# AGRICULTURAL RESEARCH AND THE OFFICE OF NATIONAL PROGRAMS

## AGRICULTURAL AIR QUALITY TASK FORCE

APRIL 6, 2016


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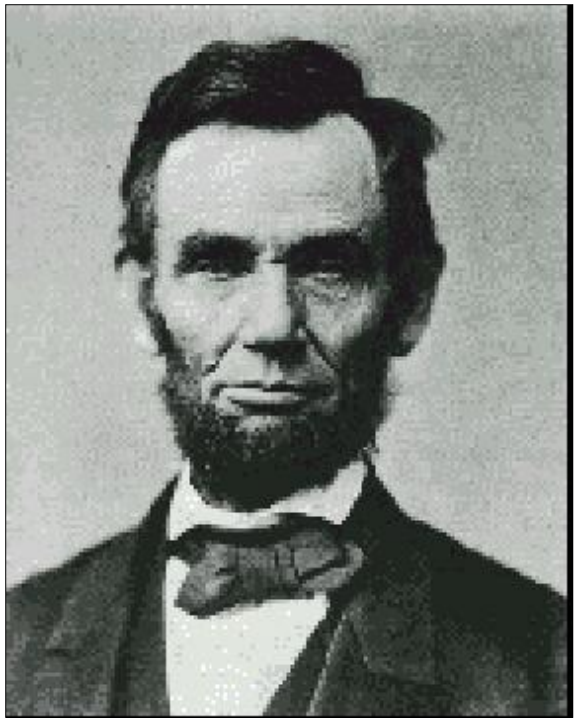
NATIONAL PROGRAM LEADER: SOIL AND AIR

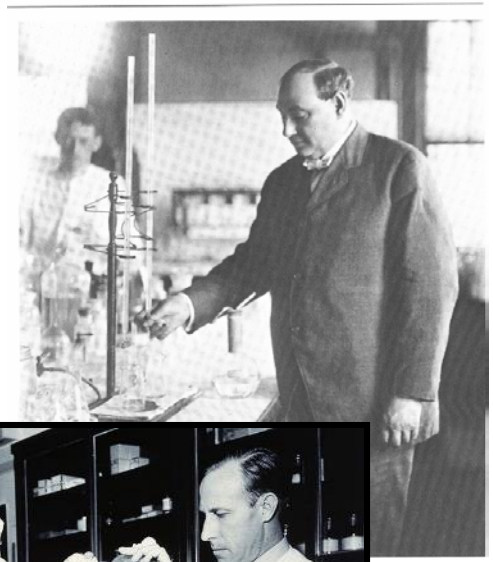
NATURAL RESOURCES & SUSTAINABLE AGRICULTURAL SYSTEMS

OFFICE OF NATIONAL PROGRAMS

# 1862-2016
# 154 YEARS OF AGRICULTURAL RESEARCH

"…procure and preserve all information concerning agriculture….. by means of books and correspondence, and by practical and scientific experiments…..

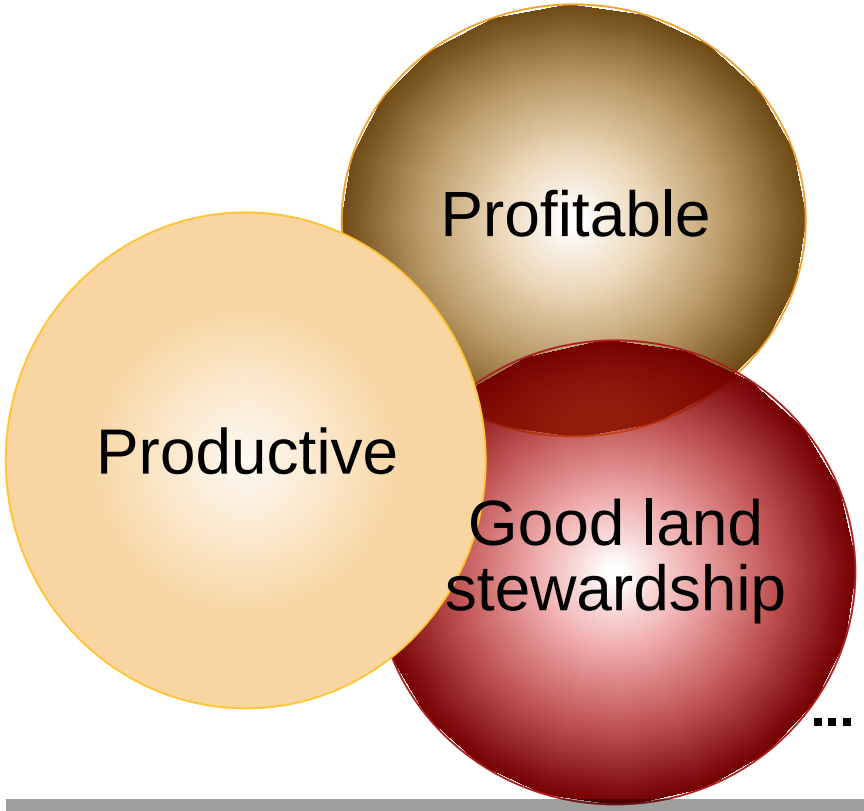




# We are going to have to increase production – but how?

- **Produce more per unit land area (“sustainable intensification”)**
  - **✓Mechanization**
  - **✓Crop/livestock genetic improvement**
  - **✓Input use efficiency**
  - **✓Protecting the health of our natural resources**

