ARS Annual Performance Report for FY 2014 and Performance Plan for FY 2015 - 2017

Introduction

Mission Statement

ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provide 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.
- provide the infrastructure necessary to create and maintain a diversified workplace

Vision Statement

The ARS vision is to lead America towards a better future though agricultural research and information.

Core Values

Our success depends on:

- **Inclusion** — Providing opportunities for ARS constituents to shape and improve those services provided by the Agency.
- **Collaboration** — Working cooperatively at all governmental levels domestically and internationally on policy matters affecting a broad audience.
- **Accountability** — Ensuring that the performance of all employees is measured against the achievement of the Agency's strategic goals.
- **Customer Focus** — Serving ARS' constituents by delivering programs that address their diverse needs.
- **Professionalism** — Building and maintaining a highly skilled, diverse, and compassionate workforce.
- **Results Orientation** — Measuring performance and making management decisions to direct resources to where they are used most effectively.

Strategic Plan Framework

Formed in 1953 as USDA's chief scientific research agency, ARS is one of the four component agencies of the Research, Education, and Economics (REE) mission area. The Agency's mission centers around conducting the basic and applied research needed to solve problems of national importance for American agricultural producers, Government action agencies, and the general public and, increasingly, for producers and consumers worldwide. This work covers a wide range of needs, ranging from animal and crop protection and production to human nutrition, food safety, and natural resources conservation. Today, with a staff of over 8,500 employees, ARS carries out research at over 100 laboratories throughout the Nation and in several foreign countries.

Outlining the major needs and corresponding goals for the next five years, this new Strategic Plan will help guide the Agency's scientific activities and the accompanying transfer of ARS research products to producers, consumers, action and regulatory agencies, the private sector, and other customers and stakeholders.

The Agency's research focuses on achieving the goals identified in the USDA and Research, Education, and Economics (REE) mission area Strategic Plans. The Government Performance and Results Act (GPRA) mandates each agency to establish general goals that will contribute to achieving beneficial societal outcomes that shape and drive the work of the Agency during the five years covered by the plan.

Goal Areas

Echoing ARS' National Program structure, the Plan is organized into 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. These Goal Areas—and the goals, performance measures, and actionable strategies identified within them—align with the components of the REE Action Plan and the USDA Strategic Plan Goals as follows:

ARS Goal Area	ARS Strategic Goal	REE Action Plan Goal	USDA Strategic Goal Objective (s)
1: Nutrition, Food Safety & Quality	1.1 Human Nutrition	4	4.2
	1.2 Food Safety	5	4.3
	1.3 Quality & Utilization of Ag Products	2B, 7	1.3
2: Natural Resources & Sustainable Ag Systems	2.1 Water Availability & Watershed Mgmt	3A	2.2 & 2.3
	2.2 Climate Change, Soils & Emissions Research	2A	2.1, 2.2 & 2.3
	2.3 Bioenergy	2B	1.1
	2.4 Agricultural & Industrial Byproducts	3B	1.3, 2.1 & 4.3
	2.5 Rangeland, Pasture & Forages	3B	2.1
	2.6 Agricultural Competitiveness & Sustainability	2A, 2B, 3B	1.3, 2.1, 2.2 & 2.3
3: Crop Production & Protection	3.1 Plant Genetic Resources, Genomics, Genetic Improvement, and Crop Production	1A, 1C	1.3, 3.1 & 4.4
	3.2 Plant Diseases, Crop Protection & Quarantine, and Methyl Bromide Alternatives	1B, 1C	4.4

4: Animal Production & Protection	4.1 Animal Production	1A, 1B, 1C	1.3 & 3.1
	4.2 Prevention and Control of Pests and Animal Disease that Threaten Agriculture	1B, 1C	1.3, 3.1, 4.3 & 4.4
5: Equal Employment Opportunity	5.1 Develop a Model Equal Employment Opportunity (EEO) Program		MI 2

Goals

Each Goal Area (with the exception of EEO/CR, an overarching Agency Goal Area) includes specific goals that are aligned groupings of ARS' 18 National Programs, derived from the Agency's specific mission, as outlined in each 5-year National Program Action Plan. In developing their individual Project Plans, each ARS scientist will, in turn, align his or her research objectives with the overarching goals identified in this portion of the ARS Strategic Plan, thereby ensuring continuity with the USDA, REE, and ARS vision for agricultural research.

Performance Measures – Explaining the Numbering System

The 14 performance measures describe specific measurable achievements, which indicate progress toward reaching the broader objectives and goals. The first digit of the performance measure ties it to the primary USDA Strategic Goal that is being addressed, the next digit represents the ARS goal area, while the 3rd digit together with the ARS goal area, represents the specific ARS goal.

Performance Targets

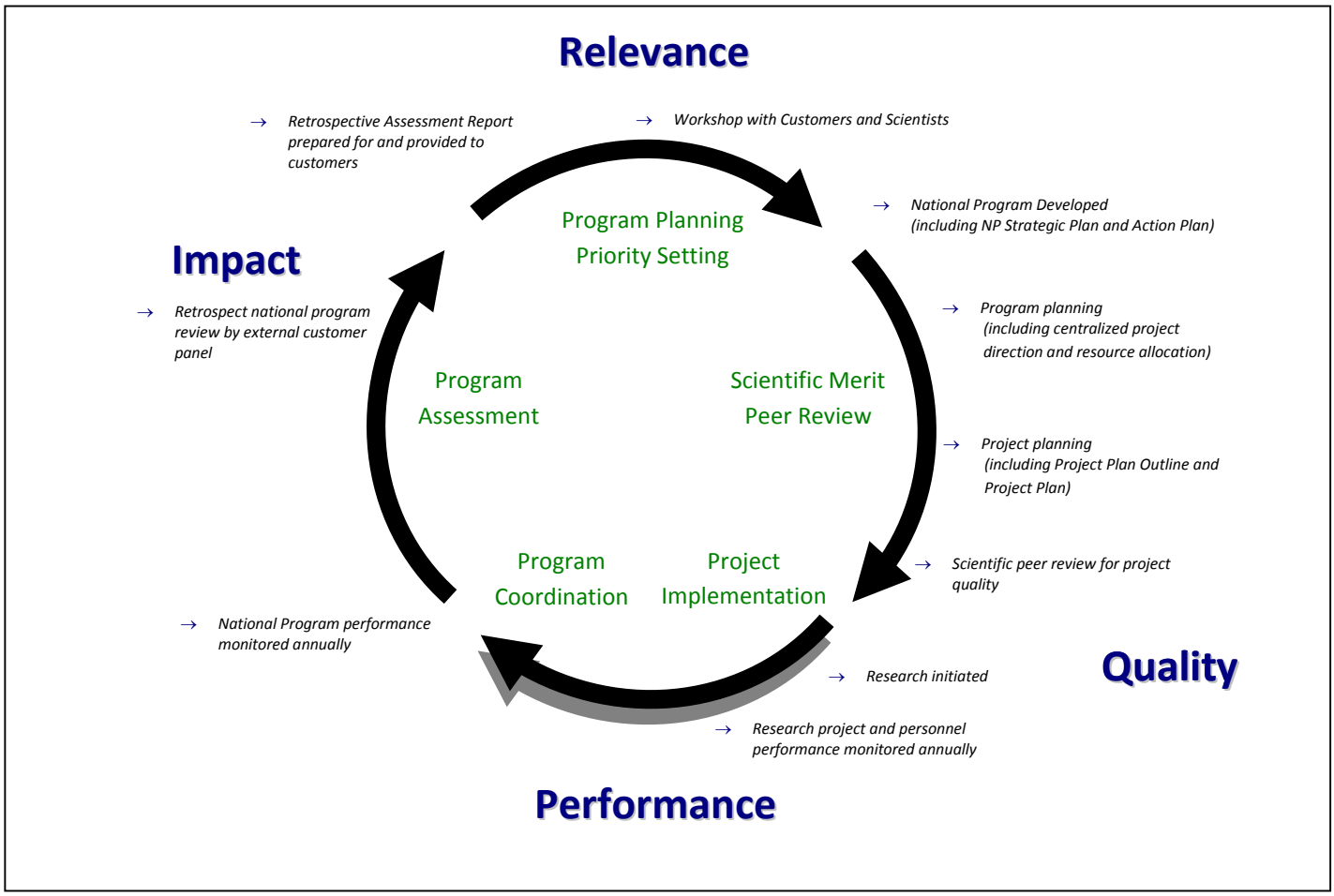
There are a number of performance targets that will be used to achieve each performance measure. These are research components broken down to more clearly align research products and accomplishments with the appropriate performance measure, with a baseline and target to be reached by 2017.

Strategies and Means

These include some of the specific research activities that ARS anticipates conducting during the next 5 years to address each Performance Measure.

National Research Program Management in ARS

Approximately 800 research projects from around the Country are aligned into 18 National Programs that encompass all the research of the Agency. The National Programs are grouped into four program areas: Animal Production and Protection, Crop Production and Protection, Natural Resources and Sustainable Agricultural Systems, and Nutrition, Food Safety, and Quality. Each of the four program areas is managed by a Deputy Administrator, and each program is led by a team of National Program Leaders (NPLs). Some 30 NPLs are responsible for planning and developing research strategies to address critical issues affecting American agriculture. Nearly 200 Research Leaders work with 8 geographically-based Area Directors to implement the coordinated research objectives issued by the National Program Leaders.



Implementation of the Five-Year National Program Cycle

The overarching objectives of the National Programs are ***relevance, quality,*** and ***impact*** of ARS research, all important elements of improved accountability. Research must be ***relevant*** to the highest priority problems, the goals and outcomes of the research should significantly ***impact*** the problems, and the science must meet the highest standards of ***quality.*** To ensure that these objectives could be achieved, ARS implemented the National Program Cycle, a cycle of phases embodying a series of recurring activities.

The 5-year program management cycle illustrates the activities by which ARS conducts its research: program planning and priority setting, peer review, project implementation, program coordination, and assessment. The cycle ties these activities together in a recurring 5-year sequence to ensure effective and efficient program and project management within ARS.

Ongoing monitoring of project quality and performance takes place throughout the program cycle, and adjustments are made when necessary to improve performance or meet emerging challenges. At the end of the program's 5-year cycle, a rigorous National Program Retrospective Review is convened. The purpose is two-fold: to ensure, based on feedback from an outside group of experts (made up of academics, stakeholders, and government) that the research is being conducted as indicated in the Action Plan; and to gain advice and insight from these same experts as to the future direction of the research.

Relevance, Quality (Prospective and Retrospective), and Performance—these objectives are what a research organization must promote to be successful. Program Planning and Priority Setting, Scientific Merit Peer Review, Project Implementation and Coordination, and Program Assessment —prescribe the actions that the Agency undertakes carefully, thoroughly, and with outside review to demonstrate that our research is of the highest quality.

Increasing Communication within and outside ARS

By definition, the planning and implementation of National Program research is designed to be a participatory process requiring significant input from the broad sources of expertise and experience within and outside the Agency. Through coordinated efforts that emphasize communication with valued partners and scientists, ARS can ensure that public resources are expended in a targeted and synchronized fashion on scientifically and programmatically relevant problems.

Further, by gathering input from outside users of ARS research, the Agency meets the ever-increasing demand for public accountability. ARS solicits input from the Administration, regulatory and action agencies, producers and producer groups, university communities, and non-governmental organizations, often through face-to-face exchanges. By accounting for the needs and priority issues of these customers, stakeholders, and partners, ARS develops responsive research that emphasizes meeting short-term emergencies or requirements as well as long-term sustained research to address problems of regional, national, and international scope and importance.

Emphasis on communication and coordination ultimately ensures that the physical, financial, and human resources of ARS are deployed appropriately to address high-priority agricultural, food, and environmental research needs of the Nation.

Because agricultural research is not the exclusive domain of any public or private entity, the very specific and the wide variety of needs that farmers, producers, ranchers, and industry stakeholders have must be met in a broad collaborative and cooperative effort. ARS has developed and continues to utilize an extensive network of research relationships among researchers with universities, industry, and other Federal government agencies to meet the research needs of U.S. agriculture. First among those Federal relationships is the USDA National Institute for Food and Agriculture (NIFA), USDA's extramural research agency. ARS and NIFA national program leaders work closely together to ensure that research funded by each agency is complimentary, and not duplicative. For example, ARS and NIFA national program leaders have collaborated on utilizing intramural and extramural research to develop joint action strategies for research on plant diseases and pests (i.e., citrus greening), animal diseases, and water and soil conservation.

National Programs

ARS organizes its research activities under 18 National Programs under four broad categories: Nutrition, Food Safety and Quality; Natural Resources and Sustainable Agricultural Systems; Crop Production and Protection; and Animal Production and Protection. To best address issues of agricultural importance, ARS makes regular adjustments to this program structure. The structure appears below.

Nutrition, Food Safety, and Quality

- Human Nutrition
- Food Safety (Animal and Plant Products)
- Quality and Utilization of Agricultural Products

Natural Resources and Sustainable Agricultural Systems

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

Crop Production and Protection

- Plant Genetic Resources, Genomics, and Genetic Improvement
- Plant Diseases
- Crop Protection and Quarantine
- Crop Production

Animal Production and Protection

- Food Animal Production
- Animal Health
- Veterinary, Medical , and Urban Entomology
- Aquaculture

General Comments: In January 1998, ARS requested a waiver from the Office of Management and Budget's (OMB) requirement "to describe specific and tangible products, steps, intermediate goals, and/or accomplishments that will demonstrate that the Agency has successfully met each Performance Measure/Goal in a given fiscal year." With OMB's concurrence, ARS is able to use narrative descriptions of intermediate outcomes and indicators of progress instead of numerical metrics as specified in GPRA. The research and technology transfer activities listed in this report are not all inclusive of the Agency's work. The reported accomplishments reflect, but do not adequately capture, the broad range of basic applied and developmental research that underpins the Agency's work.

Only Federal employees were involved in the preparation of this report.

Strategic Goal Area 1:
Nutrition, Food Safety and Quality

The Nutrition, Food Safety and Quality research and information area exists to lead and coordinate ARS research and information dissemination to define the role of food and its components in optimizing health for all Americans; develop tests and processes that keep the food supply safe; reduce and control pathogens and toxins in agricultural products; and improve the economic viability and competitiveness of American agriculture by enhancing the quality and utilization of agricultural products for the benefit of producers and consumers.

GOAL 1.1 – ENABLE AMERICANS TO MAKE HEALTH-PROMOTING, SCIENCE-BASED DIETARY CHOICES: HUMAN NUTRITION (107)

To improve the nutrition and health of the American people, ARS conducts research on the quality of the American diet and on related health behaviors. Distinctive aspects of this research include an emphasis on a food-based approach to improving health; the core capability to sustain long-term research in areas deemed of high priority for the Nation's health; the availability of state-of-the-science equipment and facilities for human research across the lifecycle; and the conduct of multidisciplinary research to improve the nutritional value of the American diet and food supply. The mission of the Human Nutrition Program is to define the role of food and its components in optimizing health throughout the life cycle for all Americans by conducting high national priority research. This research emphasizes study of essential nutrients and nonessential, health-promoting components in foods; evaluating the nutritional value of diets eaten by people in America; determining how consumption of specific foods or food components can enhance health; and developing strategies to improve food choices and lifestyle factors. Increasingly, research focuses on addressing over-consumption and caloric imbalance with incorporation of cutting-edge genomic and metabolomic technologies to carry out research. Research addresses four overarching components: nutrition monitoring, the scientific basis for dietary recommendations, obesity prevention, and life stage nutrition and metabolism. Information dissemination programs operated by the National Agricultural Library address general and specific human nutrition issues and audiences and include general Web portals such as www.nutrition.gov as well as the targeted Web sites of the Food and Nutrition Information Center.

Performance Measure

4.1.1 Monitor nutrient composition of food supply and consumption by Americans while conducting research on life stage nutrition and metabolism. Strengthen the scientific basis for dietary guidance for health promotion and disease prevention and develop strategies for prevention of obesity and related diseases.

Indicator 1: ***During 2014, ARS will survey, release data on, and analyze national food consumption patterns of Americans.***

FY 2014 Accomplishments*:*

1. ARS researchers in Beltsville, Maryland, analyzed food group contributors to sodium intake in the U.S. and found that sandwiches are major contributors to salt in the American diet.

   ***Impact*:** Because the Dietary Guidelines for Americans recommend reduced salt intake, it is important to know the sources of sodium in the diet so that the food industry can provide lower salt alternatives and consumers can become aware of the sources of higher sodium to make educated changes in food selection.

2. ARS researchers from Beltsville, Maryland, looked at 10-year trends in caffeine intake by children in the U.S. comparing data from 2001-2010.

   Impact: Over 70% of children consumed caffeine on a given day and intake increased with age of the child so that teenagers took in the most at about 40 milligrams per day; about 10% of older children exceeded suggested maximum intake levels. There was a significant decline in caffeine intake by younger children over the period studied, which reflects lower consumption of soft drinks containing caffeine.

3. ARS scientists in Beltsville, Maryland, made available nutrition survey results from the NHANES survey for the years 2011-2012 on 5,000 participants.

   Impact: Data from the only nationally representative survey of America's health and food intake is used by many Federal agencies and by academic researchers to link dietary habits with many markers of health and disease.

Indicator 2: ***During 2014, ARS will develop new methods, conduct food composition analyses, and compile databases for known, emerging, and new classes of nutrients.***

FY 2014 Accomplishments*:*

1. ARS scientists in Beltsville, Maryland, compiled and released the USDA National Nutrient Database for Standard Reference, Release 27.

   ***Impact*:** This database is the gold standard used by all commercial suppliers of nutrient data and many other countries. It is used by the public, researchers, clinicians, and other Federal agencies, including NIH, CDC, FDA, and USDA/FNS and CNPP, EPA, and the Department of Defense.

2. ARS scientists in Beltsville, Maryland, compiled and released the USDA Food and Nutrient Database for Dietary Studies 2011-2012.

   ***Impact*:** This database is used to code dietary intake data and calculate nutrient intakes by researchers analyzing the National Health and Nutrition Examination Survey, administered by CDC, and is the only nationally representative survey of the American people's health and food intake.

3. ARS scientists from Beltsville, Maryland, compiled and released the Food Patterns Equivalents Database for 2011-2012.

   Impact: This database converts foods that are reported eaten in the NHANES national survey into Food Patterns recommended in the Dietary Guidelines for Americans, published by USDA and HHS.

This allows analysis of eating habits to determine how close they are to those recommended by the Federal government. This database is used by multiple Federal agencies and researchers in academia.

4. ARS scientists in Beltsville, Maryland, developed a method for identification and quantitation of oligomeric proanthocyanins from various plant foods. These chemicals have been associated with various health improvements but the lack of standard methods has slowed research in this area.

   Impact: This method led to identification of 247 compounds in seven foods, many for the first time. For health research to advance, reproducible methods of complete analysis of foods and their bioactive compounds are essential. This new method fills that need.

Indicator 3: ***During 2014, ARS will identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.***

FY 2014 Accomplishments*:*

1. ARS scientists from Grand Forks, North Dakota, tested whether removal of seating at a playground had an effect on physical activity intensity and length of stay among children and adults. While there were small improvements in children, those were not statistically significant. However, among adults, there were significant increases in standing and total physical activity without affecting length of stay. Replacement of seats the following season resulted in returns to baseline levels.

   ***Impact*:** This almost cost-free intervention can help local community's foster increased physical activity and fitness among adults who go to parks. These results also have implications for design of playgrounds, either moving seating away from play areas or reducing money for seating that makes it available for other uses.

2. ARS researchers in Houston, Texas, studied over 7,500 children aged 5-7 from multiple ethnic groups through the fifth grade and found a clear pattern of weight gain during the summer with weight loss during the school year. This pattern emerged after the first grade and was stronger in children who were overweight, obese, or Hispanic.

   ***Impact*:** Documentation of this pattern clearly shows that participation in the school meals program does not contribute to excess weight gain in this age group and actually results in small weight loss during the school year that is more than erased during summer months. Not only does this information bolster the nutritional value of USDA-funded school meals, but suggests where obesity interventions should be emphasized in children.

