



United States Department of Agriculture

REE Action Plan: 2013 Annual Progress Report



Research, Education, and Economics Mission Area

Preface

Careful planning is fundamental to research success, and a dynamic and integrated strategic vision can be a guiding force for continued innovation, as well as the means to maximize the potential of our world-renowned system of agricultural science and education. The REE Action Plan aligns with Department and agency strategic plans; identifies priorities through goals, strategies, and actions; implements 2008 Farm Bill requirements for the role of USDA's Chief Scientist; and is essential to making USDA an effective research and development organization.

The work we do is leading to unprecedented advancements in the science of nutrition and nutrition education, agricultural systems, bioenergy, climate change, and plant and animal breeding and disease prevention. Communicating all these advances and our role in the research and development process demonstrates the powerful impact of the USDA investment in science. The REE Action Plan Annual Progress Report is an important part of our effort to communicate these accomplishments.

For 2013, sustainability in agriculture remains a focal point for the U.S. Department of Agriculture (USDA) and the Research, Education, and Economics (REE) mission area. With the world population expected to reach 8 billion by 2025, USDA agencies continue to seek solutions in the defined areas of food production, climate variability, clean and abundant water supply, energy renewal, human health, and food safety.

USDA's National Agricultural Statistics Service (NASS) provides vital statistical and basic research data used by all areas of U.S. agriculture. NASS also partners extensively with external State and Federal governmental organizations, universities, and agricultural commodity organizations to provide high-quality, rigorous, and standardized statistical consultation. In 2013, NASS worked with a USDA interagency team to implement the online, searchable *REGStats* tool. The tool provides public access to summary statistics by race, ethnicity, and gender on applicants and participants for programs administered by the Farm Service Agency, the Risk Management Agency, the Natural Resources Conservation Service, and Rural Development. Providing *REGStats* met the requirements of Sections 14006 and 14007 of the Food, Conservation, and Energy Act of 2008 (7 U.S.C. 2279-1), but also provided a critically needed tool that allows USDA stakeholders to quickly and easily access program applications and participation rate data.

In 2013, the Agricultural Research Service (ARS) alignment with USDA's research-related mission focused on five main goal areas: Nutrition, Food Safety, and Quality; Natural Resources and Sustainable Agricultural Systems; Crop Production and Protection; Animal Production and Protection; and Equal Employment Opportunity. Collaborative efforts by ARS funded researchers at Purdue University's Center for Food Safety Engineering (CFSE) in West Lafayette, Indiana, and ARS scientists in Wyndmoor, Pennsylvania, to produce a new portable Bacterial Rapid Detection using Optical Scattering Technology (BARDOT) sensor technology. Rapid detection of harmful bacteria in food is a critically needed tool to prevent foodborne illness and safeguard public health. The BARDOT instrument is able to identify known pathogenic bacteria, including pathogenic *E. coli*, *Salmonella*, and *Listeria monocytogenes*. The pathogen identification capabilities coupled with the portability of this new BARDOT instrument has tremendous potential for improving the response to foodborne illness outbreaks as the method can travel to the source, thereby reducing the time to detection. The patented BARDOT system is licensed and available for use worldwide.

The Economic Research Service (ERS) provides insightful research and analysis on economic and other social science areas in agriculture. To make agriculture research outcomes readily accessible to the public/consumers and to producers and processors, ERS provided access to research and outlook findings by issuing daily “Charts of Note” that provided clear, concise explanations of ERS research and outlook findings for ERS stakeholders. In 2013, through its food assistance and nutrition research and by working closely with USDA’s Food and Nutrition Service (FNS), ERS studied and analyzed the Nation’s nutrition assistance programs. These programs receive substantial Federal funding and affect the daily lives of millions of American children. ERS research met a critical information need of USDA, Congress, program managers, policy officials, and the research community for these programs. ERS research demonstrated that Supplemental Nutrition Assistance Program (SNAP) participation leads to modest changes in diet quality and helped inform SNAP administrators to better target outreach efforts.

In 2013, the National Institute of Food and Agriculture (NIFA) administered over \$1 billion of congressionally appropriated funds to projects and partners across the Nation to focus on the mission-critical goals identified in the REE Action Plan. NIFA supports a wide range of projects or programs. Examples of NIFA-funded programs include The Evans-Allen Program, a research program for the 1890 Colleges, Tuskegee University, West Virginia State, and the Agriculture and Food Research Initiative (AFRI) Program, which supports fundamental and applied research, extension, and education to address food and agricultural sciences. The Small Business Innovation Research (SBIR) Program, also funded by NIFA, addresses agriculture’s focus areas of food security, climate change, bioenergy, childhood obesity, and food safety. NIFA’s SBIR grants strengthen the role of small, innovative firms in federally funded research and development. Funded by grants from NIFA, New Mexico State University lead a collaboration of 14 Hispanic-serving institutions in New Mexico and Puerto Rico to address climate change issues and mentor students to prepare them for careers in natural resources management. The program provides experiential learning opportunities and has resulted in an improvement in recruitment, retention, academic performance, and graduation rates among students in underrepresented populations.

The 2013 *REE Action Plan Progress Report* identifies ongoing efforts made by the four REE agencies (NIFA, ARS, NASS, and ERS) and other USDA agencies and offices including the Forest Service (FS), Natural Resources Conservation Service (NRCS), Animal and Plant Health Inspection Service (APHIS), Rural Development (RD), Farm Service Agency (FSA), and Climate Change Program Office (CCPO) as well as public and private partners and demonstrates the shared vision for USDA science across the Department. This report illustrates our successes in creating impact-driven agricultural science and efficient use of research and educational resources. As REE Under Secretary and Chief Scientist, I am pleased to highlight some of our many accomplishments from 2013 that demonstrate that commitment. USDA, historically known as the “People’s Department,” remains committed to feeding a growing world population in a sustainable way and strengthening the critical science supporting that effort.