# But what does “sustainable” mean?



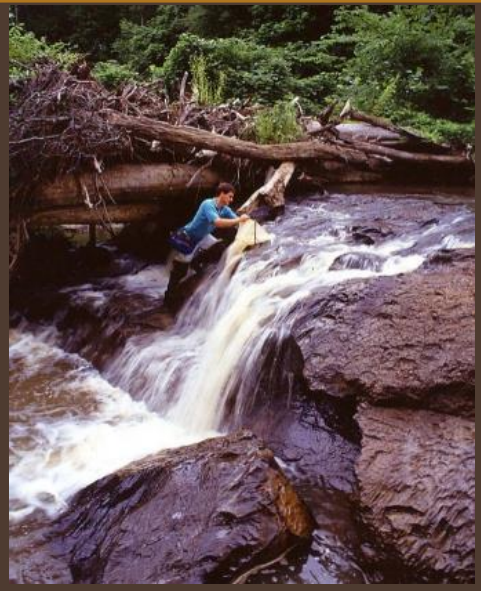


**... To those who produce food & fiber**

**….and to everybody else, too.**

**“Development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs.”** Brundtland Commision, 1987

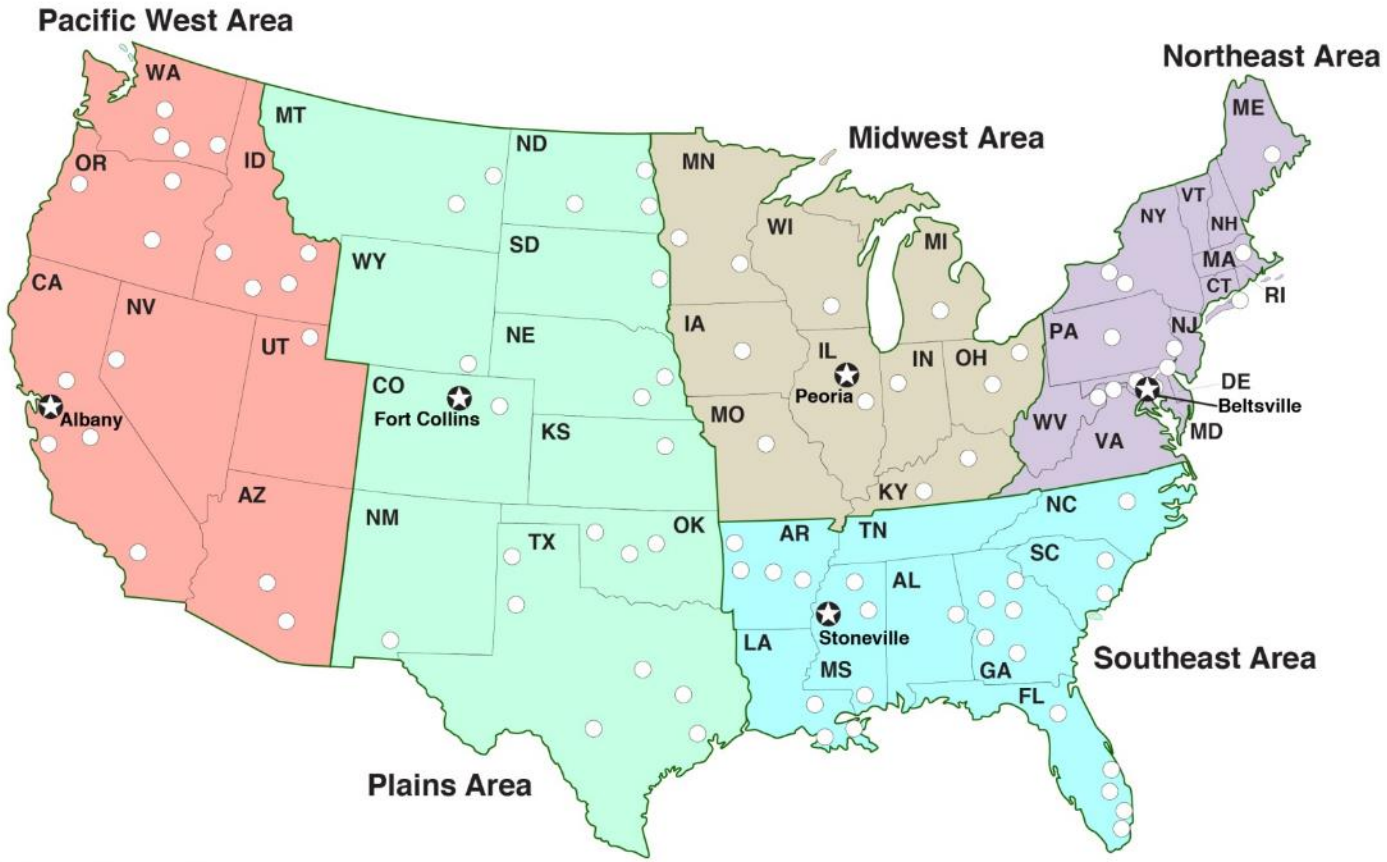
# OVERVIEW OF THE AGRICULTURAL RESEARCH SERVICE



- In-house research arm of USDA
- Farm-to-table, molecules-to-watersheds research scope
- 17 National programs
- ~800 research projects
- Partnerships with universities and industry

- ~8,000 employees
- ~1,600 scientists
- More than 90 locations (4 overseas labs)
- $1.1 billion annual budget
- Additional funds in competitive grants, and other research agreements

# Agricultural Research Service Area Organization



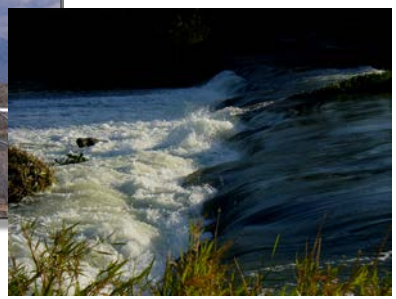

The bold lines reflect the boundaries of the ARS geographic Areas.



# NATIONAL PROGRAM AREAS

Animal Production and Protection

Nutrition, Food Safety and Quality



Natural Resources and Sustainable Agriculture Systems

Crop Production and Protection

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# ARS RESEARCH IN NATURAL RESOURCES & SUSTAINABLE AGRICULTURAL SYSTEMS

- **450** Scientists
- **139** Research Projects
- **62** Locations

- Water Availability & Watershed Management
- Climate Change, Soils, and Emissions
- Bioenergy and Energy Alternatives
- Agricultural and Industrial Byproducts