3. ARS researchers in Houston, Texas, assessed whether the amounts that were served to and consumed by children at meals were related to amounts that parents served themselves. The amounts that parents served themselves were significantly associated with the amounts that they served to their children and the amounts served strongly correlated with the amount eaten.

   Impact: Efforts aimed at improving parents' recognition of developmentally appropriate portions for young children could be useful for future obesity-prevention efforts.

Indicator 4: ***During 2014, ARS will determine the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.***

FY 2014 Accomplishments*:*

1. ARS researchers in Boston, Massachusetts, found that the plant pigments lutein and zeaxanthin, which are enriched in the retina, are correlated with cognitive function in elderly people. Macular pigment optical density, a measure of these plant pigments in the retina, are significantly associated with better global cognition, verbal learning and fluency, recall, processing speed and perceptual speed, whereas serum levels are significantly related to only verbal fluency.

   Impact**:** This observational study serves as the basis for a future controlled feeding study of foods that supply these plant pigments such as dark green leafy vegetables, corn, and egg yolks. If such a simple intervention has clinical benefit, this would be a critically important advance in health promotion and reduction of medical costs for the elderly.

2. ARS scientists in Grand Forks, North Dakota, demonstrated that soft laser scanning of the skin on the palm of the hand provided similar values for concentrations of carotenoids as when analyzed in the blood. Using those methods, the scientists also found that depletion of carotenoids from the blood takes about 3 weeks and from the skin, about 4 weeks.

   Impact**:** This study proves that a simple, noninvasive scan of the palm provides useful information for intake of a class of dietary compounds from dark green, red, orange, and yellow vegetables. It also provides a means of easily tracking seasonal changes in intake of health-promoting plant compounds.

Indicator 5: ***During 2014, ARS will publish new findings on metabolic processes that are affected by nutrient intake.***

FY 2014 Accomplishments*:*

1. ARS scientists in Davis, California, discovered that many metabolites found in blood plasma of obese women on a weight loss diet are derived from bacteria in the large intestine. These bacterial metabolites are absorbed from the colon, circulate in the blood, affect metabolism of multiple organs, and some are excreted in the urine.

   Impact**:** This study changes the basic interpretation of metabolic compounds found in blood or urine, in that they are not just derived from metabolism by the body's tissues but also from the bacteria in the intestine. The amount and types of various bacteria are highly dependent upon dietary intake so this offers a potential way of normalizing metabolism through proper diet.

2. ARS scientists from Davis, California, examined reasons for the variation in response to consuming omega-3 fatty acids derived from fish oil. In a group of 83 healthy African-American volunteers, most responded as expected with changes in blood lipids and metabolites that affect the immune response. However, those who did not respond to the omega-3 supplements were eating low amounts of vegetables, particularly from the dark-green or orange ones and legumes.

   Impact**:** These results suggest that dietary health benefits depend on the entire diet and not simply on one, or a few, specific recommendations. The data also suggest there is some effect on metabolism of omega-3 fats by consumption of the vegetables that has never been considered. One

likely possibility is that those foods induce beneficial changes in the intestinal bacteria that influence metabolism elsewhere in the body.

Indicator 6: ***During 2014, ARS will discover genetic or epigenetic factors that influence physiologic responses to diet or changes in gene expression in response to dietary intake.***

FY 2014 Accomplishments:

1. ARS researchers in Houston, Texas, worked in an international collaboration to demonstrate the first-in-human confirmation that the maternal nutritional status, measured around the time of conception, predicts the methylation patterns of portions of specific genes in their offspring. Methylation controls how genes are turned on and off. Increased maternal BMI was also predictive of decreased systemic infant DNA methylation at metastable epialleles on the children.

   ***Impact*:** The demonstration that maternal nutrient intake and body-mass index affect multiple genes and plasma biomarkers in their children definitively demonstrates the importance of nutrition during pregnancy and the maintenance of healthy weight for the next generation. Much information had been generated from animal studies but this is the first proof that the same process occurs in humans and indicates the importance of proper nutrition early in pregnancy, even before the woman knows she is pregnant.

2. ARS scientists in Boston, Massachusetts, discovered that only individuals with a specific minor variant in a gene that controls the biological clock respond to high carbohydrate intake with increased insulin resistance. This was confirmed in two independent populations from the U.S. and Spain. In addition, this relationship was independent of body-mass index.

   ***Impact*:** This observational study strongly suggests that only a minority of people are susceptible to adverse effects of high carbohydrate diets. It also may explain why there is heterogeneous response of insulin metabolism in controlled feeding studies – only a fraction of people may respond to high carbohydrate with increased fasting insulin based on their genetic variation so this has profound implications for making dietary recommendations for the population.

Performance Targets

1.1.A Link Agricultural Practices and Beneficial Health Outcomes

Baseline 2012	Target 2017
Two discoveries documented and published in peer-reviewed journals that demonstrate how agronomic practices may benefit public health by improving important nutritional components of the food supply.	Cumulatively, 6 discoveries communicated to ARS stakeholders through peer-reviewed scientific papers.

1.1.B Monitor Nutrient Composition of the Food Supply and Consumption by Americans

Baseline 2012	Target 2017
Three datasets on food composition and dietary intake were released by ARS and used by customers to establish Federal dietary policy guidelines, food assistance and feeding programs, and food labeling to safeguard the health of the American people.	Cumulatively, 15 databases developed and released to ARS customers.

1.1.C Strengthen the Scientific Basis for Dietary Guidance for Health Promotion and Disease Prevention

Baseline 2012	Target 2017
Four research studies on health effects of foods or nutrients published in peer-reviewed scientific journals that contribute evidence used in Dietary Reference Intake reports or the Dietary Guidelines for Americans.	Cumulatively, 20 studies published and released to ARS customers.

1.1.D Develop Strategies for Prevention of Obesity and Related Diseases

Baseline 2012	Target 2017
Five papers in peer-reviewed scientific journals that test innovative approaches to preventing obesity or related conditions.	Cumulatively, 25 papers documenting these discoveries added to the scientific literature on this topic.

1.1.E Conduct Research on Life Stage Nutrition and Metabolism

Baseline 2012	Target 2017
Five studies published in peer-reviewed journals that increase knowledge of nutrient requirements in the youngest and oldest Americans, how nutritional status relates to health, and how genes and epigenetic mechanisms contribute to this interplay.	Cumulatively, 25 scientific discoveries will be documented in scientific publications.

Measure 4.1.1 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 3 new technologies adopted for uses that provide data on nutrient content of foods consumed by Americans that enable regulatory agencies to monitor accuracy, allows the food industry to formulate labels without conducting their own expensive analyses, and helps health professionals, researchers, and consumers know the nutrient content of individual foods and dietary patterns.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
USDA National Nutrient Database for Standard Reference, Release 27	Nutrient content of more than 8,600 foods freely available on the ARS website.	FDA, FSIS, FNS, CNPP, EPA, food industry, academic researchers, consumers	This information enables USDA feeding programs to meet nutrient requirements by knowing how much food is needed to meet requirements.
Food and Nutrient Database for Dietary Studies, 2011-2012	12 linked files that provide nutrient content of foods reported eaten in NHANES are freely available on the ARS website.	CDC, FDA, NIH, food industry, academic researchers	These data allow analysis of nutrient content of foods reported eaten and keeps individual analyses constant by providing this information.
Food Pattern Equivalents Database, 2011-2012	Files that convert foods reported eaten into the food categories described in the Dietary Guidelines for Americans.	USDA/FNS, CDC, FDA, NIH, food industry, academic researchers	These files allow standardized conversion of various foods into categories to meet current dietary recommendations. This is critical for USDA programs that must provide them such as school meals or WIC.

Measure 4.1.1: ***Monitor nutrient composition of food supply and consumption by Americans while conducting research on life stage nutrition and metabolism. Strengthen the scientific basis for dietary guidance for health promotion and disease prevention and develop strategies for prevention of obesity and related diseases.***

During FY 2015, ARS will:

Survey, release data on, and analyze national food consumption patterns of Americans.

Develop new methods, conduct food composition analyses, and compile databases for known, emerging, and new classes of nutrients.

Identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.

Determine the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.

Publish new findings on metabolic processes that are affected by nutrient intake.

Discover genetic or epigenetic factors that influence physiologic responses to diet or changes in gene expression in response to dietary intake.

During FY 2016, ARS will:

Survey, release data on, and analyze national food consumption patterns of Americans.

Develop new methods, conduct food composition analyses, and compile databases for known, emerging, and new classes of nutrients and for branded food items.

Identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.

Determine the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.

Publish new findings on metabolic processes that are affected by nutrient intake.

Discover genetic or epigenetic factors that influence physiologic responses to diet or changes in gene expression in response to dietary intake.

During FY 2017, ARS will:

Survey, release data on, and analyze national food consumption patterns of Americans.

Develop new methods, conduct food composition analyses, and compile databases for known, emerging, and new classes of nutrients and for branded food items.

Identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.

Determine the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.

Publish new findings on metabolic processes that are affected by nutrient intake.

Discover genetic or epigenetic factors that influence physiologic responses to diet or changes in gene expression in response to dietary intake.

GOAL 1.2 – PROTECT FOOD FROM PATHOGENS, TOXINS, AND CHEMICAL CONTAMINATION DURING PRODUCTION, PROCESSING, AND PREPARATION: FOOD SAFETY (108)

The safety of the food supply continues to be a highly visible public health issue and a national priority for the Federal government. The continued priority is partly due to the diverse and complex system of production, processing, and distribution of food in the U.S. and the increasing global distribution. Outbreaks of foodborne illness are seen as a major cause of morbidity and mortality, and economic costs, both nationally and internationally. The full extent of the disease burden is still unknown, even with recent CDC estimates. Foodborne illnesses can be caused by microbial pathogens, parasites, viruses and an array of foodborne contaminants such as chemicals or toxins. The cause of every outbreak is still unknown, but persistent outbreaks of major commodity-specific foods that may directly affect public health, regulations, industry, and trade, require our immediate attention.

ARS has developed an integrated approach to food safety, that is, food production is seen as a continuous process from production, through harvesting and processing, to retail and the consumer. Pre- and post-harvest are not separated but considered an integrated production system of safe and quality food. Interventions and controls that are applied to one phase will ultimately affect the other segments of food production and processing. Food safety research has also changed during the past decade, having moved past simple, surveillance/prevalence studies to asking more complex questions. Consequently, researchers are required to think creatively to solve problems, which means considering alternate perspectives, exploiting new opportunities and technologies, and crossing conventional boundaries. Multidisciplinary collaborations, especially between Centers/Institutes, nationally and internationally are an absolute necessity.

ARS provides the intramural infrastructure and expertise to address short and long-term needs in food safety. Because of the infrastructure, ARS is uniquely poised to respond quickly to emerging and critical food safety issues. ARS also collaborates closely with Federal regulatory agencies as well as industry, professional, and international stakeholders to assist in addressing their specific food safety needs.

Performance Measure

4.1.2 Develop new technologies that assist ARS customers in detecting, identifying and controlling foodborne diseases associated with the consumption of animal products that affect human health.

Indicator 1: ***During 2014, ARS will determine how population systems in animals, plants, or the environment, or any combination of these influence the safety of food. Determine the conditions under which microorganisms exist. Determine how microorganisms may in turn influence the conditions prevailing in the environment. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processors to help assure safe food products.***

FY 2014 Accomplishments:

1. There can be considerable variation both within and between different types of Salmonella. There is also significant variation in the pathogen's ability to colonize hosts and in the severity of illness associated with contamination or infection. Two types of *Salmonella Kentucky* were isolated from a dairy herd 6 years apart. While one strain was isolated transiently in the herd, the other was associated with long-term asymptomatic infection. Whole-genome sequencing revealed the two types had genetic differences that are linked to the ability to colonize the bovine intestine and in the ability to repress virulence. Repressing virulence reduces the host immune response to the bacteria and increases the pathogen's potential for successful long-term colonization.

Impact: These findings will help scientists elucidate the genetic factors affecting pathogen colonization and virulence expression, and support the development of strategies to disrupt or prevent infection of foodborne pathogens in production animals.

2. High temperatures and drought associated with climate change can support growth of the fungus *Fusarium verticillioides*, which increases fumonisin contamination and the development of mycotoxins in corn crops. However, there is limited information about how elevated carbon dioxide (CO_2), due to the effects of climate change, will affect fungal disease and mycotoxin contamination. ARS scientists in Peoria, Illinois, and Gainesville, Florida, have shown when corn is grown in elevated CO_2 levels, plant defenses are weakened. *F. verticillioides* infections are able to increase as a result, but there is also a relative decrease in the production of mycotoxin.

   Impact: These findings provide a clearer understanding of how elevated CO_2 levels will affect plant–mycotoxin interactions and supports the development of cost-effective agricultural practices that minimize potential economic losses in the face of future climate change. These findings also provide information about the physiological conditions associated with reduced mycotoxin production during the host plant-pathogen interactions, which will assist in identifying host plant traits and genes that modulate mycotoxin formation and developing novel approaches for reducing mycotoxin contamination in corn.

3. Intestinal microbes play a key role in food safety and swine health. Using phylotype analyses (molecular identification of bacteria) and metagenomic techniques (identification of genes by sequencing), ARS researchers in Ames, Iowa, with European collaborators, detected microbiome differences among intestinal compartments. Microbial populations and gene contents at the end of the small intestine (ileum) were appreciably different from those in large intestine compartments (cecum and colon). The ileum microbes were dominated by bacteria known as Firmicutes (gram-positive bacteria), and two bacterial genera, Turicibacter and Anaerobacter. Unlike large intestine counterparts, bacteria-associated genes in the ileum contained a minimum of genes for degrading plant material, and, surprisingly, a large number of bacterial virus genes.

   Impact: This work indicated that the end of the ileum is an important region for development and proper functioning of swine intestinal immune system. These results have uncovered the unique microbial composition of the swine ileum, thereby enabling specific therapies for improving gut health and food safety to focus on those microbes in that important intestinal compartment.

4. As has been observed in several research studies, the frequency of Fusarium head blight (FHB) caused by members of the *Fusarium graminearum* species complex (FGSC) has increased in cereals in recent years, resulting in elevated levels of deoxynivalenol (DON) in cereal grains. In collaboration with Norwegian scientists, ARS scientists in Peoria, Illinois, demonstrated that the increased frequency of these FHB pathogens have not been associated with significant changes in FGSC species or trichothecene toxin types, but are likely due to changes in agricultural practices and weather conditions during cereal flowering. Isolates with the 15-ADON toxin type were detected for the first time in Norway, and the analyses indicate these isolates were recently introduced from other parts of Europe. In addition, two distinct pathogen populations that differ in aggressiveness to spring wheat were identified.

   Impact: These results indicate the need for careful international monitoring of FHB pathogen populations and advance food safety and cereal production through improved understanding of

pathogen diversity and improved understanding of the factors responsible for changes in pathogen distributions and prevalence.

5. Many human foodborne illnesses result from eating eggs contaminated by *Salmonella enteritidis*, which is transmitted to eggs by infected chickens. ARS researchers in Athens, Georgia, determined that housing experimentally infected hens in conventional or enriched cages (larger cages with perches and other enhancements) did not affect how often eggs became internally contaminated with Salmonella.

   Impact: These results demonstrate that housing egg-laying hens in enriched cages may not reduce the production of eggs contaminated by *S. enteritidis* and that other options should be considered to reduce foodborne illness from contaminated eggs. This result had a major impact for the egg industry since it was hoped the use of enriched cages would reduce the level of Salmonella contamination in eggs.

Indicator 2: ***During 2014, ARS will develop an understanding of bacterial, viral, and fungal pathogenicity through a systems biology approach. Utilize this data for pathogen intervention and control, modeling, and providing data for the development of risk assessments by regulatory agencies. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processor to help assure safe food products.***

FY 2014 Accomplishments:

1. Multi-drug resistant (MDR) Salmonella, a bacterium that can cause foodborne illness, is an important food safety concern. The development of antibiotic resistance to tetracycline, which is a commonly used antibiotic in both humans and animals, is very common. ARS scientists in Ames, Iowa, examined the impact of tetracycline on the virulence of MDR *Salmonella typhimurium* and found that tetracycline promoted the ability of some MDR Salmonella to invade host cells.

   Impact**:** This suggests that tetracycline may play a role in increasing the virulence of MDR Salmonella, and highlights the need to develop alternative treatments for Salmonella and other bacterial diseases.

2. The U.S. beef processing industry has developed and implemented effective antimicrobial interventions that have dramatically reduced the incidence of beef trim contamination by *E. coli* O157:H7, a pathogen that can cause severe foodborne illness. However, individual processing plants still experience sporadic peaks in contamination rates where clusters of multiple finished product contamination occur in a short-time frame. These peaks have been referred to as “high event periods” (HEP) of contamination. ARS scientists in Clay Center, Nebraska, determined that each HEP is linked to one type of *E. coli* O157:H7 isolate that is responsible for most, if not all, of the contamination.

   Impact**:** This work is in contrast to the range of different strains identified on the hides of cattle entering processing plants and poses a potential challenge to the current model for finished product contamination during beef processing. In addition, it was found that a high proportion of HEP are caused by strain types associated with human illness. This research indicates that beef processing plants will need additional support in developing tools and techniques to control HEP.

3. Hydroponic farming practices have increased in recent years, but little is known about how hydroponic production affects *E. coli* uptake into the internal vascular system of fresh produce. ARS

scientists in Beltsville, Maryland, grew spinach in hydroponic systems and in soil contaminated with *E. coli* O157:H7 and then measured *E. coli* uptake in plant roots, stems, and leaves at set intervals during production. Their results indicated that *E. coli* O157:H7 could enter hydroponically-grown spinach plants through the root system and migrate to the stems and leaves. When the root system in hydroponically-grown spinach was wounded, *E. coli* O157:H7 internalization and migration to the edible portions of the plant increased. However, plants grown in *E. coli*-contaminated soils had greater levels of *E. coli* internalization than plants grown hydroponically, and *E. coli* uptake was not affected by *E. coli* O157:H7 Curli expression—a type of bacterial structure that is found on the surface of *E. coli*—or by spinach cultivar.

Impact: This work shows it is possible for *E. coli* to internally contaminate hydroponically-grown produce, even though overall contamination levels may be lower than plants grown in grown is soil. The results are critically important to the fresh produce industry and the Produce Rule under the FDA Food Modernization Act.

4. Data strongly suggests that cattle may have been the source of *E. coli* O157:H7 pathogens responsible for recent outbreaks of foodborne illness linked to spinach and lettuce consumption. These outbreaks underline the importance of determining how much distance is needed between animal production facilities and crop fields to reduce the risk of *E. coli* O157:H7 transmission and associated outbreaks of foodborne illness. Current guidelines for leafy green growers recommend maintaining a provisional distance of 400 feet between concentrated animal feeding operations and leafy green crop fields. ARS scientists in Clay Center, Nebraska, evaluated how *E. coli* O157:H7 contamination of leafy green produce crops was affected by the proximity of a beef cattle feedlot. Low levels of *E. coli* O157:H7 were recovered in leafy greens at all setback distances in the study, including a 600-foot setback.

   Impact: These results suggest that the current leafy green field distance guidelines of 400 feet may not be sufficient to mitigate the migration of *E. coli* O157:H7 from concentrated animal feeding operations into nearby crop fields. This information has been transferred to the fresh produce industry and produce regulatory agencies for the Produce Rule, under the new FDA Food Modernization Act, is critical for understanding the risks associated with growing leafy greens in close proximity to cattle production, and for determining safe distances between cattle feedlots and produce.

Indicator 3: ***During 2014, ARS will develop innovative methods and advanced technology systems that rapidly and accurately detect, identify, and differentiate the most critical and economically important foodborne bacterial, viral, and protozoan pathogens. Ensure that these technologies can be utilized by regulatory agencies and/or producers to help assure safe food products.***

FY 2014 Accomplishments:

1. Aflatoxins are a potent toxin that can infect corn and other important food crops, but detecting aflatoxin contamination in harvested grain can be difficult, especially in countries that lack high-tech monitoring tools. ARS scientists in New Orleans, Louisiana, developed special goggles based on hyperspectral technology—which detects light waves in the visible and non-visible part of the light spectrum—that inspectors can use to identify aflatoxin-contaminated grain that needs to be removed from the rest of the grain

***Impact*:** A licensing agreement for the technology was developed and a patent assigned. The goggle will provide cereal farmers with a rapid and inexpensive method for detecting aflatoxin in their crops, which will significantly increase the safety of the food supply.