Catherine E. Woteki, Ph.D.
Under Secretary for Research, Education, and Economics and
Chief Scientist
U.S. Department of Agriculture

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Goal 1: Local and Global Food Supply and Security

Goal 1A: Crop and Animal Production

One of the goals for the Research, Education, and Economics (REE) mission area is to invest in research, development, and extension of new varieties and germplasm to safely increase animal and crop production and its nutritional value, identify alternative feed and forage options for animal systems that do not compete for human food and energy needs, and develop and populate a framework for understanding the sustainability outcomes of agriculture/food/forestry practices.

HIGHLIGHTS

- ❖ “Cold Hardiness” can be predicted with a computer model developed for grape growers in the Pacific Northwest. The model can anticipate the likelihood of cold damage in a specific vineyard or for a specific grape variety when extreme cold fronts occur. Applying frost protection measures in vineyards can be very costly. The model provides growers with a decision aid for the most cost-effective vineyard management during winter.
- ❖ ARS created a collection of databases that provide county-level, 5-year production footprints for key indicator crops (corn, potato, small grains, broccoli, cabbage, soybean, alfalfa, and ‘other hay’) throughout the entire 13-State region of the Northeastern United States. The databases bring together information on cropping systems and crop production, soils, land use and quality, and water resources. Researchers will also use information along with forecasting models to improve farm and crop productivity for the future.
- ❖ ARS and the United States Agency for International Development-supported Grain Legume Productivity project, through the *Feed the Future Borlaug Initiative*, completed its first year of screening germplasm and developing populations for evaluating legumes in several African countries and in the United States. Trials with cooperators in Tanzania showed positive and significant correlation (47 percent) between grain yield and nodule number on the roots and support the hypothesis that accessions with more nodules have potential to yield more in low-fertility soils.
- ❖ The increase in the price of fish oil is making it very expensive to include it at desired levels in aquaculture feeds to improve the nutritional value of farmed fish. ARS scientists in Aberdeen, Idaho, have determined that genetic variation exists between families of rainbow trout in their ability to produce and deposit fish oils in their flesh. During 2013, scientists measured the genetic variation among rainbow trout families and validated methods for measuring fatty acid levels in live fish. This methodology will improve fish oil content in filets through breeding and ultimately produce fish with greater health benefits to humans.
- ❖ Varroa mites are a major cause of colony losses in honey bees because they parasitize bees and spread viruses in the colony. ARS researchers in Tucson, Arizona, devised a treatment schedule to control the mites based on their population dynamics. The researchers determined that mites appear to be migratory and move between colonies with far greater frequency than previously thought. Their findings led to changes in recommendations on Varroa control that include a late fall treatment so mite populations remain low over the winter to prevent the loss of honey bee colonies in the spring.

- ❖ ARS researchers in Parlier, California, have developed “Sunpreme,” a new raisin grape that dries naturally on the vine without the grapes requiring cutting and drying in trays. “Sunpreme” is particularly well suited for mechanical harvesting, thereby significantly reducing production costs. Unlike other varieties used for tray-dried raisin production, “Sunpreme” can be spur-pruned, further reducing grower costs.
- ❖ Phosphorus and potassium are two of the primary nutrients used in fertilizers. ARS scientists in Wooster, Ohio, determined that gasified rice hull biochar, a commercially abundant byproduct from the processing of rice, contains a high concentration of phosphorus and potassium, and has potential as an alternative source for use in commercial potting substrates for greenhouse and nursery crops. The scientists determined that the optimal rate for amendment with gasified rice hull biochar into a typical greenhouse potting substrate is 10 percent by volume. At this rate, sufficient phosphorus and potassium are provided for a variety of crop species without additional nutrients being provided. These data provide the industry with baseline information on rates of application that can be used when this product becomes available to the horticultural industry.

Crop and Animal Production by the Numbers
Agricultural Research Service

Publications	660
New Incoming Agreements ¹	65
Material Transfer Agreements ²	21
Inventions	10

Economic Research Service

Publications	25
New or Updated Data Products	5
Briefings ³	2
Federal Register Notices and Other Government Use ⁴	46

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	5,913,737
Direct Youth Contacts by Extension	703,408
Extension Publications From Formula Grants	688
Research Publications From Formula Grants	2,965
Resources Leveraged From Formula Grant Projects	\$570M
Scientist Years for Formula Grant Projects	1,120
Patent Applications Reported by Formula Grant Recipient	61
Extension Professional FTEs From Formula Grants	1,664
Number of Active Extramural Grant Projects	4,266

M= Million

FTEs= Full-Time Equivalent staff



Goal 1B: Crop and Animal Health

The REE mission area invests in research, development, and outreach of new varieties and technologies to mitigate animal/plant diseases and increase productivity, sustainability, and product quality. An additional focus is to establish more sustainable systems that enhance crop and animal health.