- Pasture, Forage, and Rangeland Systems
- Agricultural System Competitiveness and Sustainability

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# MY ROLE AS A NATIONAL PROGRAM LEADER

**Vision and priority setting**

**Coordination and relevance**

**Inreach – foster communication and collaboration**

**Outreach – communicating results to ensure impact**

**Ensure efficient use of resources**

# CLIMATE CHANGE, SOILS, AND EMISSIONS

**Total Projects: 35**
**Total Locations: 29**
**Total Scientists: 94**

- **Enable Improvements of Air Quality via Management and Mitigation of Emissions from Agricultural Operations**
- **Develop Knowledge and Technologies for Reducing Atmospheric Greenhouse Gas Concentrations Through Management of Agricultural Emissions and Carbon Sequestration**
- **Enable Agriculture to Adapt to Climate Change**
- **Maintain and Enhance Soil Resources**

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# AGRICULTURAL AND INDUSTRIAL BYPRODUCTS


**Total Projects: 15**
**Total Locations: 13**
**Total Scientists: 42**

- **Management, Enhancement, and Utilization of Manure Nutrients and Resources**
- **Manure Pathogens and Pharmaceutically Active Compounds (PACs)**
- **Atmospheric Emissions**
- **Developing Beneficial Uses of Agricultural, Industrial and Municipal Byproducts**

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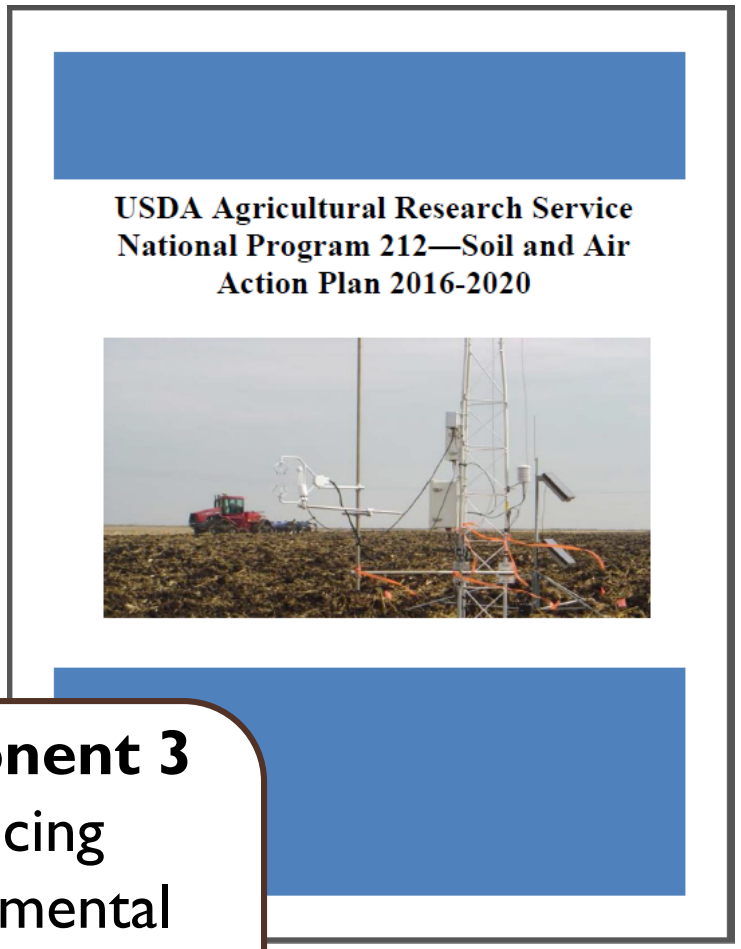
# NP212 Soil and Air