2. Apply information about genomic variation occurring across *Salmonella enterica* (SE) to improve serotyping schemes and vaccines. This information can be used to develop rapid and sensitive diagnostic and epidemiological testing methodologies for SE in poultry flocks and eggs. Regulatory agencies in the U.S. have access to sophisticated and expensive technology for serotyping Salmonella, but these methods are not generally available to the industry they regulate. For a study on Salmonella, ARS researchers at Athens, Georgia, developed a genomics method that enabled farmers and food producers domestically and worldwide to assess ecology of Salmonella from farm to fork. The method intergenic sequence ribotyping (ISR) slashed the cost and complexity of obtaining serotype for Salmonella and can be made broadly available at low cost. The new method was as specific and sensitive as older methods, and it had the added advantages of discovering new serotypes and detecting mixtures of serotypes in culture. The method is also able to determine which bacterial cultures are composed of different types of Salmonella. The new, simplified classification method may allow regulatory agencies and other testing laboratories to increase the frequency of Salmonella screening. Furthermore, the technique can be combined with more complex methods for Salmonella identification and classification to trace and confine human outbreaks of Salmonella illnesses.

   Impact: The new, simplified classification method may allow regulatory agencies and other testing laboratories to increase the frequency of Salmonella screening. Furthermore, the technique can be combined with more complex methods for Salmonella identification and classification to trace and confine human outbreaks of Salmonella illnesses. Because the method reduced cost of serotyping by 80% from traditional methods, targeted ISR was used to study *Salmonella enterica* in the USA, and Colombia, South America. Serotype Enteritidis was found circulating with the avian pathogen serotype Gallinarum in Colombia, which emphasized the need to address both food safety and the security of the food supply with management practices.

3. *Clostridium botulinum* neurotoxins are among the most lethal toxins known, and are considered both a food safety and biosecurity issue. The standard test for botulinum neurotoxins (BoNTs) is the mouse bioassay that requires 2-7 days to complete, uses death as an endpoint, and is only available in a few laboratories. A rapid, monoclonal antibody-based immunoassay (similar to a pregnancy test) was developed by ARS scientists in Albany, California, for one of the major types of botulinum neurotoxin, BoNT/B. The assay has a sensitivity comparable to that observed with the bioassay, but can be completed in just a few hours. BoNT intentionally added to two products considered as high biosecurity issues (ground beef and milk) the neurotoxin was readily detected using this test.

   ***Impact*:** The test developed further our ability to monitor for this deadly toxin and improves the safety and biosecurity of the U.S. food supply.

4. Shiga toxin (Stx)-producing *Escherichia coli* (STEC) are frequent causes of severe human diseases ranging from bloody diarrhea to life-threatening hemolytic uremic syndrome (HUS). The major virulence factor in Shiga-toxin producing *E. coli* (STEC) bacteria is Shiga toxin 2 (Stx2). Stx2 has many subtypes, including Stx2f that is difficult to detect and purify, and is not well understood. ARS scientists in Albany, California, developed monoclonal antibodies (mAbs) that bind Stx2. One set of mAb were used for sensitive and specific detection of this toxin; first, a sandwich enzyme-linked immunosorbent assay (ELISA) was developed that can detect Stx2f at low concentration as well as a colony immunoblot assay that pinpoints those bacteria producing Stx2f specifically among mixed

cultures growing in a petri dish. Second, neutralizing mAbs were identified that could facilitate the clearing Stx2 completely from intoxicated mouse blood within minutes. The studies showed that antibodies persisted in the mouse for weeks and could confer protection on mice as long as 4 weeks before exposure to Stx2.

***Impact*:** The impact of this research is two-fold. First, the developed assay furthers our ability to monitor and detect of Stx2f present in food, environmental, and clinical samples, and to better understand the role of this toxin subtype in human disease. Second, these results could lead to the development of an arsenal of therapeutic antibodies for treatment of life-threatening *E. coli* STEC infections in particular in children who are highly susceptible.

Indicator 4: ***During 2014, ARS will develop intervention and control strategies that will help to significantly decrease or eliminate pathogens in food animals and their derived products (eggs/milk), seafood, and plant crops (produce/grains/tree nuts) during critical periods of production and processing. Develop and subsequently combine new/innovative processing technologies using the intelligent hurdle concept. Ensure that these technologies can be utilized by producers and/or processors to help assure safe food products.***

FY 2014 Accomplishments:

1. Chlorine (sodium hypochlorite) is commonly used as a sanitizer by the food industry and citric acid is often used to adjust its pH and increase its efficacy. However, adding citric acid can also result in the formation of chlorine by-products that are a potential health risk. ARS researchers in Wyndmoor, Pennsylvania, studied the formation of the chlorine by-product trichloromethane in water and fresh-cut produce and assessed how the by-product was affected by citric acid. Results showed that citric acid reacted with chlorine and produced significant amounts of trichloromethane in chlorated water, but not in chlorine dioxide solution. Higher amounts of trichloromethane were produced in the chlorine solution used for washing cut-lettuce than in the solution used for diced onions, and trichloromethane levels in the final products (cut vegetables) were much lower than levels in the water. These results indicate that citric acid should be replaced with other pH adjustors to reduce the formation of trichloromethane in wash water.

   ***Impact*:** These findings can be used by the produce industry to minimize the formation of toxic chlorine by-products in water and fresh produce, and reduce potential health risks associated with food processing.

2. Fungal infections of food crops can result in the production of aflatoxins, which is a carcinogen that also causes other serious acute and chronic illness in human and animals. Food crops—particularly maize—have been most highly contaminated in Africa where illness and death from aflatoxin exposure has been documented for decades. ARS researchers in Tucson, Arizona, partnered with the International Institute of Tropical Agriculture to use *Aspergillus flavus* fungi in the development of a biocontrol product that protects food crops from aflatoxin contamination. They tested the resulting biocontrol in selected African countries and determined that the product was highly effective at preventing aflatoxin contamination of maize in these target counties. Findings also indicated that Africans are frequently exposed to very high aflatoxin concentrations (more than 50 times the concentrations allowed in U.S. pet food), which has resulted in an ongoing international human health crisis.

***Impact*:** Developing an aflatoxin biocontrol for area-wide use internationally will substantially reduce the human health risk associated with aflatoxin exposure and will provide useful lessons for the development and use of next-generation biocontrol products by the USDA.

3. The bacterium *Vibrio* is the primary cause of shellfish-associated bacterial illness and death in the United States. While evaluating the effects of pH, temperature, and algae diet on *Vibrio* levels in shellfish, ARS researchers in Dover, Delaware, and University of Delaware collaborators discovered a group of naturally occurring predatory bacteria that substantially reduce V*ibrio* levels in seawater and shellfish. ARS in collaboration with the U.S. Food and Drug Administration and industry partners assessed the use of these *Vibrio* predators for eliminating or significantly reducing *Vibrio* levels in market shellfish. As part of this effort, a pilot-scale, portable processing facility is being used to determine the effectiveness of *Vibrio* predatory bacteria in eliminating Vibrios in oysters.

   ***Impact*:** If this intervention process is successful in its evaluation, it could result in the direct application of a technology developed by ARS to manage the most significant pathogens in oysters and clams associated with foodborne illness and enhance shellfish safety worldwide.

4. The USDA Food Safety and Inspection Service recently began regulating six additional Shiga toxin-producing *E. coli* (serogroups O26, O45, O103, O111, O121, and O145) along with STEC O157:H7. It was critical for the beef industry to demonstrate that current process control practices were appropriate for these additional STEC pathogens. ARS scientists from Clay Center, Nebraska, determined that the antimicrobial compounds commonly used as interventions in the meat industry, reduce the contamination of non-O157 STEC on surfaces of fresh beef as well as they reduce *E. coli* O157:H7.

   ***Impact*:** These results were critically important for both regulatory agencies and to the beef processing industry to identify and confirm that antimicrobial compound(s) that effectively reduce *E. coli* O157:H7 also reduce non-O157 STEC. Not having to identify, validate, and implement separate interventions specific to non-O157 STEC eliminated the potential for a major food safety and financial impact.

5. Vaccination is a potential method to prevent and control foodborne pathogens in animals, including *Campylobacter jejuni*. This bacterial pathogen is responsible for nearly 1 million cases of foodborne illness annually in the USA at a health cost of $2 billion. The pathogen is also the number one foodborne illness problem nationally and internationally in poultry. ARS researchers in Athens, Georgia, screened a number of *Campylobacter jejuni* proteins against blood serum from infected broilers and breeder chickens and observed that the pathogen's flagellar capping protein reacted strongly to pathogen antibodies in the serum.

   ***Impact*:** Since this protein is very similar among all *Campylobacter* species, it could serve as a potential candidate for a vaccine that could reduce infection in chickens and increase the safety of the food supply.

Indicator 5: ***During 2014, ARS will develop bioinformatic databases and tools, and predictive user-friendly models to understand pathogen behavior and acquisition of virulence characteristics under various stress conditions. Determine the key risk factors of human pathogens in foods, and evaluate systems interventions for their impact, which will enable regulatory/action agencies to make critical food safety decisions that impact public health.***

FY 2014 Accomplishments:

1. Refrigerated chicken sold in stores is usually contaminated with low levels of Salmonella, a pathogen that can cause foodborne illness unless it is destroyed by cooking. When consumers store chicken in refrigerators that are too warm, Salmonella populations can multiply. ARS researchers in Princess Anne, Maryland, conducted studies that assessed the growth of Salmonella on chicken meat in cold storage. No Salmonella growth was observed on chicken stored at 26 to 50 degrees F, but at 54 to 61 degrees F, Salmonella growth was highest on dark meat, intermediate on skin, and lowest on white meat. The researchers used these finding to develop and validate a computer model that predicts Salmonella growth and survival on chicken stored at temperatures between 26 to 61 degrees F.

   ***Impact*:** The new model will help the poultry industry, regulatory agencies, and consumers better predict and manage the risk of developing foodborne illness from consuming chicken contaminated with Salmonella. According to the USDA Economic Research Service (ERS), Salmonella is at the top of the rankings for the most costly foodborne illnesses, with over 1 million cases per year at a cost of $3.7 Billion.

2. Adequate heat treatment destroys Salmonella and is the most effective means to guard against the potential hazards in cooked poultry products. Due to public health concerns regarding toxicity of synthetic chemicals and microbial resistance to such preservatives, consumers these days are increasingly demanding natural products. ARS researchers at Wyndmoor, Pennsylvania, defined the heat treatment required to achieve a specific lethality for Salmonella in ground chicken supplemented with natural antimicrobials, gallic acid, and eugenol.

   ***Impact*:** The developed predictive model can assist food processors to design appropriate thermal processes for the production of chicken products without adversely affecting the quality of the product. According to the USDA ERS, Salmonella is at the top of the rankings for the most costly foodborne illnesses, with over 1 million cases per year at a cost of $3.7 Billion.

Indicator 6: ***During 2014, ARS will develop innovative methods and advanced technology systems that rapidly and accurately detect and identify veterinary drugs, chemical residues, heavy metals, persistent organic pollutants, and biological toxins derived from bacteria, fungi and plants. Evaluate contaminant toxicity, and mechanism of action. Provide data which will enable regulatory/action agencies to make critical food safety decisions that impact public health.***

FY 2014 Accomplishments:

1. Nitrosamine levels in fried bacon were a major concern 30 years ago before steps were taken to reduce their formation, however, nitrosamines levels have not been monitored since the 1990s. The USDA Office of Inspector General (OIG) requested the Food Safety Inspection Service (FSIS) to conduct a survey of nitrosamine formation from cooked bacon and an accompanying risk assessment to check if the situation had changed. The previous analytical methods used for nitrosamines were unwieldy and used archaic specialized equipment that is now unavailable. ARS scientists in Wyndmoor, Pennsylvania, developed and validated a new sensitive, rapid, and easy test for assessing nitrosamine levels in fried bacon.

   ***Impact*:** Using the data generated by the ARS study, FSIS regulators performed a risk assessment and demonstrated that frying bacon did not generate levels of nitrosamines that posed a health risk. As a result of this work, nitrosamines in fried bacon do not need to be routinely monitored. Testing and

survey methods will be readily available to FSIS and others if another survey is needed. ARS' research also helped close out the longest OIG audit in FSIS.

2. Every 5 years USDA's FSIS assesses the background levels of persistent organic pollutants—including dioxins, furans, polychlorinated biphenyls, and polybrominated diphenyl ethers—in U.S. beef, pork, turkey, and chicken. Data derived from this assessment are used to determine whether background levels of these contaminants are increasing or decreasing in food animals. ARS researchers in Fargo, North Dakota, collected over 500 samples of fat from U.S. slaughter facilities for 13 months and then analyzed the samples for dioxins and dioxin-like compounds. Study results indicated that levels of dioxin and dioxin-like compounds have remained consistently low in the U.S. meat supply and are continually decreasing.

   ***Impact*:** FSIS used the data to update their risk assessment. In addition the data were disseminated by U.S. regulatory officials to other agencies and industry as evidence that the quality of the U.S. meat supply is increasing as the level of dioxin-like persistent organic pollutants declines.

3. Organic residues on processing equipment surfaces in food processing plants can generate cross-contamination and increase the risk of unsafe food for consumers. For sanitation inspection in food processing environments, ARS researchers in Beltsville, Maryland, designed and developed inexpensive fluorescence-based handheld imaging devices with Wi-Fi capabilities to display live inspection images on Smartphone or tablet devices. The aim is to provide the imaging devices as assistive tools that can be used by human inspectors performing visual sanitation inspection of food processing/handling equipment surfaces. The in-plant testing demonstrated that existing sanitation and safety surveys performed by human inspectors could be greatly enhanced by the use of these tools.

   ***Impact*:** The devices can provide an objective means to assess the effectiveness of sanitation procedures and can help processors minimize food safety risks or determine potential problem areas within a processing environment.

4. Multiclass, multiresidue methods (MMMs) of analysis are increasingly being developed to provide greater efficiency in monitoring for veterinary drug residues in food animal tissues. In this work, ARS researchers at Wyndmoor, Pennsylvania, developed and validated an improved MMM in accordance with USDA-FSIS regulatory criteria. Compared to current monitoring methods, the new method is faster, easier, and more effective due to the use of a novel in-vial dispersive solid phase cleanup/filtration step and analysis with highly sensitive modern mass spectrometer.

   ***Impact*:** More than 130 veterinary drugs can be monitored at regulatory levels of concern in bovine muscle, and the method has been provided to USDA-FSIS for their evaluation and implementation in the National Residue Monitoring Program.

Performance Targets

1.2.A Develop detection methodologies for food-borne pathogens and technologies for the rapid and sensitive detection of toxins, chemicals, and biologics that can be implemented for improved food safety and food defense.

Baseline 2012	Target 2017
Develop and transfer one new technology to ARS	

customers to detect, identify, and control foodborne pathogens and contaminants along the food production continuum.	Cumulatively, five new technologies will be developed and transferred.

1.2.B Conduct and evaluate research that will lead to effective control and intervention strategies for the reduction of microbial, chemical, and other contaminants of the food supply, as well as elucidation of the molecular and physiological mechanisms that allow for persistence, survival, and transmission of foodborne pathogens in the populations and environment.

Baseline 2012	Target 2017
Identify and evaluate potential control and intervention strategies for the reduction and control of foodborne pathogens and contaminants along the food production continuum.	Identify and evaluate potential control and intervention strategies for the reduction and control of foodborne pathogens and contaminants along the food production continuum.

Measure 4.1.2 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 5 new technologies adopted for uses that provide

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Assay for nitrosamines in complex samples: conducted national survey	New assay developed: data collected to determine levels in foods	FSIS, OIG	New method of analysis. FSIS performed risk assessment indicating frying bacon posed no nitrosamine risk to consumers. Nitrosamines do not need to be routinely monitored. Finalized longest running OIG audit for FSIS.
Developed detection system for aflatoxin	Validated goggles based on hyperspectral technology to identify aflatoxin contaminated grains	USDA, FDA, grain industry producers, farmers; other international food safety agencies	Technology will find immediate national and international regulatory and producer use for aflatoxin contaminated foods. Licensed, and U.S. Patent (8,563,934).

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Developed new immunoassay for *Clostridium botulinum* neurotoxin B.	Validated a rapid (2 h) monoclonal antibody-based immunoassay with sensitivity comparable to the mouse bioassay	USDA, FDA, CDC, industry, Military, defense agencies national and international public health agencies and labs	Innovative technology with immediate application in food safety, defense and biosecurity
Beef processing interventions for non-O157 *E. coli.*	Determined that antimicrobial compounds commonly used as interventions to reduce the contamination of O157 STEC on surfaces of fresh beef as well as they reduce *E. coli* non-O157:H7 STEC	FSIS, beef processing industry	Critical for regulatory agencies and beef processing industry confirming that currently used antimicrobials effectively reduce all *E. coli* STECs
Developed new detection method for veterinary drug residues	Validated new multiclass, multi-residue method for greater efficiency in monitoring for veterinary drug residues in food animal tissues.	FSIS, FDA, EPA, UK Food Standards Agency, EFSA-European Food Standards Agency; other international food agencies.	Technology will be immediately implemented by the FSIS National Residue Program, and evaluated by such international bodies such as the AOAC for international regulatory use

Measure 4.1.2: Develop new technologies that assist ARS customers in detecting, identifying and controlling foodborne diseases associated with the consumption of animal products that affect human health.

During FY 2015, ARS will:

Determine how population systems in animals, plants, or the environment, or any combination of these influence the safety of food. Determine the conditions under which microorganisms exist. Determine how microorganisms may, in turn, influence the conditions prevailing in the environment. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processors to help assure safe food products.

Develop an understanding of bacterial, viral, and fungal pathogenicity through a systems biology approach. Utilize this data for pathogen intervention and control, modeling, and providing data for the development of risk assessments by regulatory agencies. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processor to help assure safe food products.

Develop innovative methods and advanced technology systems that rapidly and accurately detect, identify, and differentiate the most critical and economically important foodborne bacterial, viral, and protozoan pathogens. Ensure that these technologies can be utilized by regulatory agencies and/or producers to help assure safe food products.

Develop intervention and control strategies will help to significantly decrease or eliminate pathogens in food animals and their derived products (eggs/milk), seafood and plant crops (produce/grains/ tree nuts) during critical periods of production and processing. Develop and subsequently combine new/innovative processing technologies using the intelligent hurdle concept. Ensure that these technologies can be utilized by producers and/or processors to help assure safe food products.

Develop bioinformatic databases and tools, and predictive user-friendly models to understand pathogen behavior and acquisition of virulence characteristics under various stress conditions. Determine the key risk factors of human pathogens in foods, and evaluate systems interventions for their impact, which will enable regulatory/action agencies to make critical food safety decisions that impact public health.

Develop innovative methods and advanced technology systems that rapidly and accurately detect, identify, veterinary drugs, chemical residues, heavy metals, persistent organic pollutants, and biological toxins derived from bacteria, fungi and plants. Evaluate contaminant toxicity, and mechanism of action. Provide data which will enable regulatory/action agencies to make critical food safety decisions that impact public health.

Develop approaches to understand the development, persistence, and transmission of antimicrobial resistant (AMR) genetic elements that result in antimicrobial resistant foodborne pathogens. Develop and validate assays to rapidly detect and assess AMR pathogens. Develop and evaluate alternatives to antibiotics to reduce the development of AMR in foodborne pathogens.

During FY 2016, ARS will:

Determine how population systems in animals, plants, or the environment, or any combination of these influence the safety of food. Determine the conditions under which microorganisms exist. Determine how microorganisms may in turn influence the conditions prevailing in the environment. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processors to help assure safe food products.

Develop an understanding of bacterial, viral, and fungal pathogenicity through a systems biology approach. Utilize this data for pathogen intervention and control, modeling, and providing data for the development of risk assessments by regulatory agencies. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processor to help assure safe food products.

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During FY 2017, ARS will:

Determine how population systems in animals, plants, or the environment, or any combination of these influence the safety of food. Determine the conditions under which microorganisms exist. Determine how microorganisms may in turn influence the conditions prevailing in the environment. Ensure that these technologies can be utilized by regulatory agencies, producers and/or processors to help assure safe food products.