HIGHLIGHTS

- ❖ ARS researchers successfully completed a gap analysis of Orbiviruses, which included an assessment of emerging Bluetongue and Epizootic Hemorrhagic Disease viruses in North America with recommendations for improving surveillance and a research agenda to support the development of countermeasures. The report was submitted to the United States Animal Health Association (USAHA) and Animal and Plant Health Inspection Service (APHIS).
- ❖ APHIS validated testing of a small hand-held device that provides mobile, accurate, gene-based (molecular) diagnostics for field identification of pathogens such as *Candidatus Liberibacter asiaticus* (Las) directly from individual psyllid vectors or plant tissue. Test diagnostics from this device provide the means to greatly increase surveillance for the destructive citrus greening disease at an affordable cost.
- ❖ To support outreach efforts to mitigate animal diseases, ARS successfully launched the Global African Swine Fever Research Alliance (GARA) and created a Web site in support of the research alliance objectives such as improved communication and coordination of research.
- ❖ NIFA funding supported the National Plant Disease Network (NPDN), a 50-State network of land-grant, university-based plant diagnostic laboratories. All 50 States and many U.S. territories are connected to the NPDN through digital distance diagnostics, used throughout the Nation to speed early detection of high-consequence plant pathogens and solve other agricultural problems. In fiscal year 2013, NPDN established the System for True, Accurate and Reliable (STAR-D), a lab accreditation program for NPDN diagnostic laboratories.
- ❖ Strains of the Wheat Stem Rust pathogen in the group Ug99 are threats to wheat production worldwide, and while these strains are not yet in the United States, U.S. wheat varieties are vulnerable to Ug99. ARS scientists in St. Paul, Minnesota, developed a timesaving, two-stage, assay technique to distinguish among rust strains. This assay is currently being used to track the movement of the Ug99 in Africa where the disease is endemic. Deployment of this assay in the United States will greatly enhance growers' ability to detect and identify any Ug99 introductions and to provide information for responding to potential outbreaks.



Crop and Animal Health by the Numbers
Agricultural Research Service

Publications	1,321
New Incoming Agreements ¹	222
Material Transfer Agreements ²	114
Inventions	29
New or Updated Web Sites	3
Conferences Supported	7

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	3,601,966
Direct Youth Contacts by Extension	283,629
Extension Publications From Grants	414
Research Publications From Grants	1,785
Resources Leveraged From Formula Grant Projects	\$594M
Scientist Years for Formula Grant Projects	1,285
Patent Applications Reported by Formula Grant Recipient	37
Extension Professional FTEs From Formula Grants	971
Number of Active Extramural Grant Projects	4,123

M=Million

FTEs=Full-Time Equivalent staff

Goal 1C: Crop and Animal Genetics, Genomics, Genetic Resources, and Biotechnology

The REE mission area generates new fundamental knowledge through research in genomic sciences and applications of systems approaches required to enhance the sustainability of agriculture while increasing productivity.

HIGHLIGHTS

- ❖ Global food stocks are threatened by strains of the Wheat Stem Rust pathogen in the group Ug99. Strategic deployment and use of resources and technologies in USDA wheat breeding programs are helping move genes from wheat cultivars with known resistance to Wheat Stem Rust Ug99 into elite commercial wheat cultivars. ARS developed and released a new wheat germplasm that carries wheat stem rust resistance gene Sr44.
- ❖ To support the U.S. catfish industry, NIFA funded two grants to Auburn University for developing genome sequence. Catfish genome sequencing led to development of molecular markers that can be used for selective breeding of traits such as growth rate, feed conversion, resistance to the effects of Gram-negative bacteria (*columnaris* and *Enteric septicemia*), processing yield, and tolerance to low oxygen. Whole genome sequence assembly and transcriptomes of channel catfish and blue catfish genomes will help identify sequence variants associated with production traits for selective breeding in both catfish species resulting in more efficient and higher production yields.
- ❖ ARS scientists, along with a visiting scientist from Spain, reported the discovery of markers that can be used to select blackberry seedlings that produce two crops a year without thorns. Blackberry breeders and geneticists worldwide will use these new markers. This work was published in *Theoretical and Applied Genetics*, July 2013.
- ❖ The USDA NIFA Triticaceae (Barley & Wheat) Coordinated Agricultural Project (TCAP) successfully implemented a Web-based plant breeding training network. This action is providing the continuity required for sustainable cereal breeding activities in the United States while filling the need for highly trained field breeders for the private sector.



Crop and Animal Genetics, Genomics, Genetic Resources, and Biotechnology by the Numbers

Agricultural Research Service

Publications	832
New Incoming Agreements ¹	152
Material Transfer Agreements ²	94
Inventions	7

Economic Research Service

New or Updated Data Products	1
Briefings ³	1
Federal Register Notices and Other Government Use ⁴	3

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	449,919
Direct Youth Contacts by Extension	47,365
Extension Publications From Grants	173
Research Publications From Grants	746
Resources Leveraged From Formula Grant Projects	\$300M
Scientist Years for Formula Grant Projects	557
Patent Applications Reported by Formula Grant Recipient	15
Extension Professional FTEs From Formula Grants	167
Number of Active Extramural Grant Projects	1,649

M=Million

FTEs=Full-Time Equivalent staff

Goal 1D: Crop and Animal Consumer and Industry Outreach, Policy, Markets, and Trade

The REE mission area focuses on characterizing and evaluating market performance and the provision of market information in domestic and international markets that affect producer production and marketing decisions in agriculture’s food, fiber, and energy sectors.

HIGHLIGHTS

- ❖ Haitian government adopted an ERS developed food-security assessment model and food-basket index methodology for official use.
- ❖ Tanzanian government reversed an export ban of maize based on an ERS-led policy assessment.
- ❖ ERS provided information and analysis on U.S. and global agricultural market performance that informs and supports producer production and marketing decisions in agriculture’s food, fiber, and energy sectors through seven ERS research monographs, eight journal articles by ERS authors, and briefings to senior leadership.
- ❖ In an effort to improve the understanding of climate factors that impact food systems, ERS released the report “Weather Effects on Expected Corn and Soybean Yields (FDS-13G-01)” providing analysis to support USDA assessment of the impact of weather on U.S. corn and soybean yields.