**Component 1**
Management and stewardship of soil resources

**Component 2**
Managing Nutrients in Agroecosystems

**Component 3**
Reducing Environmental Risk of Agricultural Operations

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# Data Networks Across ARS

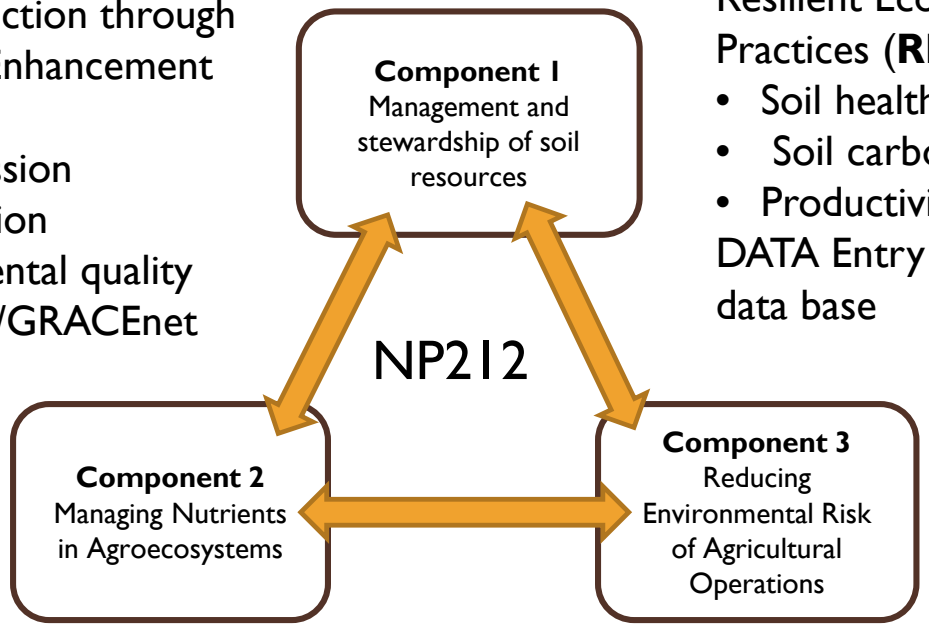
## NP212:ACTION PLAN – "NP 212 research results will also be used to facilitate data synthesis and utilization in GRACEnet, REAP, and other ARS databases".

Greenhouse gas Reduction through Agricultural Carbon Enhancement

**GRACEnet:**

- Mitigate GHG emission
- Carbon Sequestration
- Improve environmental quality

DATA Entry Template/GRACEnet data base




Resilient Economic Agricultural Practices (**REAP**):

- Soil health/quality
- Soil carbon/organic matter
- Productivity

DATA Entry Template/GRACEnet data base

Multi-agency Conservation Effects Assessment Project (CEAP):
Watershed scale

Livestock GRACEnet:
-animal system centric
Mitigate GHG emission (N2O, **CH4**, CO2)