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Develop innovative methods and advanced technology systems that rapidly and accurately detect, identify, veterinary drugs, chemical residues, heavy metals, persistent organic pollutants, and biological toxins derived from bacteria, fungi and plants. Evaluate contaminant toxicity, and mechanism of action.

Provide data which will enable regulatory/action agencies to make critical food safety decisions that impact public health.

Develop approaches to understand the development, persistence, and transmission of antimicrobial resistant (AMR) genetic elements that result in antimicrobial resistant foodborne pathogens. Develop and validate assays to rapidly detect and assess AMR pathogens. Develop and evaluate alternatives to antibiotics to reduce the development of AMR in foodborne pathogens.

GOAL 1.3 – ENHANCE THE ECONOMIC VIABILITY AND COMPETITIVENESS OF U.S. AGRICULTURE BY MAINTAINING THE QUALITY OF HARVESTED AGRICULTURAL COMMODITIES OR OTHERWISE ENHANCING THEIR MARKETABILITY, MEETING CONSUMER NEEDS, DEVELOPING ENVIRONMENTALLY FRIENDLY AND EFFICIENT PROCESSING CONCEPTS, AND EXPANDING DOMESTIC AND GLOBAL MARKET OPPORTUNITIES THROUGH THE DEVELOPMENT OF VALUE-ADDED FOOD AND NONFOOD TECHNOLOGIES AND PRODUCTS, EXCEPT ENERGY AND FUELS. (QUALITY AND UTILIZATION OF AGRICULTURAL PRODUCTS – 306)

This research will increase our knowledge and develop technologies to better measure or enhance the quality of crop and animal products after harvest. Similarly, the marketability and value of commodities can be increased by ensuring that value-added food products (such as fresh-cut or minimally processed produce) retain sensory quality, nutritional value, and are free from food safety hazards. The research in this National Program will also generate new information on health promoting components of foods and assess their effects on important human diseases and obesity, in cooperation with the Human Nutrition National Program (NP 107) and other partners. In addition to food quality and safety, consumers have expressed concern over rising food prices which can be attributed to multiple factors. A significant factor in the cost of food production can be attributed to food waste or rot. Estimates indicate that approximately 27% of food produced in the U.S. is lost as waste among retailers, food service businesses, and consumers. Additional losses occur during food harvesting, storage, and distribution. The magnitude of the loss is even greater when resources spent on growing food such as fuel, water, fertilizer, chemicals, land-use and human resources are considered. NP 306 research will develop technologies that improve quality, extend product shelf life, reduce waste, and decrease costs.

Research is being conducted on the development of nonfood, nonfuel biobased products from agricultural commodities and byproducts. Interest in biobased products has increased as consumers and governments have sought more environmentally friendly products that provide alternatives to petroleum and which do not contribute to greenhouse gases. Thus, biobased products can reduce our dependency on petroleum and provide a more sustainable technology for the future. Biobased products that were once too expensive to commercialize may now be affordable. There is some public concern that biobased products could contribute to the rising cost of food in the U.S. This program seeks opportunities to develop biobased products from agricultural feedstocks that do not compete with food, in cooperation with other ARS national programs and partners. ARS also supports quality and processing research on crop fiber, such as cotton, and animal hides, leather and wool. Stakeholders who produce fibers and hides constitute an important segment of our rural economy. These industries are severely impacted by energy and production costs and have lost market share to foreign competition. Technologies that improve fiber quality, reduce the energy consumption of processing equipment, and develop new products are needed to help the fiber industry to compete in a global market.

Performance Measure

1.1.3 Develop methods and technologies to better define, measure, preserve or enhance quality and improve utilization of food crops, animals and agricultural fibers, as well as non-food, non-fuel biobased products and sustainable technologies/processes.

Indicator 1: ***During 2014, ARS will develop technologies leading to new or improved products from bio-based (agricultural) renewable resources, residues, and wastes.***

FY 2014 Accomplishments*:*

1. Renewable, bio-based lubricants are in great demand. Estolides are fluids made from renewable animal- and vegetable-based oils. Combining estolides with alcohol results in a lubricant that performs better at colder temperatures, reduces friction and wear, and lowers fuel consumption.

ARS scientists in Peoria, Illinois, refined and improved the estolide properties and solved large-scale batch-production challenges such as incomplete fatty acid conversion.

***Impact*:** This new technology was transferred to an industrial partner for commercialization.

2. Guayule is a woody desert crop native to the United States that is being used to produce natural rubber and bioenergy. ARS scientists in Albany, California, developed a tissue culture-media protocol using calcium nitrate to grow plants with more and longer shoots.

   ***Impact*:** Knowledge from this research will be useful in establishing guayule seedlings in greenhouses and eventual field production, and should lead to more abundant natural rubber production.

3. Recent studies have demonstrated that prolonged exposure to certain chemicals used in cotton pre-harvesting may be associated with an elevated risk for Parkinson disease. Several regulatory agencies are examining a potential ban on the use of these chemicals. ARS engineers in Lubbock, Texas, have discovered a new, safe, chemical-free method to defoliate and desiccate cotton. The new technology has been patented.

   ***Impact*:** This new chemical-free methods offers a safe, valuable, alternative to using hazardous harvest-aid chemicals, and has garnered interest and financial support from a major stakeholder in the cotton industry.

Indicator 2: ***During 2014, ARS will develop new or improved methods to measure or predict marketable and or nutritional quality, or to sort by quality.***

FY 2014 Accomplishments*:*

1. Scientific evidence shows that omega-3 and other fatty acids in dairy products are advantageous to human health. ARS researchers in Wyndmoor, Pennsylvania, investigated milk from two adjacent dairy farms, one producing conventional milk, the other organic milk from pasture-fed cows. Conjugated linoleic acid, which is attributable to have benefits for human fat loss, bodybuilding, and other health aspects, was significantly higher in the organic milk throughout the year. Linolenic acid, an omega-3 fatty acid associated with benefiting the brain and a healthy heart, was also significantly higher in organic milk throughout the year.

   ***Impact*:** Americans may benefit from including dairy foods having higher levels of healthy fatty acids as part of a balanced diet.

2. Anthocyanins, the compounds that cause the red and blue coloration of fruits and vegetables, are also recognized as having anti-inflammatory and anti-carcinogenic activity, and the potential to prevent cardiovascular disease, control obesity, and alleviate diabetes. ARS scientists in Beltsville, Maryland, identified the genes that control anthocyanin accumulation in strawberries. Further research found that strawberry plants sprayed with calcium boosted expression of the anthocyanin regulator genes and made the fruit even redder.

   ***Impact*:** Strawberry is an economically important crop, and these results may help plant breeders and growers enhance the color and health benefits of strawberries.

3. Olive-fly infestation decreases fruit yield, decreases the value of olive oil, makes it unsuitable for virgin oil production, and may result in the rejection of entire lots of olives for food consumption

purposes. Detecting and removing infested olives before they are used in food or oil production improves fruit quality and saves growers and processors millions of dollars. ARS researchers in Albany, California, have developed a non-destructive method of using X-rays to rapidly detect infestation of olive-fly larvae on fruit in high-speed processing systems.

***Impact*:** Combined with near infrared spectroscopy, the two technologies allow real-time removal of infested olives from processing lines, and higher quality and marketability of American olive products.

4. Non-destructive light wavelengths can be used to assess the maturity of horticultural products and help producers deliver superior, consistent products to the market to meet or exceed consumer expectations. ARS researchers in East Lansing, Michigan, measured the spectral-scattering of peaches and tomatoes harvested at different maturities. These data were combined with destructive measurements of maturity (color, firmness, and soluble solids content) to develop calibration models that predict maturity and quality grades.

   ***Impact*:** Good predictions (around 90%) of firmness and soluble solids content were achieved for these fruits.

5. Sorghum, the ancient, gluten-free grain, is known for its dietary health benefits in combating cancer, diabetes, and cholesterol. It consists of starches, proteins, and fats, which along with grain hardness, influences the products that can be produced from it. ARS researchers in Manhattan, Kansas, along with collaborators at Texas A&M University, discovered that sorghum protein content and quality were more influenced by genetics; whereas kernel hardness, starch content, starch graininess, and fat content were influenced by the environment.

   ***Impact*:** This research will help identify grain quality traits that can be improved at the genetic level and those that are controlled by climate change.

Performance Targets

1.3.A Develop Methods and Technologies to Better Define, Measure, Preserve, or Enhance Quality and Improve Utilization of Food Crops and Animals

1.3.B Develop Methods and Technologies to Better Define, Measure, Preserve, or Enhance Quality and Improve Utilization of Agricultural Fibers

1.3.C Develop Non-Food, Non-Fuel Biobased Products and Sustainable Technologies/Processes

The following baselines and targets apply to all three performance targets listed above.

Non-food, non-fuel biobased products derived from renewable agricultural resources represent a small fraction of the market for petroleum-based industrial products and some are not yet economically competitive. Also, many agricultural products are marketed as low-value commodities, with postharvest spoilage decreasing return to producers. Healthy foods are often not convenient or readily accepted by significant numbers of consumers. Quality of agricultural fibers needs to be assured in an increasingly competitive global market.

Baseline 2012	Target 2017
Four new biobased or fiber products and food items with improved quality, nutritional or functional characteristics were developed by ARS and used by customers, both domestic and foreign.	Cumulatively, 20 new technologies developed by ARS and adopted for uses that provide food crops and products with higher quality and extended shelf life; convenient and acceptable healthy foods; non-food, non-fuel biobased products with cost and performance features comparable or superior to petroleum-based products; high quality agricultural fibers; and valuable co-products from agricultural residues and processing wastes.

Measure 1.1.3 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 8 new technologies adopted for uses that provide for enhancing the economic viability and competitiveness of U.S. agriculture by maintaining the quality of harvested agricultural commodities or otherwise enhancing their marketability, meeting consumer needs, developing environmentally friendly and efficient processing concepts, and expanding domestic and global market opportunities through the development of value-added food and nonfood technologies and products, except energy and fuels.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Vegetable oil estolides are high performing, fuel-saving, renewable lubricants	Technology was transferred to an industrial partner for commercialization	Automobile industry	Lubricant that performs better at colder temperatures, reduces friction and wear, and lowers fuel use.
Calcium in guayule production improves rubber yields	Technology was transferred to greenhouses and eventual field production sites	Guayule industry	Leads to more abundant natural rubber production.
Safe, chemical-free method for cotton defoliation and desiccation.	Technology was transferred to and financial support received from a major stakeholder in the cotton industry	Cotton Industry	Offers a safe, valuable, alternative to using hazardous harvest-aid chemicals.
Organic milk is more abundant in healthy omega-3 fatty acids than conventional milk.	Technology was transferred to the organic dairy industry	Organic dairy Industry	Americans may benefit from including dairy foods having higher levels of healthy fatty acids

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
			as part of a balanced diet.
Calcium sprays make red and blue fruits and vegetables even more colorful and healthier	Technology was transferred to the California strawberry industry	Strawberry growers	Enhance the color and health benefits of strawberries.
Non-destructive, rapid detection and removal of fly-larvae-infested olives saves money	Technology was transferred to the California olive industry	Olive industry	Higher quality and marketability of American olive products.
Determining peach and tomato maturity and quality with non-destructive light scattering	Technology was transferred to the US peach and tomato industry	Peach and tomato industry	Around 90% of firmness and soluble solids content were achieved for these fruits.
The environment selectively affects sorghum quality factors	Technology was transferred to the US sorghum industry	US sorghum industry	Help identify grain quality traits that can be improved at the genetic level and those that are controlled by climate change.

Measure 1.1.3 : Develop methods and technologies to better define, measure, preserve or enhance qulaity and improve utilization of food crops, animals and agriculutral fibers, as well as non-food, non-fuel biobased products and sustainable technologies/processes.

During FY 2015, ARS will:

Develop technologies leading to new or improved products from bio-based (agricultural) renewable resources, residues, and wastes.

Develop new or improved methods to measure or predict marketable and or nutritional quality, or to sort by quality.

During FY 2016, ARS will:

Enable commercially-viable post-harvest technologies for non-food biobased products and for value-added non-food processing.

Develop new or improved methods to measure, predict, enhance or reduce impacts to food marketability, nutritional quality, new bioactives and functional foods, and/or food processing technologies.

During FY 2017, ARS will:

Enable commercially-viable post-harvest technologies for non-food biobased products and for value-added non-food processing.

Develop new or improved methods to measure, predict, enhance or reduce impacts to food marketability, nutritional quality, new bioactives and functional foods, and/or food processing technologies.

Strategic Goal Area 2:

Natural Resources and Sustainable Agricultural Systems

We conduct research that *explains* the nature and function of agricultural systems and their physical, chemical, and biological components. With that explanatory power, we develop abilities to *predict* how agricultural systems may respond to different environments or management scenarios. Once we can make predictions with confidence, we turn that knowledge into *decision support* tools and methods for:

- Improving the efficiency and effectiveness of management practices for agricultural systems and working lands to enhance ecosystem goods and services, including the sustainable production of agricultural commodities;
- Managing soil, water, air, and biological resources for society's benefits, including reductions in environmental impact, under different climatic regimes and environmental conditions;
- Providing agricultural products and co-products as renewable, bio-based alternatives to petroleum as inputs to manufacturing and generating energy;
- Developing new, valuable, environmentally sound uses for agricultural and industrial byproducts.

Major priorities for ARS research on interactions among land, water, atmosphere, and diverse biological communities include remediation and use of degraded water for production of a wide range of crops; protection and enhancement of ecosystem goods and services arising from our natural resources; adaptation of agricultural production systems to climate change, and mitigation of agricultural greenhouse gas emissions; development of diverse energy crops and agronomic practices for efficient and sustainable production, optimized for different geographic regions and climatic conditions throughout the U.S.; identification of safe uses of agricultural wastes and byproducts in generating energy/fuel and value-added biochemical products and fertilizers; creation and evaluation of conservation practices and land management decision-support tools arising from ARS' long-term agricultural research conducted in the agency's unique, critical infrastructure of instrumented watersheds and rangelands; development of widely accessible databases to support analyses of agriculture, land management, and the environment; and creation of a broad-based data and information access portal at the National Agricultural Library to enable life-cycle analyses and development/validation of sustainability indices for agricultural production and delivery systems .

GOAL 2.1 – INTEGRATED, EFFECTIVE, AND SAFE WATER RESOURCE MANAGEMENT (WATER AVAILABILITY AND WATERSHED MANAGEMENT - 211)

There is no substitute for fresh water nor are there replacements for its essential role in maintaining human health, agriculture, industry, and ecosystem integrity. As the nation was established and expanded, it flourished in part because of its abundant and readily available water and natural resources. In the 21st century, the nation faces depleted ground water reserves, degraded water quality, and adverse climate conditions that are reducing the amount of available freshwater. At the same time, allocations of our freshwater resources are shifting among different users and different needs (e.g., from agricultural to urban uses; from storing water supplies in reservoirs to maintaining in-stream flows to support healthy aquatic ecosystems; from industrial and energy production to recreation). Our shared freshwater supply has been significantly reduced and is becoming more variable, unreliable, and inadequate to meet the needs and demands of an expanding population.

Today, agriculture is the largest user of fresh water yet offers opportunities for conserving water supplies and improving water quality for drinking, swimming, and fishing.

Agriculture faces new challenges—the increasing demand for water by our cities, farms, and aquatic ecosystems; the increasing reliance on irrigated agriculture for crop and animal production and farm income; and changing water supplies due to groundwater depletion in some areas, climate variability, and global change. Science can provide the tools needed by water planners and managers to accurately predict the outcomes of proposed water management decisions, and new technologies can widen the range of options for future water management. The factual basis for decision-making includes an understanding of effectiveness, potential unintended consequences, and a plan for getting water users and agencies to adopt the most effective technologies. The Nation has the opportunity to use science and technology to build a strong economy and to improve human and ecological health.

Performance Measure

2.2.1 Develop technology and practices to promote improvement of integrated, effective and safe water resource management.

Indicator 1: ***During 2014, ARS will develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management.***

1. Soil moisture is a key component of Earth's water cycle that is essential for plant life, affecting global energy flux, and influencing weather and climate. Monitoring the availability of soil moisture in the rooting zone is critical for forecasting variations in agricultural productivity that can affect global food prices and food availability. ARS scientists in Beltsville, Maryland designed a system to globally estimate the availability of soil moisture in the rooting zone, and produced new worldwide soil moisture maps that reveal how the wetness of the land fluctuates seasonally and with changes in weather.

   ***Impact*:** Maps are being given to the public to support a wide range of agricultural and hydrologic applications, from advancing climate models and weather forecasts to improving flood warning systems. In April 2014, USDA Foreign Agricultural Service analysts implemented this system to improve their operational forecasts of global agricultural yield and productivity. These forecasts are critically important to commodity markets, and to decision-makers who must depend on crop production information to plan for disasters such as drought, that can lead to food deficits in countries that may require food assistance.

2. Water supplies from western mountainous watersheds are in extremely high demand for agricultural production, clean electricity, and domestic uses. To optimize water supply management, traditional methods of stream flow forecasting must be improved. ARS scientists in Boise, Idaho, developed a new more sophisticated model, iSnobal, that goes beyond simple empirical relationships, but has not been used for management purposes due to its high computational demands and the expertise required to simulate snow accumulation and melt patterns over large areas.

   ***Impact*:** Over the past year, ARS scientists successfully integrated the iSnobal model into the U.S. Bureau of Reclamation's forecasting procedures for the 2,500 square mile Boise River Basin in Idaho. Also, weekly updates of snow cover density over a large region of the southern Sierra Nevada Mountains are now being provided for NASA's Alpine Snow Observatory program. This represents a major change in the commitment of western water managers toward using more sophisticated process-based modeling in their future river forecasting programs.

Indicator 2: ***During 2014, ARS will develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality.***

FY 2014 Accomplishments*:*

1. While hydrologic processes and scientific investigations related to sustainable agricultural systems are based on universal principles, research to understand processes and evaluate management practices is often site-specific in order to achieve a critical mass of expertise and research infrastructure to address spatially, temporally, and ecologically complex systems. In the face of dynamic climate, market, and policy environments, long-term research is required to understand and predict risks and possible outcomes of alternative scenarios. ARS researchers at El Reno, Oklahoma, their collaborators from the US Geological Survey and USDA Natural Resources Conservation Service, and past ARS scientists, published a collection of data and research papers describing long-term research (1961 to present) in the Upper Washita River basin of Oklahoma. Data papers document datasets in detail (weather, hydrology, physiography, land cover, and sediment and nutrient water quality) and associated research papers present analyses based on those data.

   ***Impact*:** This living history of research is presented to engage collaborative scientists across institutions and disciplines to further explore complex, interactive processes and systems, including: resilience to current and future climate pressures; sources, fate, and transport of contaminants at the watershed scale; linked atmospheric-surface-subsurface hydrologic processes; high spatiotemporal resolution analyses of linked hydrologic processes; and multiple-objective decision making across linked farm to watershed scales.

2. As ARS scientists in Oxford, MS, continue to try to improve water quality through the use of agricultural best management practices (BMPs), there is a need to better understand how effective these BMPs are within an entire watershed. To address this need, water quality measurements of water clarity, total suspended sediment and total dissolved solids were collected in Beasley Lake, a Conservation Effects Assessment Project (CEAP) watershed in the Mississippi Delta, from 1996 to 2009. BMPs put in place from 1997-2006 included within-field, edge-of-field, and Conservation Reserve Program (CRP) practices. Over the 14 years that lake water quality was studied, the lake had clearer water, less suspended sediments, and lower dissolved solids, coinciding with the amount of BMPs put in place. Changes were seen most strongly during spring.

   ***Impact*:** The study showed how a variety of BMPs implemented in this watershed improved lake water quality, helping to make a healthy, sustainable lake. By providing additional information to improve and sustain lake and flood plain water quality and overall environmental quality through the use conservation practices, these results have broad relevance for regulatory and other agencies and farming stakeholders.