Crop and Animal Consumer and Industry Outreach, Policy Markets, and Trade by the Numbers

Economic Research Service

Publications	150
New or Updated Data Products	196
Number of Extramural Grants Awarded	19
Briefings ³	17
Federal Register Notices and Other Government Use ⁴	191

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	4,145,598
Direct Youth Contacts by Extension	1,080,934
Extension Publications From Grants	629
Research Publications From Grants	2,710
Resources Leveraged From Formula Grant Projects	\$119M
Scientist Years for Formula Grant Projects	384
Patent Applications Reported by Formula Grant Recipient	56
Extension Professional FTEs From Formula Grants	1,272
Number of Active Extramural Grant Projects	1,922

M=Million
FTEs=Full-Time Equivalent staff



Goal 2: Responding to Climate and Energy Needs

Goal 2A: Responding to Climate Variability

The REE mission area develops and delivers science-based knowledge that empowers farmers, foresters, ranchers, landowners, resource managers, policymakers, and Federal agencies to manage the risks, challenges, and opportunities of climate variability, and positions decisionmakers to reduce emissions of atmospheric greenhouse gases and enhance carbon sequestration.

HIGHLIGHTS

- ❖ NIFA supported major forestry projects at genome to environmental scales that serve as the baselines for identifying useful genetic traits to macro-scale management strategies for increased greenhouse gas (GHG) sequestration. The projects will produce fundamental knowledge and the education and extension programs that will increase GHG sequestration through improved forestry management.
- ❖ A new, automated tool for mapping landscape water use (evapotranspiration-ET) provides decisionmaking criteria for water management at local and regional scales that is accessible via Web browser verified that landscape-level soil moisture monitoring via satellite is possible upon launch of Soil Moisture Active-Passive (SMAP).
- ❖ ERS presented results of comparisons of land-use models used to evaluate climate-change impacts and climate-change mitigation strategies. The presentation includes discussion of reference scenarios through 2050 and economic responses to climate change.
- ❖ Correlation of extreme weather events, including “Flash Drought,” with climate change, strongly suggests the need for more comprehensive and rapid, large-scale monitoring of vegetative conditions nationwide. VegScape, a geospatial portal (released by NASS in 2013) included the Evaporative Stress Index (ESI) created by ARS scientists. VegScape and the ESI will greatly enhance geospatial monitoring of U.S. vegetative and soil moisture conditions.
- ❖ To support development of knowledge and tools to enhance understanding of water management, the Economic Research Service sponsored a workshop on “Integrating Water Scarcity into Future Agricultural Assessments.” Workshop participants identified critical areas of model uncertainty and data needs within disciplines, discussed possible frameworks for integrating modeling efforts across disciplines and spatial scales, and explored future opportunities for collaboration on integrated assessment studies through the Agricultural Model Intercomparison and Improvement Project (AgMIP) research community.
- ❖ The Forest Service, working with partners, improved databases of stream temperatures. These data improved projections of stream temperature changes. Additional research demonstrates that stream temperature on life-history expression is critical for their management.
- ❖ The development of the NASS 2013 Cropland Data Layer (CDL) for the full Continental United States (CONUS) was implemented in 2013. The 2013 annual CDL will add a sixth year of CONUS geospatial land cover, continuing an exceptionally popular database throughout government, academia, and the private sector. The geospatial data from the CONUS CDL will greatly expand knowledge available to scientists with other geospatial data layers, and will become critical to potential Geographic Information System (GIS)-based greenhouse gases (GHGs) monitoring and modeling efforts at scalable levels.

- ❖ The NIFA-supported Climate Team developed capacity to produce downscaled climate projections that are being used to drive biogeochemical models, the outputs of which are being linked to economic performance and mitigation policy efficacy at nationally integrated scales. Collectively, soil carbon (C) assessments results indicate that tillage has a greater impact on soil organic carbon (C) in the top 30 centimeters (cm) than crop rotation or residue removal.
- ❖ NIFA-funded research assessed whether agricultural food, fiber, and bio-fuel production can be sustained in the United States through a migration of production back to the Southeastern United States under an irrigation-assisted, rain-fed agricultural system. Migration of production back to the Southeast, if sustainable, would be an adaptation strategy to climate change and provide additional capacity for long-term food, fuel, and fiber security.
- ❖ The flash droughts of 2012 and 2013 in the Nation’s corn belt were rapid onset events fueled by below normal precipitation levels and a lingering heat wave that essentially “baked” moisture reserves from the soil profile. ARS scientists in Beltsville, Maryland, developed a satellite-based drought product called the Evaporative Stress Index (ESI) that provided early warnings of deteriorating crop and moisture

conditions. ESI warnings preceded signals of drought severity recorded by the U.S. Drought Monitor and many other standard drought indicators by several weeks.

- ❖ NIFA is funding a site-specific climate-friendly farming project in collaboration with ARS, Washington State University, and the University of Idaho to develop an improved biophysical model that captures the landscape-scale, spatio-temporal variability of nitrous oxide (N₂O) emissions and related processes under different management regimes. Collaborations with local stakeholders have helped increase the understanding of challenges associated with developing site-specific prescription maps.



Responding to Climate Variability by the Numbers

Agricultural Research Service

Publications	249
New Incoming Agreements ¹	36
Material Transfer Agreements ²	5
Inventions	9

Economic Research Service

Publications	3
Federal Register Notices and Other Government Use ⁴	12

Forest Service

Publications	403
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National Institute of Food and Agriculture

Direct Adult Contacts by Extension	2,579,640
Direct Youth Contacts by Extension	242,749
Extension Publications From Grants	318
Research Publications From Grants	1,371
Resources Leveraged From Formula Grant Projects	\$144M
Scientist Years for Formula Grant Projects	365
Patent Applications Reported by Formula Grant Recipient	28
Extension Professional FTEs From Formula Grants	485
Number of Active Extramural Grant Projects	1,549

M=Million

FTEs=Full-Time Equivalent staff

Goal 2B: Bioenergy/Biofuels and Biobased Products:

Together with partners, the REE mission area strives to lead global agricultural innovation to achieve energy efficiency and independence by integrating economically, environmentally, and socially sustainable region-based biomass production systems into existing agricultural systems.

