# GRACEnet (Greenhouse Gas Reduction through Agricultural Carbon Enhancement network)
# An Assessment of Soil Carbon Sequestration and Greenhouse Gas Mitigation by Agricultural Management

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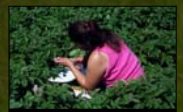
GHG Measurements next to a swine lagoon (Bowling Green, KY)


Conventional moldboard plow and No-till tillage systems (Ft Collins, CO)


Chamber measurements in no-till cropping systems (Mandan, ND)


Measuring trace gases in a potato field (Prosser, WA)


Sampling amidst corn (Brookings, SD)

Agricultural activities account for about 20% of the total human-induced warming effect due to emissions of carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). Changes in management, including minimizing or eliminating tillage, adding organic matter, and improving nitrogen management for enhanced efficiency, can convert agriculture from a net source to a net sink of greenhouse gas (GHG) emissions. There is increasing interest among land managers, policy makers, GHG emitting entities, and carbon (C) brokers in using agricultural lands to sequester C and reduce GHG emissions. Precise information is lacking, however, on how specific management practices in different regions of the U.S. impact soil C sequestration and the mitigation of GHG emissions.

GRACEnet represents a coordinated national effort by the Agricultural Research Service (USDA-ARS) to provide information on the soil C status and GHG emissions of current agricultural practices and to develop new management practices to reduce net GHG emissions and increase soil C sequestration.

Since 2003, significant emphasis within GRACEnet has been placed on comparing common management scenarios at multiple locations throughout the U.S. While soils, crops, and conditions are location specific, consistent methods and detailed record keeping has been used to facilitate cross-location comparison and to ensure quality control.

## OBJECTIVES

1) Evaluate the soil C status and direction of change of soil C in existing agricultural systems.
2) Determine net GHG emissions ($CO_2$, $CH_4$ and $N_2O$) of current agricultural systems.
3) Determine the environmental effects (water, air and soil quality) of the new agricultural systems developed to reduce GHG emissions and increase soil C storage.

## PRODUCTS

**Product 1.** A national database of GHG flux and C storage.

**Product 2.** Regional and national guidelines of management practices that reduce GHG intensity, applicable for use by producers, federal and state agencies, and C brokers.

**Product 3.** Development and evaluation of computer models to assess management effects on net GHG emissions.

**Product 4.** Summary papers for action agencies and policy makers, based on the current state of knowledge.

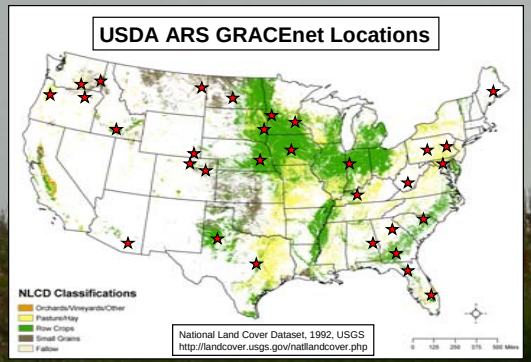
## LOCATION-SPECIFIC TREATMENT SCENARIOS

1) **Business as usual.** What are the rates of carbon accumulation or loss from soils under typical, economically viable agricultural management practices?

2) **Maximizing C sequestration rate.** What has to be done to achieve the highest rate of carbon sequestration in that production system? The only constraint is that the land remain in an agriculturally feasible production system.

3) **Minimizing net GHG emissions.** This system differs from #2 because $N_2O$ and $CH_4$ emissions must also be considered.

4) **Maximizing environmental benefits.** Carbon sequestration may well become part of a larger conservation benefit package. Land managers and policy makers will be interested in tradeoffs among management options.

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Band applying ESN or Urea fertilizer N on corn plots (Fort Collins, CO)


Modeling Carbon Sequestration (Beltsville, MD)


Farming Systems Project (Beltsville, MD)


Early spring soil sampling in a rye cover crop following residue removal (Watkinsville, GA)


Compost additions (Orono, ME)


Optimizing laser with mirrors across untilled cotton field (Florence, SC)


Eddy covariance in a tilled corn-soybean rotation (St. Paul, MN)


Measuring drainage water quality using lysimeters (St. Paul, MN)


Gas sampling in a heavily grazed pasture (Mandan, ND)


Cotton-winter rye-sorghum rotation in no-till & tillage systems (Lubbock)


Angus cow and calf grazing rye cover crop before planting corn (Watkinsville, GA)


Swine Manure into Rye Cover Crop (Ames, IA)


Soybean phase of a no-till corn-soy rotation (West Lafayette, IN)


Perennial forage peanut (L) & bahiagrass (R) in high CO2 & temperatures (Gainesville, FL)


Undisturbed grass containing alfalfa, crested wheatgrass, & western wheatgrass (Sidney, MT)


Corn and kura clover companion cropping system (St. Paul, MN)

Background photo: Switch Grass (Lincoln, NE).