Indicator 3: ***During 2014, ARS will develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.***

FY 2014 Accomplishments*:*

1. The Midwestern United States has some of the most productive agricultural soils in the world, but because of its climate much of this region would be unable to support agriculture without drainage; high

water tables would both damage crops and prevent the access of machinery in the fields at critical times. While drainage is designed to remove excess water as quickly as possible, it can also provide a conduit for the rapid loss of agrochemicals, particularly phosphorus that can subsequently degrade the quality of key drinking water supplies. ARS scientists in West Lafayette, Indiana, used a combination of field and modeling investigations to help farmers and land managers mitigate losses of phosphorus and other nutrients from tile drained croplands under conservation tillage. They developed a new conservation practice, the blind inlet, to replace tile risers, providing additional filtering capacity to reduce both sediment-bound and dissolved P in runoff, and conducted APEX modeling studies showing that a combination of two or three different conservation practices had a synergistic effect, providing a greater level of protection than the benefits associated with each individual practice when used alone.

***Impact*:** As researchers, policy-makers, and farmers search for ways to reduce phosphorus loadings to surface waters such as Lake Erie, these studies highlight the importance of treating both surface runoff and tile drainage to minimize harmful algal blooms.

2. Atrazine is one of the most prevalent soil applied herbicides used in corn cultivation. Its widespread use has led to significant contamination of surface and ground water resources across the U.S. Corn Belt. Restricted layer (clay pan) soils in northeastern Missouri are particularly vulnerable to the transport of both soil and atrazine in surface runoff. To find ways of controlling atrazine losses in these landscapes, a team of ARS scientists in Columbia, Missouri assembled 15 years of data from the 28 square mile Goodwater Creek Experimental Watershed. Researchers from this team isolated and confirmed the identity of an atrazine degrading compound (DIBOA-Glc) from eastern gamagrass that could lead to the development of a commercial product to enhance atrazine degradation in soils. The team also found that a commercially available tillage implement (a rotary harrow) substantially reduced atrazine loss, but did not significantly increase erosion compared to no-till.

   ***Impact*:** This research provides key information on atrazine movement, particularly in restricted drainage soils, providing mechanisms to help farmers both enhance atrazine degradation and prevent its loss in runoff, while simultaneously maintaining the erosion control benefits of reduced tillage. These findings have the potential to greatly improve the region's most persistent water quality problems, improving the sustainability of crop production while maintaining or increasing farmer profitability.

Performance Targets

2.1.A Develop Tools and Technologies to Improve the Effectiveness of Agricultural Water Management.

Baseline 2010	Target 2017
ARS released new FAO water quality guidelines for irrigation with marginal waters and treated wastewaters, replacing earlier guidelines that: did not consider pH; and underestimated the effects of sodium absorption on water infiltration. The new guidelines were used by customers to improve the ability to evaluate the infiltration of hazards associated with the application of marginal waters or treated wastewaters, ensuring safer use of saline waters for irrigation and increasing the water available to support irrigated agriculture.	Cumulatively, 17 models, tools, databases, sets of guidelines, or design criteria developed and released to ARS customers.

2.1.B Improve the Scientific Understanding of Erosion, Sedimentation, and Contaminant Transport Processes from Agricultural Fields and Landscapes to Facilitate the Development of Tools and Technologies to Better Protect the Agricultural Water Quality.

Baseline 2010	Target 2017
ARS released version 2010.1 of the Water Erosion Prediction Project (WEPP) model, to users in the US and throughout the world. Customers include land managers and conservationists charged with predicting runoff, soil loss, and sediment yield from hill slopes and small watersheds. The new version gives improved performance especially in areas experiencing substantial erosion from snowmelt on thawing soils.	Cumulatively, 16 technologies, databases, tools, models, or sensor-based monitoring systems developed and released to ARS customers.

2.1.C Develop Strategies to Improve the Effectiveness of Agricultural Conservation Efforts by Developing New or Improved Conservation Practices, Improving Practice Placement to Maximize Effectiveness and Minimize Cost, and Developing a Better Understanding of the Effects of Agricultural Conservation at the Landscape Scale.

Baseline 2010	Target 2017
Three tools to enhance conservation effectiveness released by ARS and used by customers to improve conservation management.	Cumulatively, 10 tools, technologies, models, databases, or improved conservation practices developed and released to ARS customers

2.1.D Conduct Research to Improve Watershed Management and Ecosystem Services in Agricultural Landscapes.

Baseline 2010	Target 2017
Two tools to enhance watershed management and ecosystem services in agricultural landscapes released by ARS and used by customers to improve flash flood forecasting and set design standards for flood and transport infrastructure, erosion estimates, storm characteristics, and other watershed processes.	Cumulatively, 10 tools, models, databases, or technologies developed and released to ARS customers

Measure 2.2.1 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 4 new technologies that enhance conservation effectiveness, watershed management and ecosystem services in agricultural landscapes

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
A global root zone soil moisture monitoring system producing new worldwide soil moisture maps that reveal how the wetness of the land fluctuates seasonally and with changes in weather.	Maps were made available to the public; In April 2014, the system was made available to USDA Foreign Agricultural Service (FAS) analysts.	The Public; USDA FAS analysts.	Public distribution supports a wide range of agricultural and hydrologic applications, from advancing climate models and weather forecasts to improving flood warning systems. FAS analysts used the system to improve operational forecasts of global agricultural yield and productivity. These forecasts are critical to commodity markets and decision-makers, who depend on crop production information to plan for disasters (e.g., drought) that can cause food deficits.
iSnobal--a new model for managing snowmelt in the western United States.	ARS scientists successfully integrated iSnobal into the U.S. Bureau of Reclamation's forecasting procedures for the 2,500 square mile Boise River Basin in Idaho. Also, weekly updates of snow cover density over a large region of the southern Sierra Nevada Mountains are now being provided for NASA's Alpine Snow	The U.S. Bureau of Reclamation; the National Aeronautics and Space Administration (Alpine Snow Observatory program).	This transfer of technology resulted in a major improvement in the way that western water managers forecast future stream flow based on snowpack accumulations.

	Observatory program.		
A 50+ Year Data Record for the Upper Washita River Watershed, Oklahoma.	Publication of a collection of data and research papers describing long-term research (1961 to present) in the Upper Washita River basin, Oklahoma, documenting weather, hydrology, physiography, land cover, and sediment and nutrient water quality datasets in detail, and presenting analyses based on those data.	The scientific community at large.	Further exploration of complex, interactive processes and systems, including: resilience to current and future climate pressures; sources, fate, and transport of contaminants at the watershed scale; linked atmospheric-surface-subsurface hydrologic processes; high spatiotemporal resolution analyses of linked hydrologic processes; and multiple-objective decision making across linked farm to watershed scales.
A 14-year (1996 to 2009) data set of water clarity, total suspended sediment and total dissolved solids measurements from Beasley Lake, a Conservation Effects Assessment Project (CEAP) watershed in the Mississippi Delta region, showing changes in response to the implementation of within-field, edge-of-field, and Conservation Reserve Program (CRP) practices in the watershed.	Findings published in the Journal of Soil and Water Conservation.	Research scientists, land managers (farmers and ranchers), regulatory and other agencies, and the conservation community at large.	Demonstration of how the implementation of BMPs in the surrounding watershed can improve flood plain lake water quality, helping to make a healthy, sustainable lake.

Measure 2.2.1: Develop technology and practices to promote improvement of integrated, effective and safe water resource management.

During FY 2015, ARS will:

Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management.

Develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality.

Develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.

During FY 2016, ARS will:

Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management.

Develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality.

Develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.

During FY 2017, ARS will:

Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management.

Develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality.

Develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.

GOAL 2.2 – IMPROVE QUALITY OF ATMOSPHERE AND SOIL RESOURCES, UNDERSTAND EFFECTS OF CLIMATE CHANGE (CLIMATE CHANGE, SOILS AND EMISSIONS RESEARCH – 212)

Agricultural systems function within the soil-atmosphere continuum. Mass and energy exchange processes occur within this continuum and agriculture can significantly affect the processes. Emissions from agriculture to the atmosphere affect air quality and increase atmospheric greenhouse gas (GHG) concentrations. While GHG emissions are a result of the natural cycling of carbon (C) and nitrogen (N), these emissions also contribute to climate change.

A changing climate impacts agriculture, range and pasture systems, and soils through alterations of precipitation and temperature patterns. Increased atmospheric carbon dioxide (CO2) concentration has an enhanced fertilization effect on plants, particularly weeds. Combining these impacts of changing climate can alter habitats, thus changing the distribution of pathogens, weeds, and invasive species, resulting in increased threats to agricultural production and increasing the cost of production. The impacts of climate change clearly create challenges to agriculture and soil, water and air resources, and yet may also offer new opportunities for agricultural production and enhancement of soil quality.

Soils are a crucial boundary resource between agriculture and the atmosphere. Soils in agricultural systems must be managed 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. Enhancement of soil productivity is a focus of ARS research and together with crop improvement research, offers promise for meeting future global agricultural demands.

The variability of the atmosphere, soils, and plants, and the complexity of interactions among these systems require collaborations by ARS scientists conducting NP212 research. Formal and informal Cross Location Research (CLR) projects including the Greenhouse gas Reduction through Agricultural Carbon Enhancement network (GRACEnet), the Renewable Energy Assessment Project (REAP), and field campaigns focused on air quality are successful examples. Synthesis and integration of information, including sources outside NP212 research projects, increases the utility and impact of ARS research for producers, land managers and policy-makers. Efficient assimilation of data from NP212 projects into existing and future collaborative data bases enhances synthesis and integration analyses and expands research opportunities.

Performance Measure

2.2.2 Improve quality of atmosphere and soil resources; understand effects of climate change through development of knowledge and technologies.

Indicator 1: ***During 2014, ARS will assess the potential risks and benefits to agricultural systems from climate change, and develop agricultural management practices and decision support strategies that enable producers to take advantage of the beneficial effects, and adapt to the adverse effects of climate change.***

FY 2014 Accomplishments*:*

1. Regional baseline assessments of crop vulnerability to regional climate changes are needed to provide a foundation for developing adaptation strategies. As part of the Midwest Climate Change Hub activities hosted by ARS in Ames, Iowa, climate impacts on annual grain crops, specialty crops, and perennial crops were evaluated across the Midwest. Soil water availability was found to be the most significant factor affecting production in the Midwest. Additionally, the findings showed that within season weather effects on annual production depend on when stress is imposed. Corn and soybean are more tolerant of

stress conditions during the vegetative stage than the reproductive stage. Vegetables are affected throughout their growth cycle by weather variations that affect insect pest populations and plant diseases. Perennial crops are affected early in the growing season by below normal temperatures, and late in the growing season by temperature and water stress.

Impact: These findings indicate that practices that increase soil water storage capacity can help cropping systems become more resilient to climate-related variables during the growing season, and provide guidance for strategies to develop climate smart crop varieties and management systems.

2. Adapting wheat production to conditions associated with climate change will require determining how higher air temperatures affect wheat and incorporating this knowledge into growth models. ARS scientists in Maricopa, Arizona, in collaboration with scientists at the University of Arizona in Tucson, conducted a "Hot Serial Cereal Experiment." On six planting dates for the experimental wheat crops, infrared heaters were deployed above some of the plots to provide additional warming. Results showed that yields decreased as season average air temperatures increased above 15°C (59°F), and that crops failed once temperatures reached 32°C (90°F).

   Impact: These results provide much needed information on the environmental limits for wheat production and will serve as a benchmark for researchers developing new varieties and new management strategies for adapting wheat to the higher air temperatures resulting from global change. This research also provides more realistic projections of future climate change effects on wheat, and data for the Agricultural Model Intercomparison and Improvement Project.

Indicator 2: ***During 2014, ARS will develop management practices and decision tools to improve soil quality, protect the environment, and contribute to the sustainability of agricultural systems***.

FY 2014 Accomplishments*:*

1. Although conservation farming practices have substantially reduced erosion and sediment loss, these benefits may be threatened by more frequent high intensity rainfall events. ARS scientists in Tifton, Georgia, evaluated runoff and sediment loss from conventionally tilled (CT) and conservation strip tilled (ST) fields in a Southern Atlantic Coastal Plain landscape during a 10 year rotational cotton peanut production with a rye winter cover crop. Over the 10 years, the mean annual amount of solid material transported by runoff was 87 percent higher in CT fields than in ST fields. Total runoff from ST fields was 41 percent less than total runoff from the CT fields. The maximum rate of annual soil erosion that still enables continued crop production, known as the soil tolerance value, was exceeded in 3 out of 10 years by CT, but was never exceeded by ST. Extreme rainfall events accounted for 61 to 72 percent of the CT system sediment load and 73 to 84 percent of the ST system sediment load.

   Impact: These results demonstrate that ST management is less susceptible to sediment loss from extreme events than CT systems, and that ST systems are still more effective at reducing sediment loss in this landscape than CT systems. More specifically, the results point to the continued use of cover crops and strip tillage as essential best management practices as the frequency of high intensity rainfall events increases.

2. The new and revised Kentucky Nitrogen and Phosphorous Index tool, which was developed by ARS scientists in Ft. Collins, CO, was transferred to the state of Kentucky. Losses of reactive nitrogen and phosphorus are impacting water quality, and there is a need to reduce the off-site transport of these nutrients. The Kentucky Natural Resources Conservation Service reviewed the Conservation Practice Standard for Nutrient Management (Code 590) and released a new version of the Standard in March of

2013. The new Kentucky Nitrogen and Phosphorous Index tool was listed in the standard as an official risk assessment tool for the state. The tool was revised and improved during the last year with new capabilities to improve the assessment of the effects of management on nitrogen and phosphorous losses.

Impact: This new, revised technology, which is quick and easy to use, and can assess the potential risk of N and P losses to the environment, was transferred to Kentucky NRCS (http://www.ars.usda.gov/npa/spnr/nitrogentools).

Indicator 3: ***During 2014, ARS will assess the greenhouse gas emissions from agricultural systems and develop methods for reducing the emissions.***

FY 2014 Accomplishments*:*

1. Most nations use simple Intergovernmental Panel on Climate Change Tier 1 methodology based on emission factors to estimate greenhouse fluxes from agricultural systems for national inventories reported to the United Nations Framework Convention on Climate Change. In contrast, the U.S. uses a Tier 3 approach employing the DayCent agro-ecosystem model which was developed by researchers from ARS in Fort Collins, CO, and Colorado State University.

   Impact: DayCent generated estimates of soil fluxes at the state and national scales reported by the U.S. to the United Nations Framework Convention on Climate Change and published by EPA in 2014 (*Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012*) have smaller uncertainty intervals than emissions reported in previous EPA inventories.

2. ARS scientists in Lincoln, Nebraska collected grain and biomass yield and composition, soil carbon, and production input data to estimate ethanol yield per acre and greenhouse gas emissions from a long-term corn (with and without corn residue harvest) and switchgrass field trial in the western Corn Belt of the US. Soil carbon storage in fields planted to corn or switchgrass resulted in large greenhouse gas emission mitigation potential and demonstrated why proper accounting of soil carbon storage will be critical in determining biofuel carbon intensities.

   Impact: Switchgrass, under optimal management, produced higher ethanol yields than the corn grain-only harvests and similar ethanol yields as corn grain with residue removal. Future integration of cellulosic ethanol biorefineries with corn grain ethanol facilities would result in improved energy efficiency for the current corn grain ethanol system.

3. Proponents of cellulosic biofuel need to understand how soil nutrient levels will be affected by removing corn stover for use as feedstock for cellulosic biofuel. More than 500 site-years of corn plant samples were collected by ARS scientists in Ames, Iowa, who divided plant samples into different parts (stems, leaves, and grain). All samples were analyzed to determine nutrient concentrations. The results showed that compared to harvesting only the grain, harvesting corn stover increased nitrogen, phosphorus, and potassium loss by 14, 1.4, and 16 pounds per ton, respectively. The losses of nitrogen and phosphorus are not considered enough to change current nitrogen and phosphorus fertilization practices for stover harvest rates of one ton/acre. However, the potassium loss is sufficiently high to warrant routine soil testing and plant analysis to monitor available potassium levels.

   Impact: This information provides guidelines for the acquisition of sufficient feedstock supplies to operate emerging cellulosic biofuel investments in a sustainable manner.

Performance Targets

2.2.A Enable Improvements of Air Quality via Management and Mitigation of Emissions from Agricultural Operations.

Baseline 2010	Target 2017
Integrated Farm Systems Model (IFSM) and Dairy Greenhouse Gas Emissions Model (DairyGEM) developed with focus on NE US agricultural systems, as a prototype for on-farm decision support technology.	Protocols implemented for standardized air quality research data collection and storage with transport parameters and emission rates for emission and transport model improvement, evaluation, and validation. IFSM and DairyGEM calibrated and tested for other regions of US.

2.2.B Develop Knowledge and Technologies for Reducing Atmospheric Greenhouse Gas Concentrations Through Management of Agricultural Emissions and Carbon Sequestration.

Baseline 2010	Target 2017
Cumulative GRACEnet project production of 208 scientific publications on GHG emissions and carbon sequestration in US croplands and rangelands.	Agriculture product/production system/-specific decision support tools and management strategies for balancing production goals, environmental stewardship objectives, GHG emission reductions, and C sequestration.

2.2.C Enable Agriculture to Adapt to Climate Change.

Baseline 2010	Target 2017
Data revealing anticipated impacts of climate change on crop production, weeds, pathogens, food and forage quality.	Prototype decision support tools that enable sustainable agriculture under conditions of changing climate

2.2.D Develop Technologies for Maintaining and Enhancing Soil Resources.

Baseline 2010	Target 2017
Data on effects of biochar amendments and crop rotations on soil biomass, carbon cycling and enzymes.	Develop guidelines and practices to lower production costs, improve soil quality and health, and reduce use of energy and petroleum-based products.

Measure 2.2.1 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 4 new technologies adopted for uses that provide on-farm decision support, management strategies, and tools that enable sustainable agriculture.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Release of germplasm (four snap bean inbred lines) with differential sensitivity to ambient ozone air pollution	The snap beans are being grown in ozone demonstration gardens to educate students and the public on the impacts of air pollution on vegetation	U.S. and international educators and scientists	The differential ozone response between tolerant and sensitive lines provides a basis for an ozone bioindicator system to assess ambient air quality effects on vegetation.
Application of Boeing's Unmanned Aircraft Technologies for Agricultural Nutrient Management	Transfer algorithm for using remote sensing data for nutrient management to cooperator.	Consultants helping farmers manage crops	Better monitoring of crops at very high resolution will increase efficiency of fertilizer and pesticide applications.
Integrated Farm System Model, a farm simulation model useful for evaluating and comparing integrated crop, dairy or beef production systems.	Internet distribution, about 350 copies of the software tool were distributed during the past year	Scientists, educators, students, and farm consultants interested in studying management effects on farm performance, environmental impact and profitability.	The model is used for classroom teaching in courses at a number of universities throughout the USA and a few other countries, and is used for evaluation of farming systems.
Computer tools (Nitrogen Index 4.5, NLEAP-GIS 4.2, and NLEAP GIS 5.0) to improve nitrogen use efficiency in order to reduce the environmental	Approximately 1000 copies of the tools have been downloaded from the website or distributed at workshops during the past year (total	The tools are being used by agencies such as the NRCS and other national and international users. For example, the new Kentucky Nitrogen and	The tools are being used by agencies and other users for assessment of nitrogen management across hundreds of thousands of acres,

impact of nitrogen losses and increase economic returns for farmers	distributions via downloads or workshops during last three years: about 2000, with downloads from 70+ countries).	Phosphorus Index tool is being used by NRCS as a tool in a policy aimed at improving nutrient management.	as well as for teaching, research, and other uses related to nitrogen management and assessment of the potential risk of losses of reactive nitrogen to the environment.

During FY 2015, ARS will:

Assess the potential risks and benefits to agricultural systems from climate change, and develop agricultural management practices and decision support strategies that enable producers to take advantage of the beneficial effects, and adapt to the adverse effects of climate change.

Develop management practices and decision tools to improve soil quality, protect the environment, and contribute to the sustainability of agricultural systems.

Assess the greenhouse gas emissions from agricultural systems and develop methods for reducing the emissions.

During FY 2016, ARS will:

Assess the potential risks and benefits to agricultural systems from climate change, and develop agricultural management practices and decision support strategies that enable producers to take advantage of the beneficial effects, and adapt to the adverse effects of climate change.