HIGHLIGHTS

- ❖ The ERS report “Agriculture’s Supply and Demand for Energy and Energy Products” examined how farmers are adapting to policy and market changes such as the increased production of biofuel crops and other sources of renewable energy, together with changes in production practices to economize on energy-based inputs like fertilizer. The report suggests farmers are adapting by adjusting their use of energy-based agricultural inputs, altering energy-intensive production practices, and growing more energy-feedstock crops.
- ❖ ARS researchers in Lincoln, Nebraska, released a new lowland-type switchgrass cultivar, “Liberty,” in 2013 after a 3-year trial period in Illinois, Nebraska, and Wisconsin. “Liberty” had an excellent winter survival rate and greater biomass yields than available upland cultivars. It will be the first bioenergy type cultivar for the Midwest and the northern Great Plains and will likely be adapted to the Northeastern States as well.
- ❖ The National Agricultural Library (NAL) supported research data sharing and management activities related to project sustainability modeling. NAL implemented a Comprehensive Knowledge Archive Network (CKAN), an open source data management system researchers can use to share modeling data and provide a data-sharing platform for project researchers. The USDA and U.S. Navy collaboration to develop biomass-based jet fuel is one example of research data sharing.
- ❖ Supported by collaborations between USDA, U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA), the Biomass and Research Development Initiative (BRDI) continues to fill a significant gap in the continuum of technology development and commercialization supported by USDA and other Federal programs. The program has demonstrated success in hydroprocessing biomass, deriving synthetic gas to produce liquid fuels, optimizing feedstock from wood sugar, optimizing fermentation processes, identifying the price point needed to re-establish polyitaconic acid manufacturing in the United States, and constructing the Morris Gasification Plant to generate combined heat and power.



Bioenergy/Biofuels and Biobased Products by the Numbers
Agricultural Research Service

Publications	92
New Incoming Agreements ¹	7
Material Transfer Agreements ²	16
Inventions	6

Economic Research Service

Publications	1
New or Updated Data Products	12
Federal Register Notices and Other Government Use ⁴	24

Forest Service

Publications	86
Inventions	1

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	56,306
Direct Youth Contacts by Extension	20,134
Extension Publications From Grants	74
Research Publications From Grants	319
Resources Leveraged From Formula Grant Projects	\$66M
Scientist Years for Formula Grant Projects	139
Patent Applications Reported by Formula Grant Recipient	7
Extension Professional FTEs From Formula Grants	61
Number of Active Extramural Grant Projects	408

M=Million

FTEs=Full-Time Equivalent staff



Goal 3: Sustainable Use of Natural Resources

Goal 3A: Water Availability (Quality and Quantity):

The REE mission area develops and provides the best available science and technology to inform decision-making and improve practices in water conservation, use, and quality by fostering a watershed/landscape-scale approach that encourages place-based agricultural water management.

HIGHLIGHTS

- ❖ ARS continues to maintain the Sustaining the Earth's Watersheds Agricultural Research Data System (STEWARDS), updating the database each year and providing database access to the Natural Resources Conservation Service (NRCS), and facilitating linkages with United States Geological Survey (USGS) and United States Environmental Protection Agency (EPA) water quality databases. These activities enable cross-site and regional comparisons of the effectiveness of conservation practices in improving environmental quality.
- ❖ The Water Quality Information Center (WQIC) at the National Agricultural Library (NAL) continues to pursue ways to highlight USDA watershed research for the public. Current channels include the National Agricultural Library Digital Collections (NALDC), the Enviro-News listserv, and the WQIC Web site. Through the NALDC, the USDA watershed research results are made widely available. Enviro-News and the WQIC Web site provide mechanisms for learning about the types and extent of USDA watershed research.
- ❖ ARS developed the blind inlet, a new conservation practice, to reduce agricultural pollutant discharges from upper Midwestern glacial landscapes characterized by the presence of potholes. Natural Resources Conservation Service (NRCS) in Indiana now offers blind inlets as a cost-sharing practice through the Environmental Quality Incentives Program (EQIP). The use of this new practice reduces nitrogen and phosphorus losses from Midwestern glacial landscapes that include farmed potholes.
- ❖ The Climate and Corn-based Systems Coordinated Agricultural Program (CAP) grant continues to develop a water footprint for corn in 10 Midwestern States. A survey of 20,000 farmers established baseline attitudes in the top 22 corn-producing watersheds. Approximately 20 students from historically Black college Lincoln University are included in this project. Extension outreach provided corn producers accounting for 70 percent of 2013 U.S. production with high-value educational programs and resources on drought and water management.
- ❖ Salish Kootenai College, a Native American tribal college located in Pablo, Montana, serving the Bitterroot Salish, Kootenai, and Pend d'Oreilles Tribes, finalized their undergraduate hydrology program. This is an accredited 4-year hydrology program with Native teachers and culturally appropriate curricula. There were 20 students enrolled initially. This is the only Associates and Bachelor of Science Hydrology degree program offered at a tribal college.
- ❖ NIFA-funded research and extension led to the training of 6,000 producers and educators on methods for reducing nutrient and sediment loss to water in row crop production systems.
- ❖ To support USDA's vision for the future of water management, NIFA Hispanic education grants supported 200 watershed internships for minority and female students to prepare them for USDA careers in watershed management.

- ❖ ARS scientists identified low-disturbance manure incorporation technologies, suitable for use in reduced tillage cropping systems, which can reduce ammonia emissions by more than 90 percent over conventional practices. These activities were the basis for several publications and influenced Natural Resources Conservation Service’s development of interim practice standards for manure injection in Pennsylvania and other States in the Chesapeake Bay watershed.
- ❖ The Forest Service initiated a program of work for generating streamflow estimates for ungaged basins across the Western United States and validating flow estimates and several metrics over the region. The ability to estimate flow from headwater streams in small watersheds will be greatly enhanced, providing better data for current large-scale models, and for Forest Service lands water availability estimates.
- ❖ A NIFA-supported program led to the completion of the first commercial agricultural groundwater trade and sets legal precedence for future sales and leases of groundwater rights. As a result, water supplies in the Nebraska Platte River are sustained for endangered species, such as the sandhill crane, while reimbursing farmers for their groundwater rights and maintaining agricultural production.