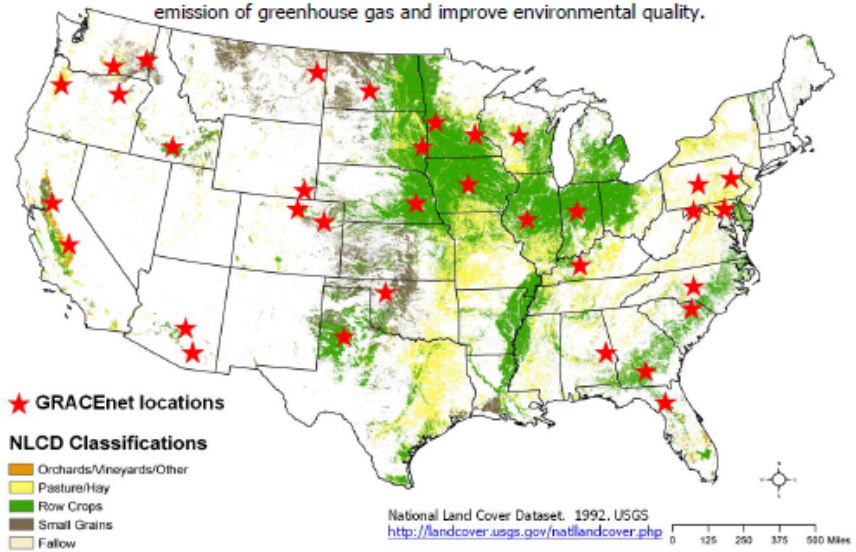
LTAR – NP211
Agro-ecosystem productivity
Climate variability and change
Conservation and environmental quality
Socio-economic viability and opportunity
-Metrological data - NAL

| ARS –networks and working groups | ARS- National Program -partners | USDA | Other USA partners/stake holders | International partners/stake holders |
|---|---|---|---|---|
| GRACEnet | **NP212*** | USDA Regional Climate Hub network | US-DOE's Knowledge Discover Framework | Global Research Alliance (GRA)-Cropland Research Group (CRG) |
| LTAR | NP216 | USDA-Regional Biomass Research Centers | US-DOE-National Laboratories | Managing Agricultural Greenhouse Gasses Network (MAGGNet) |
| Livestock GRACEnet | NP215 | USDA-NRCS- Soil Health initiative | Antares Landscape Effort | Global Alliance for Climate Smart Agriculture |
| GxExM | NP213 | USDA Building Blocks for Climate Smart Agriculture and Forestry | University Partners | Committee on World Food Security |
| Precision Agriculture | NP211 | USDA-NRCS field offices | Private industries (e.g., AgSolver, POET, DuPont, Monsanto) | Global Soil Partnership (GSP) Sustainable Development Goals |
| Emerging NP212 Working Groups: | NP305 | Soil and Water Conservation District | Commodity groups (e.g., Corn Growers, Soybean Association) | *The 4/1000 Initiative: Soils for Food Security and Climate* |
| -Soil Biology | NP304 | Foreign Agricultural Service | Land Stewardship | |
| -Nitrogen (nutrient) Management | Grand Challenge: Transform agriculture to deliver a 20% increase in quality production at 20% lower environmental impact by 2025. | | Soil Renaissance | |
| -Soil Erosion | | | Soil Health Partnership | |
| -Antimicrobial Resistance | *REAP's programmatic home | | | |

# Greenhouse gas Reduction through Agricultural Carbon Enhancement network GRACEnet

## GOAL

Identify and develop agricultural strategies to enhance soil carbon sequestration and reduce greenhouse gas emission and to provide a scientific basis for carbon credit programs, to reduce net emission of greenhouse gas and improve environmental quality.




## APPROACH

Consistent protocols for soil, trace gas and plant sampling are used across the network.

Assessment within GRACEnet follows four location -specific scenarios:

1. Business as usual in production agriculture for various areas of the country.
   - What is the carbon accumulation/loss rate under typical agricultural management?

2. Maximizing carbon sequestration rate.
   - What can be done to reach the highest carbon sequestration rate?

3. Minimizing net greenhouse gas emission.
   - Agriculture is the main source of nitrous oxide and methane to the atmosphere. Practiices will be developed to decrease the emission of these gases. What can be done to reach the highest carbon sequestration rate?

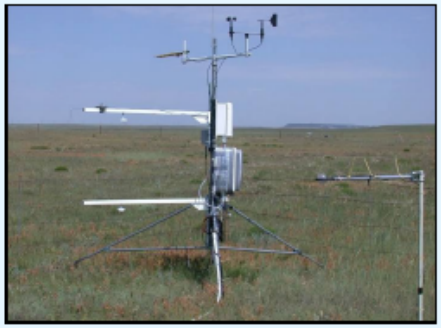
4. Maximizing environmental benefits by improving water, air, and soil quality.
   - This scenario investigates management systems to optimize both agricultural and environmental benefits, by sequestering soil carbon and decreasing greenhouse gas emissions.