Develop management practices and decision tools to improve soil quality, protect the environment, and contribute to the sustainability of agricultural systems.

Assess the greenhouse gas emissions from agricultural systems and develop methods for reducing the emissions.

During FY 2017, ARS will:

Assess the potential risks and benefits to agricultural systems from climate change, and develop agricultural management practices and decision support strategies that enable producers to take advantage of the beneficial effects, and adapt to the adverse effects of climate change.

Develop management practices and decision tools to improve soil quality, protect the environment, and contribute to the sustainability of agricultural systems.

Assess the greenhouse gas emissions from agricultural systems and develop methods for reducing the emissions.

GOAL 2.3 – ENABLE NEW BIOREFINING TECHNOLOGIES TO SUPPORT AN ECONOMICALLY ROBUST BIOREFINING INDUSTRY (BIOREFINING - 213)

The ARS Biorefining 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 will optimize both the production of plant feedstocks and the biorefining of agricultural materials to bioenergy and value-added coproducts. This research will strengthen rural economies, provide increased supplies of renewable transportation fuel, enhance energy security, and improve the U.S. balance of trade.

The growth and long-term viability of bioenergy production in the Nation is impeded by a number of technical and commercial barriers. ARS leverages its unique strengths and capabilities to pursue technical barriers that can be overcome by ARS resources.

In addition to tackling specific technical barriers and leveraging ARS core competencies, ARS bioenergy research is consistent with relevant non-technical considerations associated with public policy, general resource constraints, and overall practices/trends within the bioenergy industry.

Performance Measure

1.2.3 Enable new commercially-viable technologies to (1) convert agricultural materials and byproducts into fuels and other marketable products, and (2) reduce risks and increase profitability in existing industrial biorefineries.

Indicator 1: ***During 2014, ARS will enable technologies that can reduce business risks, increase the value of co-products, and/or expand the number of revenue streams for existing biorefineries.***

FY 2014 Accomplishments*:*

1. Antimicrobial resistance, a major health concern, has decreased the effectiveness of therapeutic drugs to treat and prevent infectious disease. As a result, antibiotic alternatives are needed to maintain the health and welfare of animals. ARS scientists in Peoria, Illinois, collaborated with a scientist from Rangsit University in Thailand to test a novel oil produced by the fungus *Aureobasidium pullulans* for antibacterial activity. The oil, known as one of the liamocins, was produced through bioconversion of a variety of sugars and lignocellulosic feedstocks and was found to preferentially inhibit the growth of strains of the pathogenic bacteria *Streptococcus*.

   ***Impact*:** The antibacterial oil can improve animal health in the dairy, swine, and aquaculture industries, and can support the biorefining industry by providing a new high-value bioproduct.

2. To provide sufficient quantities of biomass sources between growing seasons, ARS researchers in Albany, California, developed a large pilot scale biorefinery located at the Salinas, California, Crazy Horse Landfill that converts rural and urban solid waste into ethanol, biogas, compost, and value-added recyclables. Each ton of food processing waste at the landfill currently can be converted into 65 gallons of ethanol. Together, ARS and the city of Salinas are creating an “energy park” that converts both agricultural biomass and curb collected garbage into bioenergy in the same biorefinery, which demonstrates the facility’s remarkable flexibility in handling and processing different feedstock supplies.

   ***Impact*:** One ton of biomass (urban solid waste) converted to liquefied natural biogas has the same burn rate as 100 percent ethanol, and it yields 108 gallons of transportation fuel, which can be used to power diesel turbines.

Indicator 2: ***During 2014, ARS will enable technologies for the production of new biofuels which are compatible with the Nation's existing fuel distribution infrastructure.***

FY 2014 Accomplishments*:*

1. The cold flow properties of fatty acid methyl esters (biodiesel) are relatively poor and detract from commercial viability of biodiesel as a fuel source during cold weather. Synthetic cold flow improver (CFI) additives made from soybean, canola, and palm oils have been shown to increase the ability of biodiesel to flow at low temperatures. ARS scientists in Peoria, Illinois, and Wyndmoor, Pennsylvania, collaborated on the synthesis and testing of CFI additives obtained from non-food resources such as waste cooking oil. Biodiesel fuel producers, distributors, and consumers will also benefit from better flowability and performance in cold weather.

***Impact*:** Results from the research benefits farmers who supply seed oils for biodiesel conversion by making the fuel more flowable and marketable during cooler seasons.

Performance Targets

2.3.A Enable New Technologies that Benefit Biorefiners which Utilize Biochemical Processes to Convert Carbohydrate-Based Feedstocks.

Baseline 2012	Target 2017
ARS will characterize 2 important feedstock traits, make progress on one enhanced germplasm pool, and establish one significant public-private partnership for advancing feedstock variety improvement.	By 2017, ARS will characterize 10 important feedstock traits, create three enhanced germplasm pools, and establish five significant public-private partnerships for advancing feedstock variety improvement.

2.3.B Enable New Technologies that Benefit Biorefiners with Convert Lipid-Based Feedstocks.

Baseline 2012	Target 2017
ARS will incorporate at least one new technology that enables production of biomass and will contribute to the introduction of a new region-based system.	By 2017, ARS will incorporate six new technologies and introduce three new region-based systems that enable the production of biomass feedstocks to help achieve U.S. goals for meeting legislated mandates for blending biofuels. We will provide 10 science-based practices suitable for developing NRCS conservation plans.

2.3.C Enable New Technologies that Benefit Biorefiners which Utilize Pyrolysis to Convert Feedstocks.

Baseline 2012	Target 2017
ARS will commercialize one biorefining and /or co-products technology which was enabled by ARS research.	By 2017, industry will commercialize five biorefining and/or co-products technologies which were enabled by ARS research.

Measure 1.2.3 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 3 new methods were developed to measure enzyme deterioration of sugar beet, sugarcane and sweet sorghum, and to predict/control processing problems at the processing plant.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Novel microbial oil has antimicrobial activity	Technology was transferred to the biorefining industry.	The biorefining industry.	Antibacterial oil can improve animal health in the dairy, swine, and aquaculture industries, which supports the biorefining industry by providing a new a high-value bioproduct.
Changing landfills into biorefineries.	Technology was transferred Salinas, California, Crazy Horse Landfill.	Urban solid waste landfill facilities.	1 ton of Biomass (residential garbage) when converted to liquefied natural biogas, has the same burn rate as 100 percent ethanol, and yields 108 gallons of transportation fuel.
Sustainable biodiesel additives improves cold weather flow.	Technology was transferred to biodiesel fuel producers, distributors.	Biodiesel fuel producers distributors, and consumers.	Farmers who supply seed oils for biodiesel conversion by making the fuel more flowable and marketable during cooler seasons.

Measure 1.2.3 : Develop technologies to enable sustainable commercial production of bioenergy feedstocks and other biofuels.

During FY 2015, ARS will:

Enable technologies that can reduce business risks, increase the value of co-products, and/or expand the number of revenue streams for existing biorefineries.

Enable technologies for the production of new biofuels which are compatible with the Nation's existing fuel distribution infrastructure.

During FY 2016, ARS will:

Enable technologies that can reduce business risks, increase the value of co-products, and/or expand the number of revenue streams for existing biorefineries.

Enable technologies for the production of new biofuels which are compatible with the Nation's existing fuel distribution infrastructure.

During FY 2017, ARS will:

Enable technologies that can reduce business risks, increase the value of co-products, and/or expand the number of revenue streams for existing biorefineries.

Enable technologies for the production of new biofuels which are compatible with the Nation's existing fuel distribution infrastructure.

GOAL 2.4 – EFFECTIVELY AND SAFELY MANAGE AND USE MANURE AND OTHER AGRICULTURAL AND INDUSTRIAL BYPRODUCTS IN WAYS THAT MAXIMIZE THEIR POTENTIAL BENEFITS WHILE PROTECTING THE ENVIRONMENT AND HUMAN AND ANIMAL HEALTH. (AGRICULTURAL AND INDUSTRIAL BYPRODUCTS - 214)

Improvements are needed in animal feeding and management regimens in order to increase the proportion of dietary nutrients retained in the animal or animal products while decreasing the quantity of dietary nutrients excreted and lost to the environment. Basic research is needed to evaluate the fate and transport of manure nutrients in the major soil-crop systems common to animal agriculture. This is the foundation for developing Best Management Practices (BMP). Application methods are needed that can improve nutrient use efficiency and incorporate manure to conserve N while maintaining adequate crop residue to protect the soil from erosion and runoff. These practices, and their associated nutrient management plans, must be based on sound understanding of the fate and transport of specific nutrients for major soils, hydrologic conditions, and cropping systems. Information is needed on pathogen inactivation and die-off as well as their potential for regrowth as functions of environmental conditions (e.g., temperature, moisture, etc.) during all stages of waste management. Technologically sound methods are needed for utilizing byproducts that will be characterized as beneficial and can result in products that are commercially sustainable. This includes blending, composting, and amending byproducts as well as developing land application and management techniques that will improve soil, water, and air quality in addition to improved plant growth. In addition, improved formulations of agriculture byproducts feed stock for use in industrial as well as agricultural applications are needed.

Performance Measure

2.2.4 Effectively and safely manage and use manure and other agricultural and industrial byproducts in ways that maximize their potential benefits while protecting the environment and human and animal health.

Indicator 1: ***During 2014, ARS will increase utilization of manure nutrients and resources.***

FY 2014 Accomplishments*:*

1. New or expanding swine operations in North Carolina are required to meet one of the strictest environmental standards in the world. These standards include emissions of ammonia and odor; the release of pathogens; and nutrient and heavy metal contamination of soil and groundwater. Scientists at ARS in Florence, South Carolina together with industry and university cooperators, demonstrated and verified a 3rd generation wastewater treatment system for swine manure (US Pat. 7,674,379) that could meet the environmental standards at reduced cost. Additional goals included replacement of the existing lagoons, and efficient performance when installed in larger swine farms. The technology was demonstrated full-scale on a farrow-to-finish swine farm that produced 30,450 hogs per year and generated 75,000 gallons of manure per day. The technology separated solids in the flushed manure with settling and polymer flocculants; subsequently, the ammonia nitrogen was treated with a new nitrifying bacteria adapted to cold temperatures (US Pat. 8,445,253); and lastly, the soluble phosphorus was recovered and the effluent disinfected.

   ***Impact*:** The 3rd generation treatment process met the criteria identified in the referenced performance standards. This treatment process significantly reduces the potential for emissions of odor and ammonia, and the transfer of nutrients and pathogenic bacteria to surface and groundwater in the drainage basin where the animals are raised in animal feeding operations. The treatment process also provides a mechanism and market for the separated solids.

Indicator 2: ***During 2014, ARS will reduce manure pathogens and Pharmaceutically Active Compounds (PACs).***

FY 2014 Accomplishments*:*

1. *Salmonella* is a leading cause of bacterial foodborne disease. In the United States, more than 50 percent of the swine farms experience *Salmonella* contamination. On-farm interventions are needed to reduce the levels of *Salmonella* in swine production and limit the potential risk of foodborne disease in humans. A rationally attenuated *Salmonella typhimurium* vaccine has been developed by ARS researchers in Ames, Iowa, and is currently undergoing efficacy trials. To date, vaccine trial analysis indicates that swine vaccination reduces disease severity and gastrointestinal colonization due to challenges with both wild type *S. typhimurium and S. choleraesuis*.

   ***Impact*:** One advantage of the vaccine is that it still allows the use of an industrial test, *Salmonella* lipopolysaccharide, which is used in Europe to monitor *Salmonella* status at the herd level. Consequently, the new vaccine can still be used to differentiate infected from vaccinated animals.

2. Unintentional discharge from feedlot runoff holding ponds can potentially contaminate soil and groundwater. Working with the Nebraska Cattlemen's Association, Nebraska Department of Environmental Quality, and AgraTek LLC, ARS scientists in Clay Center, Nebraska, developed an automated resistivity array that can be used as an early warning system for this discharge.

   ***Impact*:** The technology allows sub-surface observations and greatly expands the surface area monitored compared with traditional monitoring. The system can notify land managers via modem or cell phones when a spill occurs, improving response and clean-up times.

Indicator 3: ***During 2014, ARS will reduce atmospheric emissions from animal production facilities.***

FY 2014 Accomplishments*:*

1. Ammonia losses from cattle feed-yards represent both an air pollutant and a loss of nitrogen that could be recycled as a soil amendment. Ammonia emissions will be regulated by the U.S. Environmental Protection Agency in the near future; however, the EPA currently lacks an effective model to determine ammonia emissions or estimate effects of management strategies on ammonia fluxes from agricultural operations. ARS scientists in Bushland, Texas, and State College, Pennsylvania, have improved the Integrated Farm Systems Model to estimate feed-yard ammonia emissions.

   Impact: This model is more accurate than current EPA emission models and has the potential to be adapted by regulators, consultants, and producers to better estimate ammonia emissions and determine the effectiveness of different ammonia management strategies in minimizing ammonia losses in feed-yards.

2. Loss of phosphorus from runoff on dairy farms can pollute local waters, and it is difficult to identify the areas of a particular site that are most responsible for these losses. ARS scientists in Madison, Wisconsin, monitored phosphorus runoff from cattle pastures and extensively surveyed four pasture-based dairy farms over a multi-year period. Data on runoff and farm management were combined with

topographical information to develop advanced computer models to quantify phosphorus loss from a particular site.

Impact: The research demonstrated that surveys such as this, in combination with new, advanced models, can reliably and quickly determine phosphorus loss from runoff and identify those areas in the greatest need of alternative management.

Indicator 4: ***During 2014, ARS will develop beneficial uses of agricultural, industrial, and municipal byproducts.***

FY 2014 Accomplishments*:*

1. There are growing concerns regarding the fate of nutrients, especially P, from land application of animal waste. One approach to reduce runoff losses of P is to treat manure or the soil receiving manure with chemical amendments such as gypsum. A study using rainfall simulations to examine the impact of flue gas desulfurization (FGD) gypsum application on runoff nutrient losses was conducted on a Coastal Plains soil. ARS scientists in Auburn, Alabama applied four different rates of FGD gypsum to plots of coastal bermudagrass, which had received application of poultry litter. Plots with FGD gypsum but no poultry litter and plots with no litter or FGD gypsum were also utilized. Rainfall simulation was used to generate water runoff for 60 min and samples were analyzed for soluble reactive P (SRP) and other total and soluble elements. Heavy metals were also analyzed. Results indicated a 51% reduction in total SRP load with the application of 8.9 Mg ha^{-1} FGD gypsum. Measurements of heavy metals in runoff were all found to be below detection limit.

   ***Impact*:** The results indicate that use of FGD gypsum on pastures receiving poultry litter in the Coastal Plains would be an effective method of reducing SRP losses to the environment. Results from this work resulted in gypsum use with poultry litter application being adopted as a Best Management Practice in Alabama.

2. ARS scientists in Beltsville, Maryland installed field test plots using phosphate, biosolids compost and iron oxides combinations in 1997. In 2013, the soils were re-sampled to obtain longer equilibrated soils for both chemical (bioaccessibility) and mouse feeding (bioavailability) tests to examine the effect of soil treatments on Pb bioavailability. In addition, some Joplin, MO, soils were fed to quail to test whether soil treatments could reduce bioavailability to birds. Studies confirmed the persistent reduction in soil Pb bioavailability and bioaccessibility due to both phosphate and biosolids compost treatments.

   ***Impact*:** These in situ treatments can strongly reduce the risk from Pb in ingested soil at low cost compared to soil removal and replacement.

Performance Targets

2.4.A Increase Utilization of Manure Nutrients and Resources.

Baseline 2012	Target 2017
Data of the effectiveness of current practices.	Manure treatment/handling systems and management strategies for maximizing effective nutrient utilization and environmental stewardship objectives.

2.4.B Reduce Manure Pathogens and Pharmaceutically Active Compounds (PACs).

Baseline 2012	Target 2017
Data on environmental fate and transport of pathogens and PACs.	Animal production strategies for reducing excretion of pathogens and PACS. Manure treatment/utilization systems minimizing introduction of pathogens and PACs into the environment.

2.4.C Reduce Atmospheric Emissions from Animal Production Facilities.

Baseline 2012	Target 2017
Initial datasets of emissions from animal production operations and facilities.	Manure treatment/handling systems and animal production/management strategies for minimizing emissions.

2.4.D Develop Beneficial Uses of Agricultural, Industrial, and Municipal Byproducts.

Baseline 2012	Target 2017
Reuse of some materials and disposal of the majority	Ten new economical and environmentally beneficial products created from materials previously considered to be wastes. Examples include new fuels, structural materials, and soil amendments.

Measure 2.2.4 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 5 new technologies adopted that decrease the use of manure nutrients and resources, reduce risk of pathogen and PACs transport, and protect the environment.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Annual P Loss Estimator (APLE) model, which estimates annual P loss in runoff from agricultural fields and long-term changes in soil P	Access to the APLE model is free to the public, and was downloaded 146 times during FY14.	The APLE model is used by domestic and international scientists, extension personnel, and policymakers.	The APLE model is being used in Wisconsin, Maryland, Kentucky, Oregon, and Washington to develop tools to comply with Natural Resources Conservation Service

			nutrient management policies.
Kentucky Phosphorus Index	The Kentucky P Index was incorporated in the ARS Kentucky N Index software and transferred to NRCS.	All states are required to evaluate their phosphorus index as part of the revised USDA-NRCS Conservation Practice Standard for Nutrient Management (Code 590).	The new Kentucky Phosphorus Index tool is being used by NRCS(Kentucky)
Gypsum use to reduce P loss from agricultural fields	Alabama Cooperative Extension Bulletin	Other scientists, producers, general public	Improved understanding of gypsum use to reduce phosphorus losses when poultry litter is used as a fertilizer source.
Anammox bacterium isolate	U.S. Patent 8,574,885 B2 issued Nov. 5, 2013	Livestock producers, industrialists, extension practitioners, other scientists	This novel bacterium strain is capable of oxidizing ammonium and releasing di-nitrogen gas under anaerobic conditions. The strain can be used for the treatment of municipal, industrial or agricultural wastewater.
Expanded the list of cover crops and estimated corresponding nitrogen reduction efficiencies for the Chesapeake Bay Model	Cover Crop Expert Panel Report for the Chesapeake Bay Program	Public and private nutrient managers, NRCS agents, extension service agents, fertilizer dealers, farmers and farm managers, State Dept. of Agric. program managers, and applied research scientists in ARS and land grant universities	Updates and educates these customers/users on the value of different cover crops in capturing nitrogen and thus reducing nitrate losses to receiving waters of the Chesapeake Bay.

Measure 2.2.4: Effectively and safely manage and use manure and other agricultural and industrial byproducts in ways that maximize their potential benefits while protecting the environment and human and animal health.

During FY 2015, ARS will:

Increase utilization of manure nutrients and resources.

Reduce manure pathogens and Pharmaceutically Active Compounds (PACs).

Reduce atmospheric emissions from animal production facilities.

Develop beneficial uses of agricultural, industrial, and municipal byproducts.

During FY 2016, ARS will:

Increase utilization of manure nutrients and resources.

Reduce manure pathogens and Pharmaceutically Active Compounds (PACs).

Reduce atmospheric emissions from animal production facilities.

Develop beneficial uses of agricultural, industrial, and municipal byproducts.

During FY 2017, ARS will:

Increase utilization of manure nutrients and resources.

Reduce manure pathogens and Pharmaceutically Active Compounds (PACs).

Reduce atmospheric emissions from animal production facilities.

Develop beneficial uses of agricultural, industrial, and municipal byproducts.

GOAL 2.5 - DEVELOP AND TRANSFER ECONOMICALLY VIABLE AND ENVIRONMENTALLY SUSTAINABLE PRODUCTION AND CONSERVATION PRACTICES, TECHNOLOGIES, PLANT MATERIALS AND INTEGRATED MANAGEMENT STRATEGIES, BASED ON FUNDAMENTAL KNOWLEDGE OF ECOLOGICAL PROCESSES, THAT CONSERVE AND ENHANCE THE NATION'S DIVERSE NATURAL RESOURCES FOUND ON ITS RANGE, PASTURE, HAY AND TURF LANDS. (RANGELAND, PASTURE & FORAGES – 215)

This program develops and integrates improved management practices, germplasm, and land-use strategies to optimize productivity, economic viability and environmental enhancement in managing vegetation, livestock and natural resources on private and public grass and forage lands. Research activities include: enhancing conservation and restoration of ecosystems and agro ecosystems through improvements based on the application of ecological principles; improving management of fire, invasive weeds, grazing, climate change and other agents of change; developing grazing-based livestock systems that reduce risk and increase profitability in existing and emerging markets; developing improved grass and forage legume germplasm for livestock, conservation, turf and bioenergy and bioproduct systems; improving the sustainability of turf management; and improving decision-support systems including improving inventory, monitoring, and assessment tools.