**Water Availability: Quality and Quantity
by the Numbers**

Agricultural Research Service

Publications	367
New Incoming Agreements ¹	68
Material Transfer Agreements ²	1
Inventions	5

Economic Research Service

Publications	1
New or Updated Data Products	1
Federal Register Notices and Other Government Use ⁴	6

Forest Service

Publications	81
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National Institute of Food and Agriculture

Direct Adult Contacts by Extension	1,695,277
Direct Youth Contacts by Extension	183,567
Extension Publications From Grants	217
Research Publications From Grants	935
Resources Leveraged From Formula Grant Projects	\$83M
Scientist Years for Formula Grant Projects	190
Patent Applications Reported by Formula Grant Recipient	19
Extension Professional FTEs From Formula Grants	384
Number of Active Extramural Grant Projects	901

M= Million

FTEs=Full-Time Equivalent staff



Goal 3B: Landscape-Scale Conservation and Management

In collaboration with USDA sister agencies, such as the Forest Service’s Research and Development and the Office of Environmental Markets, the REE mission area develops and provides the best available science and technologies to inform U.S. Government policies and programs and to support application of land-management practices that improve the economic, social, and environmental sustainability of our Nation’s working farms, ranches, and forests.

HIGHLIGHTS

- ❖ NIFA funded the promotion of rangeland restoration through the seeding of species that enhance the productivity and sustainability of ecosystem services. A low-cost method for seeding perennial grasses was successfully developed and demonstrated in a research field coupled with an on-ranch test.
- ❖ To help identify the determinants of socioeconomically viable and environmentally sound livestock, forage, and forest-production systems and support development of solutions, NIFA funded projects to improve efficient irrigation for water conservation in the Rio Grande Basin. This research demonstrated that using plastic polypipes, instead of the traditional irrigation methods of earth ditches or furrows, has increased the amount of water conserved, increased labor efficiency, and reduced production costs.
- ❖ The Forest Service provided agroforestry input to the draft document: “Science-Based Methods for Quantifying Greenhouse Gas Sources and Sinks at the Local Entity Scale in the Forest and Agriculture Sectors.” This document provides the required farm-level greenhouse gas (GHG) accounting methodologies that will make it possible for landowners to participate in potential carbon markets and help America meet future GHG goals.

Landscape-Scale Conservation and Management by the Numbers

Economic Research Service

Publications	12
Number of Extramural Grants Awarded	3
Briefings ³	2
Federal Register Notices and Other Government Use ⁴	27

Forest Service

Publications	22
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National Institute of Food and Agriculture

Direct Adult Contacts by Extension	2,431,598
Direct Youth Contacts by Extension	308,606
Extension Publications From Grants	393
Research Publications From Grants	1,696
Resources Leveraged From Formula Grant Projects	\$300M
Scientist Years for Formula Grant Projects	664
Patent Applications Reported by Formula Grant Recipient	35
Extension Professional FTEs From Formula Grants	564
Number of Active Extramural Grant Projects	2,561

M= Million

FTEs= Full-Time Equivalent staff



Goal 4: Nutrition and Childhood Obesity

The REE mission area builds the evidence base for food-based and physical activity strategies and develops effective education/extension translational activities to promote health and reduce malnutrition and obesity in children and high-risk populations.

HIGHLIGHTS

- ❖ The ERS examined the effect of USDA food and nutrition assistance programs on food insecurity and the economic well-being of low-income households. ERS reports titled “Alleviating Poverty in the United States: The Critical Role of SNAP Benefits” and a journal article titled “How Much Does SNAP Alleviate Food Insecurity?” provided timely information to policymakers on how USDA food assistance programs are linked to important health and well-being outcomes.
- ❖ ARS scientists, collaborating with faculty from Baylor College of Medicine, showed how a new statistical approach is more accurate than the existing one for modeling energy expenditure in adults and children and should be applied when the nutritional standard for daily calorie needs are re-evaluated.
- ❖ The ARS released “The Food Patterns Equivalents Database for 2009-2010” on the Web. This database enabled the USDA Center for Nutrition Policy and Promotion (CNPP) to evaluate how multi-ingredient foods contribute to helping Americans meet the recommended intake of food groups.
- ❖ ERS released the report “Household Food Security in the United States, 2012,” which contains nationally representative statistical data on the food security status of the American population. These data provide unbiased information on the food security status of Americans, an integral part of nutrition and economic surveillance data.
- ❖ ERS provided an assessment of impacts of updated regulations governing the USDA National School Lunch Program. This information is used to assess the potential for new school meal standards to improve children’s diets and indicate where action is needed to help schools to implement standards successfully.
- ❖ ARS research identified factors under parental control that encourage and discourage Hispanic 3-to-5-year-olds from physical activity.
- ❖ ARS and Baylor College of Medicine research involving over 3,500 children found that effective weight control for children aged 5 to 7 years points to parental education and involvement with weight management as a requirement for success.



