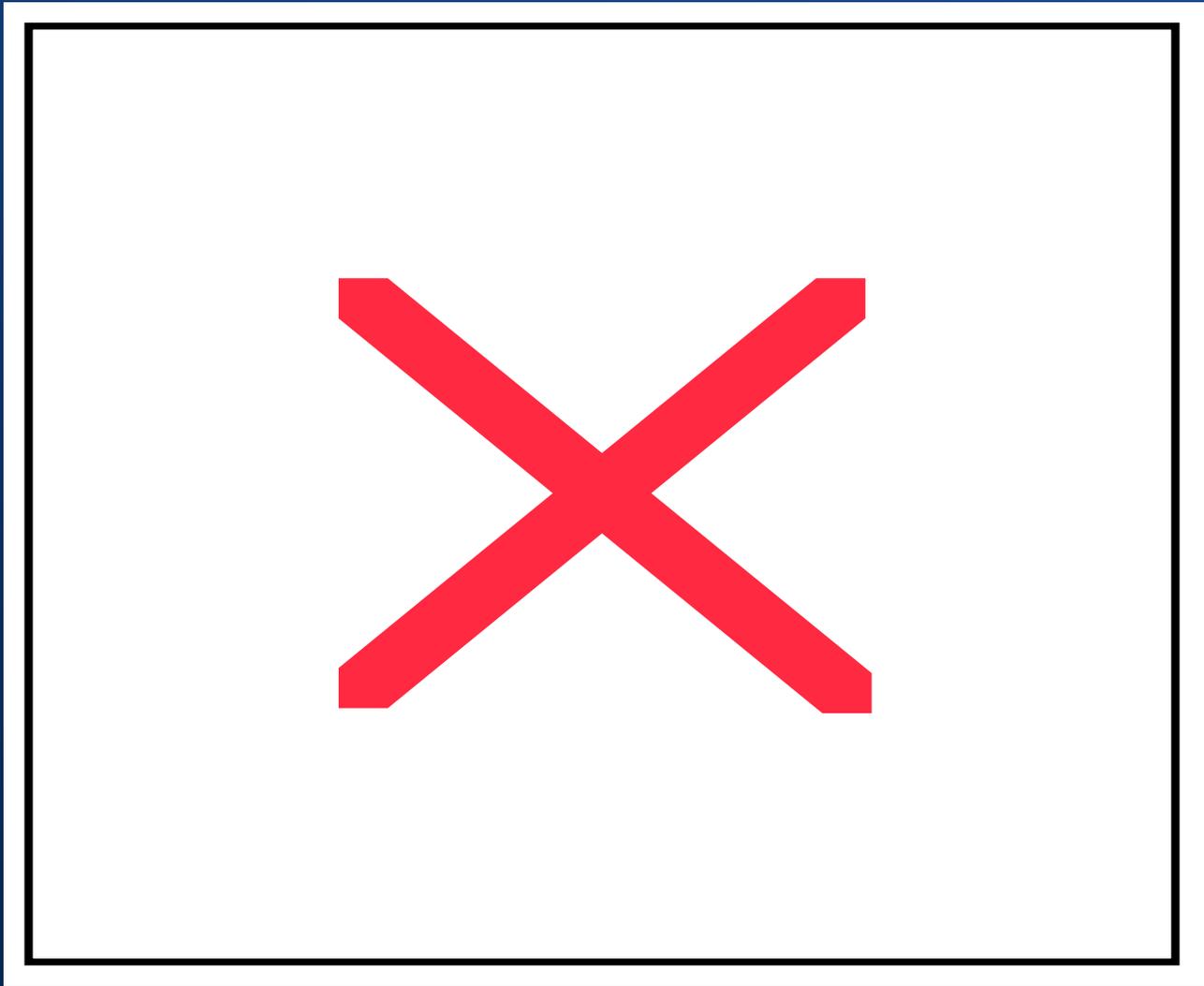


**Measuring Components
of Solar Radiation**



**Close-up of
Eddy Covariance
Flux Sensors**

Tower Eddy Covariance CO₂ Flux Measurements: Net Ecosystem Production





Monitoring and Mapping of Soil C Stocks

Team members:

Achim Dobermann

Gregorio Simbahan

Michelle Haddix

Darren Binder



Litter Decomposition



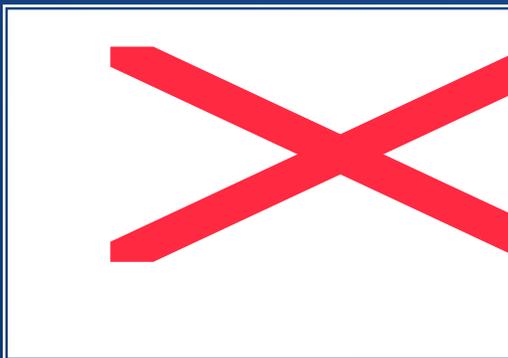
Team members:
Johannes Knops
Kenneth Elgersma
Amy Kochsiek



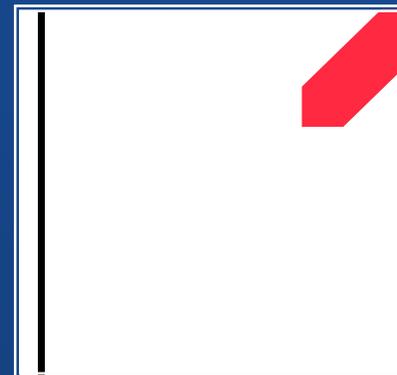
Aboveground Biomass Leaf Area Index

Team members:
Tim Arkebauer
Dave Scoby

Belowground Processes: Root Sampling



Field Sampling



Washing



Sorting & Staining



Imaging

Dan Walters



Belowground Processes

Measuring and Estimating C Pools:

1. Carbon deposition as root biomass and exudation
2. Soil respiration (R_s)
 - 1) Root (autotrophic) respiration (R_a)
 - 2) Heterotrophic respiration (R_h)
 - Residue decomposition
 - Soil C oxidation

Leaf Level Gas Exchange



Tim Arkebauer



Continuous Measurements of Soil Surface N_2O , CH_4 and CO_2 Fluxes Using Autochambers

Team members:

Tim Arkebauer

Achim Dobermann

Brent Holmquist

Hui Shen



Full Carbon-Cost Accounting and Global Warming Potential of Irrigated and Rainfed Maize- Based Cropping Systems

Dan Walters



Remote Estimation of Green Leaf Area Index, Green Biomass, and CO₂ Fluxes

Team members:

Anatoly Gitelson

Donald Rundquist

Elizabeth Walter-Shea

Mark Mesarch



Ecosystem Modeling

(with emphasis on maize-based cropping systems)

Team members:
Haishun Yang
Ken Cassman
Achim Dobermann
Dan Walters



- **High precision CO₂ mixing ratio measurements: *Verma***
- **Physical and chemical fractionation of soil organic C pools: *Walters***