Performance Measure

2.2.5 Develop and transfer economically viable and environmentally sustainable production and conservation practices, technologies, plant materials and integrated management strategies, based on fundamental knowledge of ecological processes, that conserve and enhance the Nation's diverse natural resources found on its range, pasture, hay and turf lands.

Indicator 1: ***During 2014, ARS will provide improved germplasm and cultivars that can be released for pasture, harvested forages, turf, biofuels, rangeland restoration, and conservation.***

FY 2014 Accomplishments*:*

1. Switchgrass is one of the leading candidates for bioenergy feedstock production, especially in marginal environments where field crops are neither profitable nor sustainable. However, many of those marginal lands are in the more northern USDA Hardiness Zones 3 and 4 where switchgrass is not as productive as it is in the more southern Hardiness Zones 5 and 6. Recent field experiments by ARS scientists in Madison, Wisconsin, demonstrated that biomass yields in Zones 3 and 4 can be increased and competitive to those grown in Zones 5 and 6 through directed selection and breeding for high biomass yield and winter survival following harsh winters. The greatest gains in biomass yield, up to a 50 percent increase, were achieved with hybrid switchgrass that combined the high yield of a southern strain with the winter hardiness of a northern strain. This research provides the first documentation that high-yielding switchgrass strains can be productive in Hardiness Zones 3 and 4.

   ***Impact*:** The new switchgrass hybrid will expand opportunities to derive value from marginal lands in northern climates.

2. Under field conditions, soil moisture is often inadequate for the satisfactory establishment of native grass seedlings. These dry soil conditions limit a rangeland manager's ability to reestablish native grasses after a disturbance, such as drought or energy exploration. ARS scientists in Woodward, Oklahoma, in cooperation with the NRCS in Knox City, Texas, and Manhattan, Kansas, have developed a variety of sand bluestem (a native, perennial, warm season bunch grass) that has superior field emergence and plant density when planted in dry soil conditions. The new variety, named “Centennial,” was developed using

traditional breeding techniques, and is expected to help increase establishment success with its improved seed germination under dry soil conditions. This variety has demonstrated increased emergence and 17 percent higher plant density compared to other varieties.

Impact: The increased growth potential of this variety provides rangeland managers in the arid Southern Plains Region another viable option when attempting to establish native grasses on disturbed lands.

Indicator 2: ***During 2014, ARS will provide forage, pasture, and rangeland management technologies and strategies that reduce inputs while improving livestock performance and sustaining the environment.***

FY 2014 Accomplishments*:*

1. Standardized approaches are needed to monitor rangelands that enable agencies to share data and address policy needs. ARS scientists in Las Cruces, New Mexico, led in the implementation of ARS-developed core land monitoring indicators, field methods, and sample design techniques within the Bureau of Land Management (BLM), which included its national guidance for monitoring solar and oil/gas development impacts and sage grouse habitat. In addition, ARS led in the integration of BLM's monitoring efforts with existing USDA Natural Resources Conservation Service's Natural Resources Inventory private land monitoring program. ARS scientists at the Jornada Experimental Range also created Web-based tools for monitoring data analysis and reporting, mobile and tablet-based data collection applications, and extensive training modules that are deployed with other U.S. agencies and international partners.

   Impact**:** These techniques and tools are providing managers and policy-makers with information needed to manage resources through multi-scale inventory, monitoring, and assessment of western rangelands.

2. Understanding plant response to grazing following summer fire can help reduce ecological and financial risks associated with wildfire. Most wildfires occur during summer, and fire effects during this season are least understood. ARS researchers at Miles City, Montana determined that summer fire had no first-year effect on productivity for any biomass component and that grazing after fire had no effect on total aboveground productivity the year after grazing compared to non-burned, non-grazed sites. Fire and grazing increased grass productivity 16% and reduced forbs (51%), annual grasses (49%), and litter (46%). Results indicate that grazing with up to 50% biomass removal the first growing season after summer fire was not detrimental to productivity of semiarid rangeland plant communities. Livestock exclusion the year after summer fire furthermore did not increase productivity or shift species composition compared to grazed sites. Consistent responses among dry, wet, and near-average years suggest plant response is species-specific rather than climatically controlled.

   Impact**:** These results are changing post-fire grazing management decisions, particularly for federally managed lands that required one to three years of livestock removal following fire.

Performance Targets

2.5.A Develop Practices and Technologies to Improve Rangeland Productivity and Ecological Services.

Baseline 2012	Target 2017
3 practices and technologies that improve livestock production and the effectiveness of conservation and restoration including reducing the risk of wildfires, invasive weeds and climatic uncertainty to improve profitability and enhance ecological services	Cumulatively, 15rangeland practices and technologies developed and released to ARS customers

2.5.B Develop Practices and Technologies to Improve Pasture Productivity and Ecological Services.

Baseline 2012	Target 2017
2 practices and technologies that improve livestock production and the effectiveness of conservation on pasture lands including reducing the risk of climatic uncertainty and enhancing water resources and other ecosystems services	Cumulatively, 10 pasture practices and technologies developed and released to ARS customers

2.5.C Developed Sustainable Harvested Forage Systems for Livestock, Bioenergy and Bioproducts.

Baseline 2012	Target 2017
2 practices and technologies that improve harvested forage production for livestock and bioenergy while reducing the risk of climatic uncertainty and enhancing water resources and other ecosystems services	Cumulatively, 10 pasture practices and technologies developed and released to ARS customers

2.5.D Develop Improved Germplasm and Management Practices for Sustainable Turf Systems.

Baseline 2012	Target 2017
1 improved germplasm that enhances turf management including improving the environment and reducing the risk of climatic uncertainty	Cumulatively, 5 improved germplasm releases or improved management practices developed and released to ARS customers

Measure 2.2.5 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 4 new technologies adopted for uses that provide improved germplasm for climatic variability, and more effective conservation and restoration practices.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
A surfactant seed coating (SSC) formulation that is effective in treating soil water repellency, increasing soil water availability, and improving seedling establishment in wildland, turfgrass, and agricultural systems.	The technology was discovered through a Cooperative Research and Development Agreement (CRADA) with Aquatrols Corporation of America	Customers planting in areas with limited irrigation and/or rainfall. Potential markets include 1) turfgrass golf-course greens, sport fields, and lawns, 2) home gardens, 3) various agricultural row crops, 4) cereal crops, 5) forage grasses and legumes, 6) cover crops, 7) bedding and cut flowers, and 8) wildland restoration.	The potential for improved moisture availability along with improvements in plant establishment will play a pivotal role in restoring areas affected by severe drought and/or wildfire conditions.
Ecologically Based Invasive Plant Management Program tools and demonstration for land managers, educators and students.	Oral and poster presentations at professional meetings; field tours for teachers and students; restoration seminar for teachers, students and management professionals.	50 restoration specialists and students at Colorado State University (CSU), ~200 grammar school and high school students and teachers.	Development of more effective tools for restoration planning and management; outreach to students on careers in natural resource management.
Development of dihaploid tall fescue lines utilizing a novel L. multiflorum "inducer" line that exhibits genome loss of the maternal Lolium parent when hybridized with L. arundinaceum (tall fescue).	Over 400 dihaploid derivatives were generated and forwarded to the cooperator for transplantation to the nursery in Albany, OR.	Barenbrug USA (cooperator)	Dihaploids with superior agronomics are increased by the cooperator and placed into hybridization trials. The eventual impact of this effort is to generate superior lines of tall fescue germplasm or cultivars with wide adaptation to the environmental

			stresses of the Southern Plains Region of the USA.
The technology is an integrated system for processing biomass on-farm, and for collection of an enriched liquid product stream that includes solvents and other value-added chemicals.	A provisional process patent was filed by the University of Kentucky (employer of 5 of the 6 inventors).	Interest was expressed by a group associated with the Von Allmen Center for Entrepreneurship, but they have not acquired the IP.	A business plan was drafted based on the technology. The business plan has won 2 regional awards.

Measure 2.2.5: Develop and transfer economically viable and environmentally sustainable production and conservation practices, technologies, plant materials and integrated management strategies, based on fundamental knowledge of ecological processes, that conserve and enhance the Nation's diverse natural resources found on its range, pasture, hay and turf lands.

During FY 2015, ARS will:

Provide improved germplasm and cultivars can be released for pasture, harvested forages, turf, biofuels, rangeland restoration, and conservation.

Provide forage, pasture, and rangeland management technologies and strategies that reduce inputs while improving livestock performance and sustaining the environment.

During FY 2016, ARS will:

Provide improved germplasm and cultivars can be released for pasture, harvested forages, turf, biofuels, rangeland restoration, and conservation.

Provide forage, pasture, and rangeland management technologies and strategies that reduce inputs while improving livestock performance and sustaining the environment.

During FY 2017, ARS will:

Provide improved germplasm and cultivars can be released for pasture, harvested forages, turf, biofuels, rangeland restoration, and conservation.

Provide forage, pasture, and rangeland management technologies and strategies that reduce inputs while improving livestock performance and sustaining the environment.

GOAL 2.6 – DEVELOP INTEGRATED SOLUTIONS TO SOLVE CHALLENGES RELATED TO AGRICULTURAL SYSTEM PRODUCTIVITY, PROFITABILITY, ENERGY EFFICIENCY, AND NATURAL RESOURCE STEWARDSHIP. (AGRICULTURAL COMPETITIVENESS & SUSTAINABILITY – NP 216)

Profitable farms are the basis of vibrant rural economies. Consumers benefit from agricultural production that provides abundant choices of products at relatively low costs. Even though commodity prices are now high, many farms still have difficulty responding to changing market conditions, and the high costs of fuel and other purchased inputs. In addition, there is increasing competition from overseas markets where production costs are comparatively low. At the same time, continued advancement of conservation goals is needed to enhance the natural resource base upon which the nation not only depends for food, feed, fiber, and renewable energy, but also for supplies of fresh water, clean air, and healthy ecosystems. The challenges producers face regarding productivity, profitability, and natural resource stewardship are complex, so the solutions to these challenges will not be simple.

Producers and natural resource managers need holistic solutions to the complex problems they face. Not only do they need to decide what the best production methods, improved varieties, and advanced technologies to use, they want to know how these innovations can be best incorporated into their operations and whether their investment will increase their ability to compete in the market. Though many of the problems producers face are the same across the country, it is accepted that each region and every farm is different, so there are no "one-size-fits-all" solutions.

These challenges are not unique to the United States. The United Nations Food and Agriculture Organization (GAO) addressed similar issues in their Strategic Framework 2010-2019 (ftp://ftp.fao.org/docrep/fao/meeting/017/k5864e01.pdf). Strategic Objective A – Sustainable Intensification of Crop Production – seeks to increase production per unit land area to meet world food needs and "requires the integration and harmonization of all appropriate crop production policies and practices aimed at increasing crop productivity in a sustainable manner, thereby meeting key millennium development goals aimed at reducing hunger and preserving the natural resources and environment for future use."

Interdisciplinary systems research provides an approach to understand how different kinds of farm enterprises function, and how changing or introducing new technology will affect their productivity, profitability, energy efficiency, and natural resource stewardship. Finding the best combinations of practices will help producers achieve their production goals, while enhancing the environmental goods and services derived from agricultural lands. Diverse and dynamic agricultural systems are needed that can adjust to changing environmental and market conditions to increase the long-term financial viability and competitiveness of farms, enhance natural resource quality, contribute to the vibrancy of rural communities, and increase the food, fiber, and energy security for the Nation and the world. This research will contribute to making sustainable intensification of agriculture a reality.

Performance Measure

1.2.6 Develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship.

Indicator 1: ***During 2014, ARS will develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship.***

FY 2014 Accomplishments*:*

1. Growers in this production zone of the Pacific Northwest have not been planting winter canola because of poor stand establishment in summer fallow. An ARS agronomist at Pullman, Washington, conducted a five year study in which winter canola was planted at four pounds per acre in August when air temperatures were about eighty-five degrees Fahrenheit for several days. He found that canola stand establishment and subsequent yield were improved greatly over conventional planting methods.

   Impact: During the study period, growers in two northern Washington counties increased winter canola acreage from less than hundred acres to more than eleven thousand acres. The new management strategy simultaneously increases crop production, reduces soil erosion and increases economic returns to the growers – all goals of sustainable agriculture.

2. Agricultural producers can use variable-rate application technology to vary N fertilizer within farm fields. ARS researchers with the Soil and Water Conservation Research Unit in Pendleton, Oregon, and Montana State University, estimated changes in costs and net returns associated with variable-rate N application on spring wheat in eight northern Montana farm fields. They found little evidence that variable N application improves agronomic returns and profits, or reduces N use under the water-limited conditions found in northern Montana. The reasons can be traced to modest yields, low yield response to applied N, and inability to accurately predict N fertilizer requirements. These results suggest this technology cannot be cost effectively utilized by producers in areas of low rainfall to accommodate crop variability.

   Impact: The lessons learned from the study increase consumer awareness and enable growers to make informed spending decisions when investigating variable rate technology strategies for increased yields, environmental enhancement, and profitability.

3. Small-scale organic vegetable farmers often broadcast cover crop seed to establish cover crops but lack information on the most effective implements to incorporate the seed into the soil. Experiments were conducted with winter and spring-sown cover crops to compare drilling versus broadcasting methods for establishing mixtures of rye and vetch. ARS researchers in Salinas, California, determined that the cultivator and rototiller are preferable implements to incorporate broadcast seed on beds, and that 50% to 100% higher seeding rates are needed for broadcasting than drilling.

   Impact: This research provides growers with information on the most efficient means of establishing cover crops on raised beds, and the implications of planting method on seed costs.

4. Farmers are hesitant to use cover crops due to establishment costs even though cover crops enhance ecosystem services. ARS Researchers in Watkinsville, GA and Beltsville, MD conducted a 4-year study evaluating cotton productivity following a winter rye cover crop grazed in the spring by cattle or killed with a roller-crimper before planting. Cotton yields tended to be better in the non-grazed treatment but were significantly different only during 2009. Differences between grazed and non-grazed returns ranged from $10 to $143 per acre annually and averaged $33 per acre when based on market year prices. Although negative effects of soil compaction were observed when spring rains caused poor grazing conditions, returns from grazing had the potential to offset establishment costs of a rye cover crop, and increase profits.

   Impact: Grazing of cover crops offers opportunities for soil conservation, greater economic stability through diversification, and potentially greater profit for producers.

5. Removal of nutrients from dairy manure is a beneficial strategy to reduce nutrient contamination around dairies and supply nutrients to potato and other crops. ARS scientists in Prosser, Washington, conducted laboratory, greenhouse and field studies to characterize and determine the nutrient dynamics, plant availability and environmental impacts of nutrients recovered from Anaerobic digested (AD) systems, biochar filter media and co-products applied to soil. Nutrients recovered from AD can supply sufficient nitrogen, phosphorus and potassium to potato, sweet corn, wheat and beans. Phosphorus availability was comparable to commercial mono–ammonium-phosphate fertilizer. Yields were comparable among treatments.

   Impact: The use of recovered nutrients for crop production provides a viable alternative source for fertilizer that can reduce farmer input costs, and defines value for dairy manure. The results offer options for sustainable agriculture systems.

6. Assessing how land use alters water quality of nearby streams and rivers is an important aspect of pollution monitoring and natural resource stewardship. Tools are needed that can quantify how land use alters stream and river water quality over long time periods. ARS scientists in Corvallis, Oregon, collected data over an 8-year period to define 56 land use patterns of crops, forests, and urban development that represented 99 percent of the Willamette River Basin of western Oregon. The data collected were incorporated into the Soil and Water Assessment Tool model. In validation tests, the model showed an increased capability to predict how land management altered nutrient and sediment load in streams and rivers.

   Impact: A tool is now available during land management planning that enables determination of the environmental consequences of changing land use patterns within across landscapes within watersheds. This technology has been a high priority need for NRCS, as projections of long-term consequences of management practices across landscapes has been needed to ensure agroecosystem sustainability.

Performance Targets

2.6.A Develop new strategies and technologies to reduce production costs and risks of economic losses for agronomic and bioenergy crop production systems.

Baseline 2012	Target 2017
Description of baseline systems for regional agronomic crop production systems.	Identify five new region-specific agronomic crop production system configurations that utilize on-farm resources and natural ecosystem processes to reduce the need for purchased inputs and reduce whole-system costs and risks.

2.6.B Develop new specialty crop management strategies to reduce production costs but have neutral or positive impacts on yield, product quality, and risk of economic loss.

Baseline 2012	Target 2017
Description of baseline condition for region-specific specialty crop production systems.	Identify four new region-specific production system configurations for new crops that utilize on-farm resources and natural ecosystem processes to reduce the need for purchased inputs and reduce whole-system costs and risks.

2.6.C Develop new strategies that integrate crop and livestock production elements to reduce risks of economic loss, diversify income, and enhance environmental benefits.

Baseline 2012	Target 2017
Description of baseline conditions for integrated crop-livestock production systems.	Identify two enhanced region-specific system configurations that take advantage of the complimentary benefits of combining crop and livestock production enterprises to reduce the need for purchased inputs and reduce whole-system costs and risks.

2.6.D Develop and integrate technology and decision support tools to increase production system efficiency.

Baseline 2012	Target 2017
Single natural resource and plant growth assessment models calibrated for local conditions.	Natural resource assessment and plant growth models applied to regional crop production systems and integration of economic factors.

Measure 1.2.6 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on 6 new technologies adopted for uses that provide management strategies to increase sustainability and economic viability.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
New management strategy for winter canola cover crop increases yield, and	Presentations at grower meetings	Pacific NW growers, NRCS	Acreage of harvestable cover crop expanded from several hundred to

protection against soil erosion			11,000 acres for greater economic returns and protection of soil.
Assessment of profitability of variable-rate nitrogen (N) application on dryland wheat	Science journal papers, conference presentations	Northern Great Plains growers, precision agriculture industry	Increased consumer and industry awareness of the economic viability of using variable rate technology - helping to maintain grower economic viability.
Most efficient means of establishing cover crops on raised beds, and the potential implications of planting method on costs.	Presentations at grower meetings	Small-scale specialty crop growers	Decision-making support for sustainable production and economic viability of small-scale specialty crop growers.
Economic viability of establishing cover crops offset by grazing the cover crop.	Science journal papers,	Cotton growers	Additional incentive for soil conservation via cover crops greater economic stability through diversification, and potentially greater profit for producers.
Technology to predict how land management alters nutrient and sediment load in streams and rivers.	Science journal papers	NRCS, land managers	Provided study area (99 percent of the Willamette River Basin of western Oregon) with information needed for land use and conservation decisions. Provides a tool for others to conduct the same analysis.
Nutrients recovered from anaerobic digesters as a viable source of sufficient nitrogen, phosphorus and potassium for crop production.	Science journal papers, presentations to grower groups	Dairy producers, potato, sweet corn, wheat and bean growers	Verifies the value of, and offers, alternative nutrient sources for sustainable economic and environmental viability of producers.

Measure 1.2.6: Develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship

During FY 2015, ARS will:

Develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship.

During FY 2016, ARS will:

Develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship.

During FY 2017, ARS will:

Develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship.

Strategic Goal Area 3:
Crop Production and Protection

Research conducted by ARS's Crop Production and Protection Program (CPP) National Programs will deliver science-based information and technologies to meet

- Producers' needs for increased crop productivity and quality, protection from diseases and pests, and economically and environmentally sustainable methods of crop production;
- Consumers' demands for a ready supply of high quality, safe, affordable and nutritious food;
- Worker's needs for a safe working environment;
- The public's desire to protect the environment; and
- The global community's needs for food security.