## OBJECTIVES

1. Evaluate status and direction of change in soil carbon for typical and alternative agricultural systems.

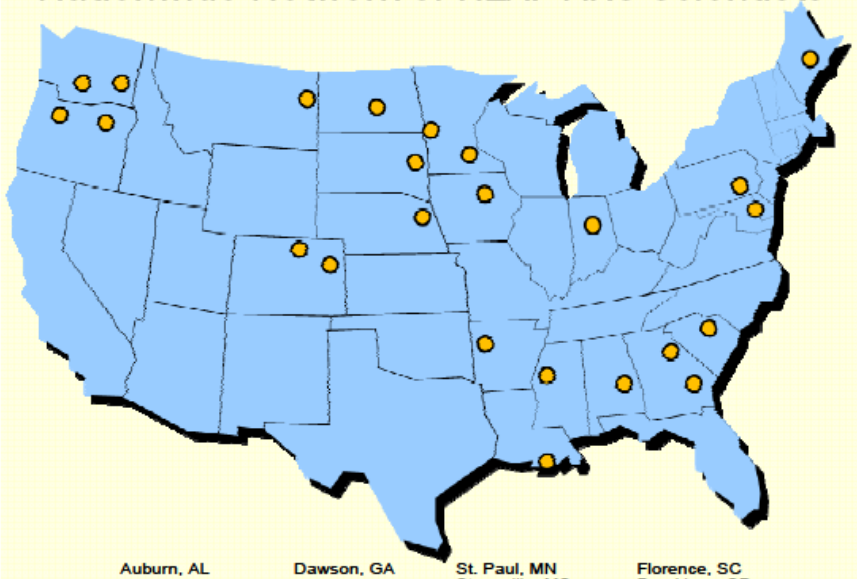
2. Determine net greenhouse gas emission (carbon dioxide, methane and nitrous oxide) of current agricultural systems for typical and alternative agricultural systems.

3. Determine the environmental effects (water, air and soil quality) of agricultural systems developed to reduce greenhouse gas emission and increase soil carbon storage.



# RESILIENT ECONOMIC AGRICULTURAL PRACTICES

## Nationwide Network of REAP ARS Scientists



| | | | |
|---|---|---|---|
| Auburn, AL | Dawson, GA | St. Paul, MN | Florence, SC |
| Booneville, AR | Watkinsville, GA | Stoneville, MS | Brookings, SD |
| Akron, CO | Houma, LA | Sidney, MT | Corvallis, OR |
| Fort Collins, CO | Beltsville, MD | Mandan, ND | Pendleton, OR |
| Ames, IA | Orono, ME | Lincoln, NE | Prosser, WA |
| West Lafayette, IN | Morris, MN | University Park, PA | Pullman, WA |

## Challenge

How to harvest corn and other residue without deleting soil organic carbon or increasing risk of erosion, and risking loss of soil productivity.

## Management Strategies

1. Inclusion of perennials
2. Cover crops
3. Living mulch
4. Reducing tillage
5. Limiting harvest rates

## Opportunities

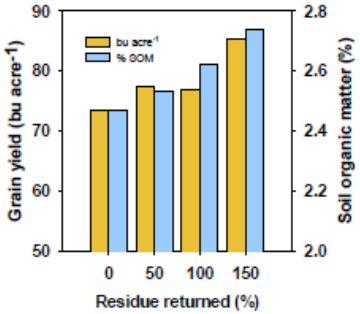
Successful biomass feedstock systems:

1. Produces food, feed and fiber for an increasing world population
2. Provides ecosystem services: erosion control, carbon sequestration, wildlife habitat and protects water quality
3. Replenishes soil organic carbon and cycles plant nutrients
4. Produces feedstock for biofuels

## Objective

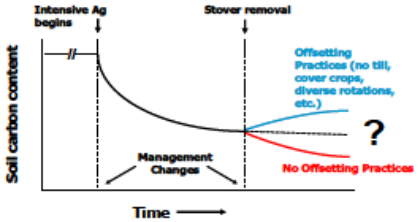
Develop biomass feedstock harvest rates and management strategies that safeguard the soil so it can meet the demand for food, feed, fiber, and fuel.

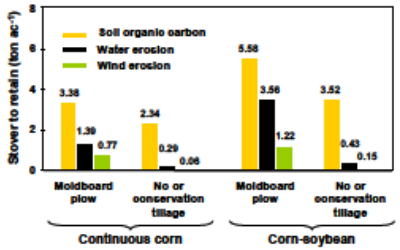
Residue removal impact on grain yield and soil organic matter



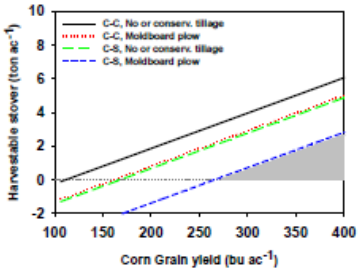

Returning crop residue to the field has a positive impact on yield and soil organic matter.

Soil C change with management




Generally, it takes more stover to manage for soil organic carbon than for water or wind erosion. Stover should not be harvested from highly erodible lands.




The amount of stover that can be sustainably harvested will vary by management. In this example, stover in the shaded area would be sustainably harvestable under moldboard plow tillage in a corn-soybean rotation (blue dashed line).

Harvestable amounts will vary by crop and region.