- ❖ Research by ARS and Baylor College of Medicine identified peanut consumption as a significant predictor of better weight status in Hispanic children. The addition of peanuts to the diets of children may be an effective way to improve weight and nutritional choices.
- ❖ In an early childhood feeding study, ARS followed infants’ mental, motor, and language skills in the first year of life. An exclusive breast milk diet in the first 6 months after birth resulted in better development than either a soy milk diet or a cow’s milk formula diet. However, infants who were fed the two formulas had similar developments within the normal range for all outcomes. This result is critical to building the evidence base for dietary guidance in the birth-to-24-month age range, which will be added to Dietary Guidelines for Americans in 2020.
- ❖ Urinary tract infections result in millions of doctor visits annually and some people suffer from recurrent bacterial infections. Cranberry juice phenolic compounds associated with its red color were previously thought to be solely responsible for preventing E. coli. ARS scientists in Wyndmoor, Pennsylvania, described the composition of sugars derived from and unique to cranberry pulp that prevented the adherence of E. coli to urinary tract cells. A joint patent application was filed under a collaborative research and development agreement with a major cranberry producer. These newly recognized cranberry sugars may provide the consumer with another bioactive food ingredient that improves health.

Nutrition and Childhood Obesity by the Numbers

Agricultural Research Service

Publications	413
New Incoming Agreements ¹	31
Material Transfer Agreements ²	5
Inventions	2
New or Updated Web Sites	2

Economic Research Service

Publications	56
New or Updated Data Products	20
Number of Extramural Grants Awarded	17
Briefings ³	14
Federal Register Notices and Other Government Use ⁴	76

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	5,511,768
Direct Youth Contacts by Extension	5,315,913
Extension Publications From Grants	769
Research Publications From Grants	3,316
Resources Leveraged From Formula Grant Projects	\$228M
Scientist Years for Formula Grant Projects	501
Patent Applications Reported by Formula Grant Recipient	68
Extension Professional FTEs From Formula Grants	1,972
Number of Active Extramural Grant Projects	1,869

M=Million

FTEs=Full-Time Equivalent staff

Goal 5: Food Safety

The REE mission area provides science that informs decisions and policies that contribute to a safe food supply and the reduction of foodborne hazards.

HIGHLIGHTS

- ❖ NIFA's support of ongoing research at Texas Tech University will provide innovative and practical solutions to the beef industry to improve public health by mitigating bacterial foodborne threats. To date, researchers have analyzed almost 4,000 lymph nodes from 12 commercial packing plants from across the United States. Commercial packing plants that remove lymph nodes from beef carcasses had reduced Salmonella in their ground beef products. Industry partners are exploring opportunities and approaches to remove lymph nodes from carcasses based on the data collected. Removing lymph nodes will help reduce the burden of Salmonella in beef, and thereby enhance food safety in the United States.
- ❖ The National Animal Health Monitoring System Farm to Fork pilot project identified and sampled collection and data analysis. Research is ongoing comparing the antimicrobial resistance patterns on animals at farms compared to at time of slaughter. The result is expected to identify the potential challenges, costs, and benefits for long-term monitoring of antimicrobial resistance in food animals.
- ❖ ARS research is ongoing to understand and minimize the potential accumulation of antibiotic-resistant pathogens in vegetables following irrigation using recycled water. New experimental protocols were developed, including the evaluation of the uptake of Salmonella by lettuce plants. Four methods were tested to identify the most efficient method for yielding consistent recovery and low detection limits of Salmonella in lettuce. A lower percentage of lettuce plants are infected with Salmonella under normal conditions, however, under drought conditions, the percentage is higher.
- ❖ ARS researchers developed and filed a patent for a new technology that pasteurizes shell eggs using radio frequency energy. The new technology may substantially reduce the threat of illness from uncooked and undercooked shell eggs.
- ❖ ARS scientists collaborating with colleagues at Purdue University have developed a portable, cost-effective BARDOT (bacteria rapid detection using optical scattering technology) instrument. The new instrument is easy to use and can rapidly identify known pathogenic bacteria, including pathogenic E.coli, Salmonella, and Listeria monocytogenes. The pathogen identification capabilities coupled with the portability of this new BARDOT instrument has tremendous potential for improving the response to foodborne illness outbreaks because the method can travel to the source, thereby reducing the time to detection.
- ❖ ARS-supported genetic analysis of resistant E. coli isolates demonstrated that the baseline level of resistant E. coli in cattle was more likely due to the persistence of a few feedlot-adapted resistant E. coli strains rather than the transfer of the genes conferring resistance between E. coli strains. This study is significant since it indicated that antibiotic treatment of disease in cattle feedlots does not increase the prevalence of antibiotic-resistant E. coli in those cattle when they are harvested.

- ❖ NIFA provided awards for several detection technology projects through Small Business Innovation Research (SBIR), Phase I and Phase II, including awards to address Salmonella in poultry, both on carcasses and on contact surfaces and developing a new technology to remove black walnut shells from walnut meat during walnut processing which is a significant economic and safety issue.
- ❖ E. coli disease can be very serious in humans and is potentially fatal, particularly in young children and the elderly. The most common source of serious E. coli disease in humans is cattle. ARS scientists recently identified the full spectrum of bacteria in the gut of cattle using metagenomic phytotyping studies. This research has increased USDA's understanding of the potential to reduce shedding and transfer of deadly E. coli and determine if E. coli shedding levels are heritable traits.



**Food Safety by the Numbers
Agricultural Research Service**

Publications	472
New Incoming Agreements ¹	42
Material Transfer Agreements ²	26
Inventions	7

Economic Research Service

Publications	7
Number of Extramural Grants Awarded	3
Federal Register Notices and Other Government Use ⁴	14

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	672,945
Direct Youth Contacts by Extension	289,095
Extension Publications From Grants	268
Research Publications From Grants	1,155
Resources Leveraged From Formula Grant Projects	\$56M
Scientist Years for Formula Grant Projects	130
Patent Applications Reported by Formula Grant Recipient	24
Extension Professional FTEs From Formula Grants	277
Number of Active Extramural Grant Projects	511

M= Million

FTEs = Full-Time Equivalent staff

Goal 6: Education and Science Literacy

The REE mission area and our partners recognize the importance of recruiting, cultivating, and developing the next generation of scientists, leaders, and a highly skilled workforce for food, agriculture, natural resources, forestry, environmental systems, and life sciences.

