United States Department of Agriculture

Agricultural Research Service

Natural Resources & Sustainable Agricultural Systems

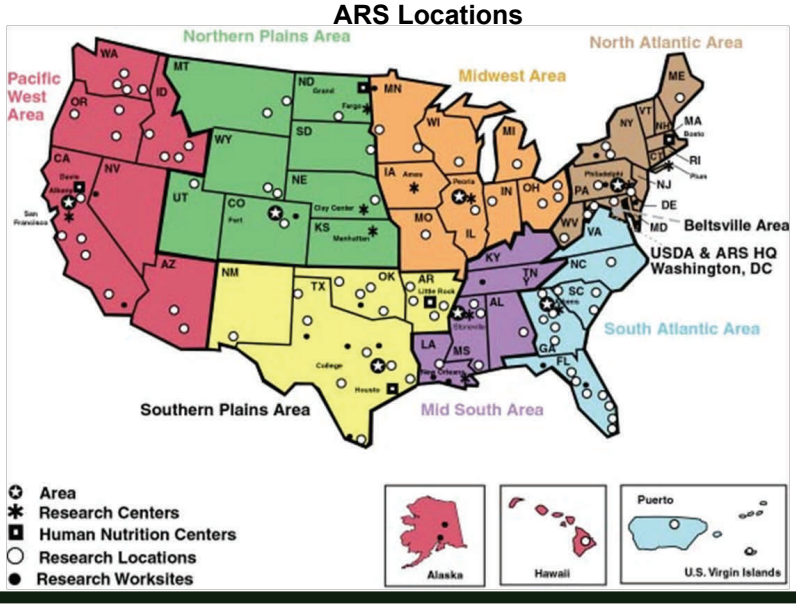
ARS Mission

The Agricultural Research Service conducts research to develop and transfer solutions to agricultural problems of high national priority and provides information access and dissemination to:

- ensure high-quality, safe food and other agricultural products
- assess the nutritional needs of Americans
- sustain a competitive agricultural economy
- enhance the natural resource base and the environment, and
- provide economic opportunities for rural citizens, communities, and society as a whole.

USDA is an equal opportunity provider and employer.

ARS Locations



Natural Resources and Sustainable Agricultural Systems (NRSAS) supports researchers at 70 locations throughout the U.S. developing the technologies and strategies needed to help farmers, ranchers, and other managers become effective stewards of the diverse agricultural ecosystems across the Nation. Emphasis is given to developing economically efficient management practices and technologies that support profitable production and enhance the Nation's vast renewable natural resource base. Research priorities are identified through a continual dialog with a wide range of customers and stakeholders to ensure that our science is relevant and provides effective solutions to their concerns. We address issues affecting both private and public lands, because together these are the foundation of a healthy and vibrant agricultural industry that provides food, feed, fiber, and renewable energy to the Nation, while maintaining abundant and high quality supplies of fresh water, clean air, productive soils, and healthy ecosystems.

NRSAS Statistics:
Total Projects: 191
Total Locations: 72
Total Scientists: 533

Web Site
http://www.ars.usda.gov/research/NRSAS

The ***Water Availability and Watershed Management*** program conducts fundamental and applied research on the processes that control water availability and quality and develops new and improved technologies for managing agricultural water resources to help ensure the health and economic growth of the Nation. Results provide the technologies to manage and deliver safe and reliable fresh water supplies to the agricultural, urban, and industrial sectors of society while enhancing the aquatic natural resources of the Nation.
Total Projects: 51
Total Locations: 31
Total Scientists: 144

This National Program is organized into six component areas:

- Effectiveness of Conservation Practices
- Irrigation Water Management
- Drainage Water Management Systems
- Integrated Erosion and Sedimentation Technologies
- Watershed Management, Water Availability, and Ecosystem Restoration
- Water Quality Protection Systems