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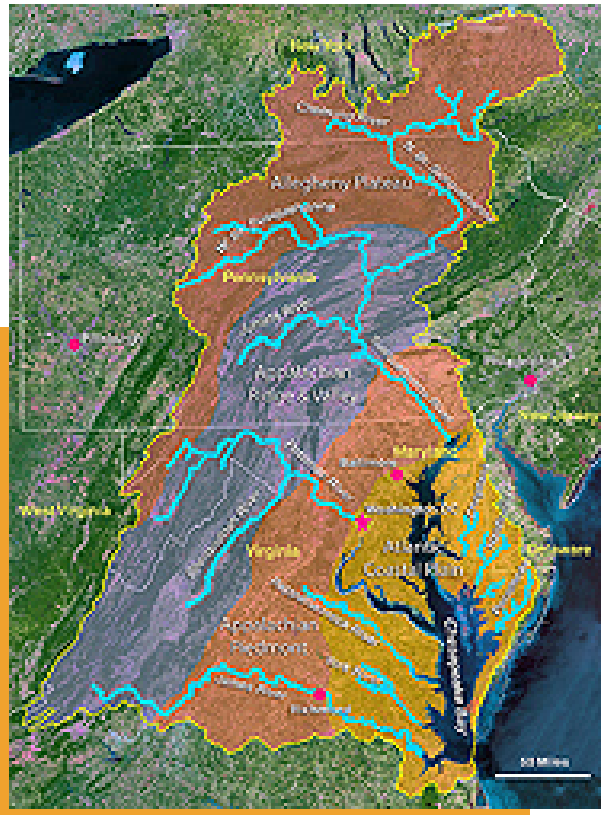
# THE LONG-TERM AGRO-ECOSYSTEM RESEARCH (LTAR) NETWORK

# Long Term Agro-ecosystem Research Network

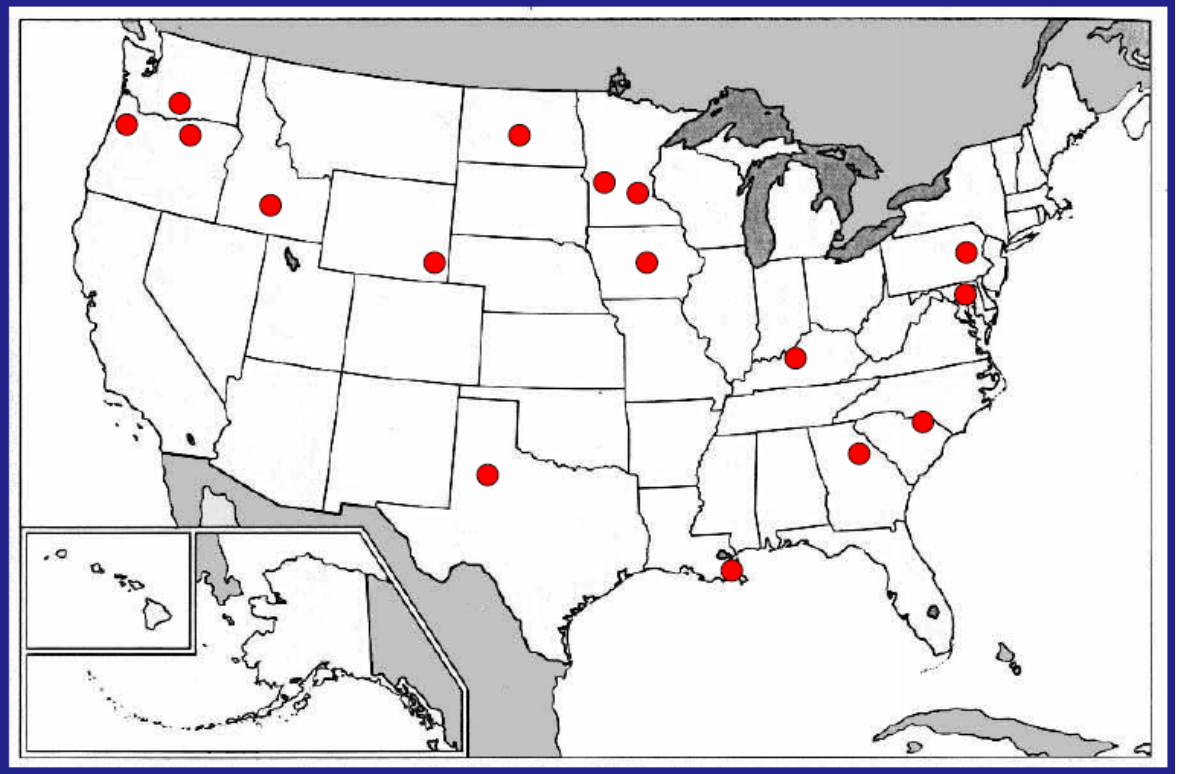


## SHARED RESEARCH STRATEGY

- FOUR PRIORITY AREAS OF CONCERN
  - AGRO-ECOSYSTEM PRODUCTIVITY;
  - CLIMATE VARIABILITY AND CHANGE;
  - CONSERVATION AND ENVIRONMENTAL QUALITY;
  - SOCIO-ECONOMIC VIABILITY AND OPPORTUNITIES.
- FOUR KEY PRODUCTS
  - NEW KNOWLEDGE OF PROCESSES & SYSTEMS;
  - NEW TECHNOLOGIES & MANAGEMENT PRACTICES;
  - IMPROVED AGRO-ECOLOGICAL MODELS;
  - COMPREHENSIVE, ACCESSIBLE DATA.