HIGHLIGHTS

- ❖ A project funded by NIFA’s Beginning Farmer and Rancher Development Program (BFRDP) developed the Dairy Grazing Apprenticeship (DGA) training and mentorship program. The occupation of “Dairy Grazier” has been determined to be an “Apprenticeable Occupation” by the U.S. Department of Labor’s Office of Apprenticeship, and DGA has become the first federally recognized apprenticeship for farming in the Nation. Four Journey Dairy Graziers graduated in early 2013, with another 12 apprentices in training, and more than 50 apprentice candidates awaiting placement. Three graduates of the program now have their own farms, and another graduate is managing a farm.
- ❖ The NIFA 1890 Capacity Building Grants Program awarded approximately \$16.7 million for programs including 24 teaching applications awarded to enhance instruction and provide student support and 18 research applications awarded, which include support for and/or participation by undergraduate and graduate students.
- ❖ NIFA funded four proposals in support of the Multicultural Scholars Program (MSP) to develop a well-integrated and coordinated approach to recruit minority and non-minority students; research, education, and Cooperative Extension professionals; and pre-collegiate, undergraduate, and graduate students.
- ❖ As a result of NIFA funding, the Northwest Colorado Collaboration in Learning Agriculture Sciences Project (CO-CLAS) will develop a dual enrollment Agricultural Education Certificate program in six regional high schools and three new degree programs at Colorado Northwest Community College (CNCC) to address inconsistency in dual enrollment course rigor and accessibility in geographically isolated areas of Colorado. CO-CLAS will increase the number of agricultural science students in postsecondary degree programs, and it will increase secondary and 2-year post-secondary instructional quality to meet workplace needs.
- ❖ Over the past 7 years, a University of Nebraska educator developed a network of farmers that adopted new, improved technologies for irrigation and water management. The network of more than 1,100 farmers and over 1.5 million acres of cropland has reduced the amount of irrigation by 114 billion gallons of water annually—enough water to supply a city the size of Tucson, Arizona, for an entire year.
- ❖ NIFA funded eight Higher Education Challenge projects, including one with the goal to develop curriculum for undergraduates on the causes and consequences of childhood obesity, that can be folded into existing advanced research methods, practicum, service learning, or special topics course. The curriculum format allows faculty to “flip the classroom” so valuable classroom time may be spent interacting with students to promote team collaboration. The program embeds students in real-world problem-solving situations that promote collaboration, interdisciplinary thinking, and strong interpersonal communication skills.

- ❖ 4-H representatives participated in the National Aeronautics and Space Administration (NASA) “Adopt a Pixel” project connected with the Landsat system. An educational guidance for the project was developed and participants chose a location and collected photographs and location coordinates to send to NASA. This data will be used to verify and support data received from Landsat. Participants will have access to historical Landsat imagery to use in geospatial projects.
- ❖ NASS, American Statistical Association (ASA), and National Ag in the Classroom collaboration has resulted in lesson plans and activities associated with grades 4-12 Census at School statistical literacy initiative. ASA and NASS engaged nearly 20 teachers in a teacher workshop and distributed about 200 printed lesson plans. Lessons are available online for interested teachers, as well as the general USDA, REE educational audience through back-to-school initiatives.

Education and Science Literacy by the Numbers
National Institute of Food and Agriculture

Direct Adult Contacts by Extension	408,891
Direct Youth Contacts by Extension	149,336
Extension Publications From Grants	69
Research Publications From Grants	297
Resources Leveraged From Formula Grant Projects	\$6M
Scientist Years for Formula Grant Projects	21
Patent Applications Reported by Formula Grant Recipient	6
Extension Professional FTEs From Formula Grants	45
Number of Active Extramural Grant Projects	344

M= Million
 FTEs= Full-Time Equivalent staff



Goal 7: Rural-Urban Interdependence and Prosperity

The REE mission area strives to provide effective research, education, and extension that inform public and private decisionmaking in support of rural and community development.

HIGHLIGHTS

- ❖ To help rural communities take advantage of new technologies and spur much-needed innovations, ERS completed 2 publications covering current trends in rural broadband Internet and some of the issues of broadband Internet demand shortfall, including reasons why some households choose not to obtain Internet access.
- ❖ ERS's ongoing Rural Establishment Innovation Survey helped establish the determinants of rural prosperity and develop indicators to measure regional assets and performance.



Rural-Urban Interdependence and Prosperity by the Numbers

Economic Research Service

Publications	20
New or Updated Data Products	7
Number of Extramural Grants Awarded	1
Briefings ³	7
Federal Register Notices and Other Government Use ⁴	88

National Institute of Food and Agriculture

Direct Adult Contacts by Extension	6,514,249
Direct Youth Contacts by Extension	10,929,736
Extension Publications From Grants	801
Research Publications From Grants	3,450
Resources Leveraged From Formula Grant Projects	\$90M
Scientist Years for Formula Grant Projects	223
Patent Applications Reported by Formula Grant Recipient	71
Extension Professional FTEs From Formula Grants	3,588
Number of Active Extramural Grant Projects	1,231

M= Million

FTEs= Full-Time Equivalent staff

¹ New incoming agreements are agreements where ARS is receiving funds from an outside source to do research based on the statement of work in a proposal or agreement.

² Material Transfer Agreements are contracts governing the transfer of tangible research materials between two organizations, when the recipient intends to use it for his or her own research purposes.

³ Briefings are for senior USDA staff, congressional staff, or other Federal Agencies.

⁴ Federal Register Notices and/or other government use are Federal Register Notices of Rules or other Federal Agency Decision Reports that use ERS research findings (Government Accountability Office, Congressional Research Service, Council of Economic Advisors, etc.).

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