The ***Climate Change, Soils, and Emissions*** program conducts research to improve the quality of atmosphere and soil resources affected by, and have an affect on agriculture, and to understand the effects of, and prepare agriculture for, adaptation to climate change. Agricultural systems are bounded by soil and atmosphere systems. There are exchanges of mass and energy between agriculture and these systems affecting the states and processes of each. Emissions from agriculture to the atmosphere affect air quality and increase atmospheric greenhouse gas (GHG) concentrations that, while necessary to the natural cycling of carbon (C) and nitrogen (N), also contribute to climate change. A changing climate impacts agriculture, range and pasture systems, and soils through alterations of precipitation and temperature patterns, and enhanced atmospheric carbon dioxide (CO_2) concentration. The effects of climate change create challenges to agriculture and offer new opportunities for production, and use of soil resources. Soils serve as a crucial boundary resource between agriculture and the atmosphere. Management of soils in agricultural systems must be able to meet rising global demands for food, feed, fiber, fuel and ecosystem services while maintaining soil productivity and limiting undesirable interactions between soils and the atmosphere.
Total Projects: 45
Total Locations: 31
Total Scientists: 100

This National Program is organized into four component areas:

- 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

The ***Bioenergy*** program develops technologies to enable sustainable commercial production of biofuels by the agricultural sector in ways that enhance our natural resources without disrupting existing food, feed, and fiber markets. Research optimizes both the production of plant feedstocks and the conversion of agricultural materials to bioenergy and value-added coproducts. Emphasis is on technologies that enable economical production of large volumes of biofuels and bioproducts. This research strengthens rural economies, provides increased supplies of renewable transportation fuel, enhances energy security, and improves the U.S. balance of trade.
Total Projects: 16
Total Locations: 8
Total Scientists: 45

This National Program is organized into three component areas:

- Feedstock Development (*Enable new varieties and hybrids of bioenergy feedstocks with optimal traits*)
- Feedstock Production (*Enable new optimal practices and systems that maximize the sustainable yield of high-quality bioenergy feedstocks*)
- Biorefining (*Enable new, commercially preferred biorefining technologies*)

The ***Utilization of Manure and Other Agricultural and Industrial Byproducts*** program develops management practices, technologies, and decision support tools that allow effective use of manure and industrial byproducts without threatening human, animal, or environmental health. A key feature of this program is reducing atmospheric emissions, controlling nutrient losses, and limiting transport of pathogens or chemicals from animal production operations. Guidelines are developed for safe and effective use of selected industrial byproducts. Increased use of manure and byproduct materials in agriculture will enhance recycling, lower production costs, improve soil properties, reduce energy use, and help provide feedstocks for energy production.

Total Projects: 25
Total Locations: 17
Total Scientists: 63

This National Program is organized into four component areas:

- 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

The ***Pasture, Forage and Rangeland Systems*** program develops and integrates management practices, germplasm, and land-use strategies to optimize economic viability and environmental enhancement in managing vegetation, livestock, and natural resources on private and public lands. Research activities include studying the application of ecological principles to conserve and restore ecosystems, improving management of agents of ecological change, developing grazing-based livestock systems that increase profitability, improving grass and forage legume germplasm for livestock, conservation, turf, and improving inventory, monitoring, and assessment tools. The overall goal is to provide appropriate technologies and management strategies that conserve and enhance the Nation's diverse natural resources found on its range, pasture, hay, and turf lands.

Total Projects: 35
Total Locations: 25
Total Scientists: 110

This National Program is organized into four component areas:

- Rangeland Management Systems to Improve Economic Viability and Enhance the Environment
- Pasture Management Systems to Improve Economic Viability and Enhance the Environment
- Sustainable Harvested Forage Systems for Livestock, Bioenergy and Bioproducts
- Sustainable Turf Systems

The ***Agricultural System Competitiveness and Sustainability*** research program integrates information and technologies to develop dynamic systems that enhance the productivity, profitability, energy efficiency, and natural resource management of American farms. New practices are identified that utilize on-farm resources and natural ecosystem processes to reduce production costs and risks. Precision management, automation, and decision support technologies are used to increase production efficiencies and enhance environmental benefits. Whole farm strategies are developed for sustainable production of bio-based energy. Production systems incorporate consumer preference and supply-chain economic information to expand market opportunities for agricultural products. Diverse agricultural systems will support the long-term financial viability, competitiveness, and sustainability of farms and rural communities and increase food, fiber and energy security for the Nation and the world.