# CHARNET

## USDA-ARS Biochar and Pyrolysis Initiative (CHARNet)

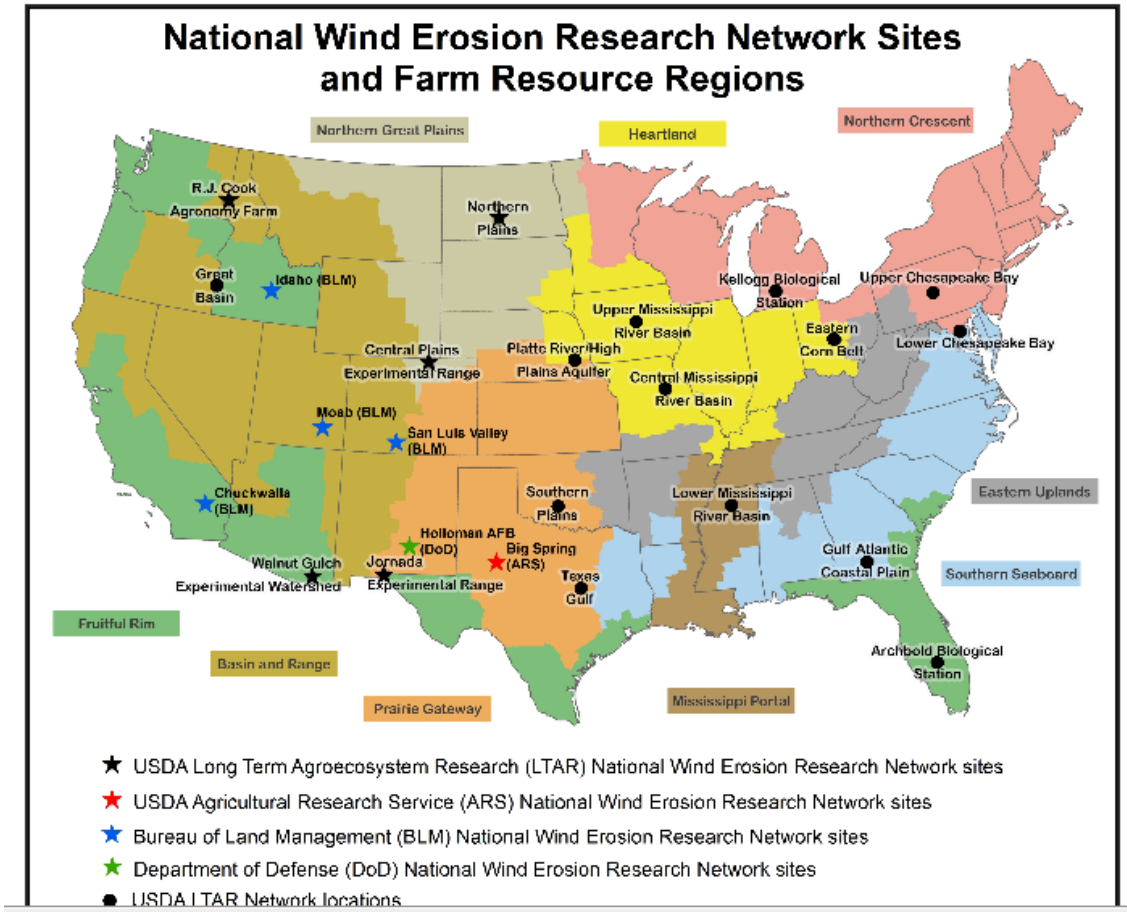


16 Locations – Coordinated Multi-location Research Activities

# WIND EROSION RESEARCH NETWORK

## Welcome to the National Wind Erosion Research Network

The National Wind Erosion Research Network was established in 2014 as a collaborative effort led by the US Department of Agriculture (USDA) Long Term Agro-ecological Research (LTAR) network and the Bureau of Land Management (BLM). The research domain incorporates the diverse soils and vegetation communities in the rangelands and croplands of the western United States, with sites located in New Mexico, Texas, Arizona, California, Colorado, North Dakota, Utah, Idaho and Washington.



- Soil Biology Network
- Nutrient Management Network
- Others

# Questions?

# Thank You!

# Marlen Eve

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