Total Projects: 20
Total Locations: 20
Total Scientists: 70

This National Program is organized into four component areas:

- Agronomic Crop Production Systems
- Specialty Crop Production Systems
- Integrated Whole Farm Production Systems
- Integrated Technology And Information To Increase Customer Problem Solving Capacity

ARS' Data Management Efforts

Our goals for data management are to capture and distribute relevant data to the research community, especially modelers, in useable formats. Data includes measurement data, such as values of sediment in streams, and descriptive data such as the methods used for measuring the data. Data management includes the activities surrounding storing created data, finding data, obtaining the data, and analyzing the data for specific uses.

Current major data management efforts include **STEWARDS**—a database delivery application for the watershed project known as CEAP, the GRACEnet database on climate change research, and the REAP database on bioenergy.

CEAP (Conservation Effects Assessment Project) develops methods, tools, and data to quantify the effects of the USDA Conservation Programs by providing detailed assessments of conservation practices on watersheds. The diverse data from the watersheds is aggregated in a database delivery application known as STEWARDS, which includes data for sites, weather, precipitation, soils, management, and water quality. STEWARDS is the baseline system for future NR database systems and is currently available at http://129.186.109.10/stewards.1/.

GRACEnet (Greenhouse gas Reduction through Agricultural Carbon Enhancement network) is a program that provides the research community with information concerning carbon storage in agricultural systems and information on nitrous oxide, methane, and other greenhouse gases (GHG) that may be emitted by agricultural practices. The GRACEnet database includes data for sites, weather, soils, land management, and measurement methods for net GHG emissions (carbon dioxide, nitrous oxide, methane) and carbon (C) sequestration.

REAP (Renewable Energy Assessment Project) provides the research community with information concerning soil implications of farm management practices used to grow crops for bioenergy production. The corresponding database includes data sets for describing the geographic characteristics of research sites, soil chemistry, farm management practices, and economics impacts.

Our sophisticated and comprehensive modelers require extensive data to develop and validate their applications. Following is a sample listing of ARS-developed models:

SWAT (Soil and Water Assessment Tool) predicts the impact of land management practices on water, sediment, and agricultural chemical yields over long periods of time.

PGA-BIOECON is the **Parallel Genetic Algorithm for Computation of Biophysical and Economic** Multi-objective Pareto Sets optimizes the tradeoffs among economic, environmental, and policy efficiency objectives by linking SWAT to a farm level profit maximization model.

EPIC (**Environmental Policy Integrated Climate**) model predicts the effects of management decisions on soil, water, nutrients and pesticide movements, as well as their combined impact on soil loss, water quality and crop yields for areas with homogeneous soils and management.

WEPP is the **Water Erosion Prediction Project** model, a physically-based simulation tool for estimating the effects of land management practices on runoff, soil loss, and sediment yield from hill slope profiles and small watersheds.

WEPS, the **Wind Erosion Prediction System,** is a process-based, continuous, daily time-step model that simulates weather, field conditions, management, and wind erosion.

AGNPS is the **AGricultural Non-Point Source** Pollution Model, which predicts non-point source pollutant loadings within agricultural watersheds.

CQESTR simulates the effects of climate, crop rotation, and tillage management practices, and soil amendment additions and losses on soil organic carbon (C).

RZWQM2 (**Root Zone Water Quality Model**) simulates the effects of major agricultural management practices on physical-chemical processes and plant growth, and the movement of water, nutrients, and pesticides to runoff and through the crop-root zone to shallow groundwater.