To meet these needs, ARS will conduct research that addresses the national priorities of genetic resource conservation, genomics, and genetic improvement; prevention and treatment of plant diseases; identification and management of arthropod and weed pests, including quarantine pests; improved crop management strategies; and the development of methyl bromide alternatives. The research of the Crop Production and Protection National Programs is well integrated with other ARS research in Animal Protection and Production; Natural Resources and Sustainable Agricultural Systems; and Nutrition, Food Safety and Quality. Through the National Invasive Species Information Center and Alternative Farming Systems Center of the National Agricultural Library, key information will be disseminated to agricultural producers, the research and education community, and the general public.

GOAL 3.1 – PROTECT, EXPAND, AND ENHANCE THE UNITED STATES' CROP GENETIC RESOURCE BASE, INCREASE SCIENTIFIC KNOWLEDGE OF CROP GENES, GENOMES, BIOLOGICAL PROCESSES AND SYSTEMS, AND DELIVER ECONOMICALLY AND ENVIRONMENTALLY SOUND TECHNOLOGIES THAT IMPROVE THE PRODUCTION EFFICIENCY, QUALITY, HEALTH AND VALUE OF THE NATION'S CROPS. (PLANT GENETIC RESOURCES, GENOMICS, AND GENETIC IMPROVEMENT – NP 301 & 305).

Crop Improvement

U.S. crop production depends on new and improved varieties of crops—developed faster and for less cost—that are competitive in the market, increasingly tailored to meet the complex demands for food, feed, fiber, ornamentals, and energy; and adapted to an increasingly challenging global climate. To do so, ARS research will harness the inherent genetic potential of plants. This research will develop, and effectively apply, new knowledge of crop genes, genomes, and the control and expression of genes, to accelerate productivity and improve the quality of crops; realized via traditional and novel plant breeding methods.

Genetic resources are the foundation of our agricultural future. ARS crop gene banks contain the sources of resistance to biotic and abiotic stresses and new genes to improve the quantity and quality of food, feed, energy, fiber, and ornamental crops. To ensure that these genes are available for research and breeding, ARS will continue to acquire and conserve crop genetic resources, develop more effective screening methods for identifying superior traits, characterize the genetic profiles of gene bank holdings, ensure that genetic resources are distributed where and when they are needed, and safeguard these collections and their associated information for future generations.

New ARS genetic technologies will address the specific needs for higher crop yields; more durable and effective tolerance to abiotic stresses including drought, heat, cold, freezing, and flooding; more efficient crop use of key inputs such as water and nutrients; more durable and effective pest and disease resistance; control of flowering time; enhanced product composition and nutritional quality; value-added traits; and conversion efficiency to biofuels. ARS research will elucidate how crop traits are controlled by underlying genetic systems, how these traits are affected by environmental factors during crop production, and how to enhance traits by incorporating novel sources of genetic variation from underexploited genetic resources or by genetically-engineering such traits. ARS will devise new crop genetic improvement methods that incorporate advances in genome sequencing and analysis, molecular genetics, computational biology, and metabolic engineering. New crop breeding theories and strategies will be developed to more effectively capture the intrinsic genetic potential of germplasm—especially to improve key agronomic and horticultural traits—resulting in crops tailored for consumer and producer needs.

ARS will continue to lead the development of crop genetic and genomic information management and database systems that broadly support and enhance crop research, from germplasm improvement and breeding to genetic and genomic analyses. New tools will be generated to efficiently incorporate valuable new data into databases, extract key information from the massive quantity of data safeguarded in those databases, identify the important properties of genes, apply that knowledge to crop improvement, and build on genetic advances in one crop so as to accelerate genetic gains in others.

Crop Production

The Nation's economic vitality depends on the ability of U.S. crop producers to grow and market food, fiber, ornamentals, industrial products, feed, and fuels profitably; while enhancing the natural resource base on which crop production depends. Future economic success for U.S. producers depends on increased productivity, access to new markets for specialized products, new technologies that generate new opportunities for U.S. farmers, and new tools and information to mitigate risks and enable rapid adjustments to changing market conditions. The agricultural sector is challenged by a wide variety of resource, climatic, economic, and social factors that require an equally diverse array of strategies and solutions for successfully meeting those challenges.

Contemporary U.S. crop enterprises for annual, perennial, and greenhouse crop production are complex and depend on access to and successful integration of highly diverse components, such as a steady stream of superior crop varieties, new strategies for mitigation of crop losses from biotic and abiotic stresses, and mechanization and automation of undesirable or labor intensive activities. The development of successful new production systems to sustain or increase crop yield and quality requires focusing on 1) productive and profitable crop management strategies for new and traditional crops that conserve natural resources; 2) efficient and effective integrated management strategies for multiple pests; 3) mechanization of management activities to address labor constraints; and 4) improved crop management models and decision aids.

Pollination is a critical element in agriculture as well, because honey bees pollinate more than 130 crops in the United States and add $15 billion in crop value annually. Declining honeybee populations and honey production due to Colony Collapse Disorder (CCD) require special attention. CCD has now increased honey bee mortality to more than 30 percent. Also, as new crops are introduced and stresses on honeybees increase, pollinators will be continuously required for specific crops or protected environments.

Improved production systems must address the needs of small, intermediate, and large field-, greenhouse-, orchard-, and vineyard-based farming enterprises for more efficient conventional, organic, and controlled-environment production methods and strategies. New crop production technologies must increase production efficiency, conserve energy and natural resources, and provide resilience in the face of abiotic and biotic stresses; while maintaining or enhancing productivity and product quality.

Key Outcome: New technologies (such as superior crop varieties; enhanced breeding stock; more effective crop and pest management strategies; improved sensors, robotics, and spray application equipment; improved decision support systems; more efficient production systems) and information that sustain U. S. crop production and enable producers to compete more effectively in the global market place. The U. S.'s national capacity to exploit the genetic potential of crops efficiently and effectively is maintained, and U.S. crop productivity and efficiency are enhanced.

Performance Measure

1.3.1 Develop knowledge, strategies, systems and technologies that maximize the production efficiency of our annual, perennial, greenhouse and nursery cropping systems. Develop new technologies and tools contributing to improving these systems to meet current and future food crop production needs of diverse consumers, while ensuring economic and environmental sustainability and production efficiency, health, and value of our nation's crops.

Indicator 1: ***During 2014, ARS will breed superior new crops, varieties, and enhanced germplasm.***

FY 2014 Accomplishments*:*

1. To meet market demands for healthier cooking oils, research is ongoing to develop and commercialize soybean varieties with the high oleic acid seed oil trait. A major impediment to commercial success of new soybean varieties with improved seed composition traits is the threat of inferior yields associated with the trait. ARS researchers in Columbia, Missouri, crossed the high oleic acid trait with a commercial soybean variety and compared the yields of the resulting new high oleic lines with control varieties, and results from two years of field trials demonstrated high oleic acid soybean lines produced yields similar to the high yielding control varieties. The high oleic lines averaged 80 percent oleic acid in the seed oil compared to 30 percent oleic acid for the control varieties. These results demonstrated that yield potential for high oleic acid soybean varieties was not negatively impacted by the high oleic trait itself.

   ***Impact*:** Breeders are referencing this discovery as they continue to breed new high oleic cultivars. Continued development of high yield/high oleic soybean varieties will provide U.S. producers with expanded opportunities to meet market demands.

2. The presence of acrylamide in processed food products has become a human health concern over the past decade. French fries contain acrylamide, and the potato processing industry has been proactive in reducing acrylamide levels in processed potato products. French fries made from A02507-2LB, an advanced potato breeding clone developed by ARS researchers in Aberdeen, Idaho, and their university colleagues, have 80 percent less acrylamide on average than fries made from the potato variety Russet Burbank, the industry standard. Seed of A02507-2LB is being rapidly increased to allow large-scale industry evaluation. A02507-2LB is also notable for having resistance against all Potato virus Y strains due to incorporation of the Rysto gene, and additionally has resistance to late blight, Verticillium wilt, early blight, and corky ringspot.

   ***Impact*:** The commercial use of A02507-2LB will enhance the sustainability of potato production.

Indicator 2: ***During 2014, ARS will devise innovative approaches to crop genetic improvement and trait analysis.***

FY 2014 Accomplishments*:*

1. The narrow genetic base of the soybean crop limits progress in developing higher yielding varieties. ARS scientists in Urbana, Illinois, discovered and transferred unique yield genes from Glycine tomentella (a very distant, perennial relative of soybean) into cultivated soybean. These two species are so genetically different that direct progeny from these crosses are sterile, and special procedures, including several backcrosses to the soybean parent, were needed to produce fertile progeny. Each new plant from these crosses is likely to have a different complement of G. tomentella chromosomes and could be genetically quite different. In tests at seven locations across four states, 10 lines were identified that yielded significantly more than the commercial soybean parent—as much as by 7 bushels/acre.

   ***Impact*:** This is the first report of soybean lines derived from perennial G. tomentella. Increasing yield is the most important objective for soybean breeders, and the genes to increase yield that were transferred from G. tomentella are now available to soybean breeders for the first time.

2. It is known that variation in the ability of winter wheat to survive the winter months in the field is associated with differences in the vernalization 1 (VRN1) and frost resistance 2 (FR2) genes, but knowledge of how specific forms of the genes influence winter hardiness and possible interactions among them is lacking. ARS researchers in Pullman, Washington, assayed variation in the composition of the genes and the number of copies at the FR2 and VRN1 loci in a large set of winter and spring wheat genotypes from around the world representing a broad range of freezing tolerance. Results indicate that selection of wheat varieties with a specific form of the FR2 gene (the FR-A2-T allele) and three copies of the recessive vrn-A1 allele would be a good strategy for improving frost tolerance in winter wheat.

   ***Impact*:** These findings provide wheat breeders with valuable new molecular tools for improving winter survival in wheat.

3. Cotton cultivars differ in how strongly fibers are attached to the seed, and cultivars with less fiber-seed attachment force can be ginned faster with less energy and fiber damage. ARS cotton breeders and engineers in Stoneville, Mississippi, determined that percent fuzz was correlated with ginning efficiency and that selecting for genotypes with low fuzz percentage resulted in genotypes with better ginning efficiency.

   Impact: This finding will help cotton breeders develop cotton cultivars that gin faster with lower ginning energy requirements and high fiber quality.

4. ARS researchers in Lubbock, Texas, and in Ithaca, New York, identified multi-seeded mutants and related genes with more primary and secondary flowering branches. These have been incorporated into higher yielding sorghum germplasm lines. These discoveries are now enabling public and private sector sorghum breeders to exploit the germplasm lines and related molecular markers to develop new varieties with substantially increased sorghum yields.

   ***Impact*:** These discoveries are now enabling public and private sector sorghum breeders to exploit the germplasm lines and related molecular markers to develop new varieties with substantially increased sorghum yields.

5. Cacao, the source of cocoa, is grown primarily on small farms primarily in West Africa. Production and marketing of specialty, high-value cocoa can provide economic opportunities for growers in the developing world and greater profits for the cocoa/chocolate industry. But to realize those benefits, the varietal identity for high-value cacao, some of which is rather rare, must be authenticated. ARS researchers in Beltsville, Maryland, developed a new method of DNA testing that can identify a cacao variety from a single bean.

   Impact: This new testing method can more efficiently identify high-value cacao for on-farm protection and propagation, and also can authenticate commercial sources for this increasingly high-value product.

Indicator 3: ***During 2014, ARS will expand crop genomic information resources and advanced bioinformatic capabilities.***

1. The Maize Genetics and Genomics Database (MaizeGDB) is the corn research community's central repository for genetic and genomic information. In 2014 a new redesigned version of MaizeGDB was released to the public. The new MaizeGDB provides corn breeders, geneticists and researchers with enhanced access to the global corn community research knowledgebase. MaizeGDB is home to the new maize genome reference assembly (Version 3) with over 25 new information tracks accessible through the MaizeGDB genome browser. Moreover, two tools–CornCyc and MaizeCyc–provide enhanced access to experimentally confirmed and predicted metabolic pathway information and gene interactions for use in crop improvement. In addition, MaizeGDB software and systems technologies were updated to enable access to data stored off-site from within a context-appropriate site. ARS researchers at Ames, IA, Columbia, MO, Albany, CA, and Cold Spring Harbor, NY, collaborated on the new release.

   Impact: The new tools and software will be used by plant scientists to obtain new information on the genetic basis of plant traits and applied to improve corn and related crop species.

2. A key research challenge for soybean breeders and geneticists is to integrate the wealth of genomic data into coherent plant breeding schemes. One important need is understanding the function of predicted genes in the soybean genome. USDA-ARS researchers developed a new online tool available at SoyBase for breeders and geneticists to search and access information about soybean lines with known DNA mutations—a comprehensive tool for searching, visualizing and reporting information for plant lines that contain DNA mutations derived from radiation, transposable elements, or other sources. The mutated plant lines have been extensively characterized in terms of their performance in the field, the chromosomal locations of the DNA mutations, and the predicted genes contained in DNA that have undergone mutations. The new tools in SoyBase enable breeders and geneticists to explore and use these data and associations.

   Impact: This information will be used by breeders and geneticists to generate improved soybean varieties.

3. Sorghum is a major climate resilient crop in the U.S. for feed, forage, and as a biofuels feedstock. Improvements to sorghum through the utilization of natural and induced genetic variation have the potential for rapid impact, through an existing seed industry, and through farmers who are familiar with sorghum as an annual row crop. However, the impacts of sorghum genome sequence variation data has been limited, in part, by how the data was released. USDA-ARS researchers worked with U.S. and international partners to process and increase access to genetic variation from 378 prioritized sorghum accessions in both machine and human readable standard formats. The standard format allows an investigator to visualize the genetic variation information in the context of gene structure and function, providing insight on the functional consequences of the variation. The machine-readable formats

support the ability to operate on the data programmatically, support data reuse. Standardization and integration with gene structure and function, increases accessibility, reuse of the data, and increasing the value of the initial investment.

Impact: Improved accessibility of the sorghum variation will support insights into genome evolution, ease of reuse for genotype and phenotype analysis, and accelerate germplasm improvement through biotechnology and marker assisted breeding.

4. Global demand for peanuts–the protein-rich, nutrient-dense food and oil crop–continues to increase domestically and globally. The genomes of two of the closest wild relatives of peanut were recently assembled by USDA-ARS scientists and their collaborators as part of the ongoing international effort to sequence the peanut genome. The two genome sequences and related genetic resources are now available at the USDA's PeanutBase.

   Impact: The availability of these two genome sequences will enable breeders and researchers to more rapidly breed varieties that have improved yield, disease resistance, and stress tolerance.

5. USDA-ARS researchers including the GrainGenes and The Triticeae Toolbox (T3) teams, Boyce Thompson Institute, Cornell University, and the Bill & Melinda Gates Foundation partnered to develop a new API to support the exchange of DNA sequence data (genotype) and trait data (phenotype) among crop genomic and genetic databases like GrainGenes and T3. It is a shared, open API, to be used by all data providers and data consumers who wish to participate and will include software tools to analyze the data. The results of this collaboration are being made public as they emerge at http://docs.breeding.apiary.io/.

   Impact: Access to these new software tools can be exploited by plant breeders worldwide to speed-up development of new varieties.

Indicator 4: ***During 2014, ARS will conserve and encourage the use of plant and microbial genetic resources and associated information.***

FY 2014 Accomplishments*:*

1. Oaks, key tree species for many temperate and arid-land forests, furnish highly valuable wood for construction, furniture, and other uses. Endangered oak species require protection in genebanks, but until now, that has been problematic because acorns did not survive under conventional ultra-cold genebank storage conditions. ARS researchers in Fort Collins, Colorado, and their collaborators developed methods for successfully preserving under ultra-cold conditions embryos dissected from acorns of more than 20 oak species.

   ***Impact*:** This breakthrough will enable ARS and other genebanks to effectively protect the gene pool of endangered, highly valuable oak species.

2. The wild relatives of crops provide critical raw material for genetic improvement that underpins crop productivity, but they can be difficult to conserve effectively in genebanks and to protect in the field. ARS researchers in Pullman, Washington, compared the genetic contents of samples from an endangered U.S. wild clover species conserved for 10 years in an ARS genebank with those of the wild populations where they originated. The genetic changes between the wild-collected and genebank samples were minimal.

***Impact*:** If collected adequately, genebank samples could effectively conserve the genetic diversity of an endangered crop wild relative, but continued monitoring of protected field populations is needed to detect genetic erosion and determine when additional collections are required to effectively conserve this valuable germplasm.

Indicator 5: ***During 2014, ARS will expand fundamental knowledge of plant biological and molecular processes.***

FY 2014 Accomplishments*:*

1. Acidic soils constitute 40 percent of arable land in the tropics and subtropics. Aluminum (Al) toxicity in acidic soil stunts and damages root growth resulting in significant reductions in crop yields due to nutritional deficiencies and drought stress. Rice is the most Al-tolerant of the major cereal crops. ARS and university scientists in Ithaca, New York, showed that rice tolerance to Al is due in part to a novel transporter gene (OsNRAT1) that promotes Al sequestration into the root cell vacuole.

   ***Impact*:** OsNRAT1 is sufficient for promoting Al transport in diverse systems from plants to yeast. This knowledge will advance the growing of target crops with Al tolerance in acidic soils using conventional breeding or transgenic approaches.

2. Potential cacao yields are reduced in soil with inadequate potassium levels. ARS scientists at Beltsville, Maryland, developed a method to identify cacao genotypes that use potassium more efficiently employing a sand-culture method. Varied levels of potassium can be applied in the medium and subsequent effects on growth, physiological traits and metabolites of cacao genotypes measured.

   ***Impact*:** Scientists will use this new method to identify potassium-efficient genotypes for cacao improvement programs and also use the results to provide recommendations to cacao farmers for optimal fertilization management practices to improve cacao sustainability and yield. Scientists can use this new method to identify potassium-efficient genotypes for cacao improvement programs and also use the results to provide recommendations to cacao farmers for optimal fertilization management practices to improve cacao sustainability and yield.

3. Fungicide resistance is a looming issue for pecan growers. Recent work by ARS scientists at Byron, Georgia, identified a novel biorational compound with activity against pecan scab. The compound, trans-cinnamic acid, is produced by symbiotic bacteria from the gut of entomopathogenic nematodes. Isolation of the compound, and in-vitro testing, showed it to be 100 percent efficacious in reducing scab.

   Impact: These results will be used to develop better management methods to protect pecan production from disease losses.

Indicator 6: ***During 2014, ARS will develop more effective means for plant biotechnology risk assessment.***

FY 2014 Accomplishments*:*

1. Sharka disease, which is caused by the plum pox virus, has devastated stone fruit production (plum, peach, cherry, and almond) in Europe and periodically threatens the United States. There is no known source of natural genetic resistance to Sharka. When outbreaks are discovered in North America, diseased trees are eradicated by removal at great cost. ARS scientists in Kearneysville, West Virginia, have developed a biotech plum called HoneySweet that is resistant to Sharka. In 2014, EPA approved an

amendment to the registration of HoneySweet that will require ARS, but not nurserymen or HoneySweet growers, to be responsible for registering, keeping records, and reporting production of HoneySweet to the EPA.

***Impact*:** This agreement provides a way forward for ARS to officially release C5 HoneySweet plum as an option for plum growers facing a severe outbreak of Sharka disease.

Indicator 7: ***During 2014, ARS will develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.***

FY 2014 Accomplishments*:*

1. Conventional spray application technology can require excessive amounts of pesticide to achieve effective pest control in floral, nursery, and fruit crop productions. ARS researchers at Wooster, Ohio, invented an automated, variable-rate, air-assisted, precision sprayer that minimizes human involvement in determining the amount of sprays needed for applications. This intelligent spraying system is able to characterize the presence, size, shape, and foliage density of target trees and applies the optimum amount of pesticide in real time. Field experiments have shown that the intelligent sprayer reduces the variation in spray deposition due to changes in tree structure and species, and it increases the uniformity of spray deposition on targets at different growth stages, as compared to conventional sprayers. The pest control efficacies of the new sprayer are comparable to those of conventional sprayers, while the new sprayer reduces average pesticide use by 46-68 percent, for an annual average pesticide cost savings of $230 per acre. Additional tests in an apple orchard have shown that the new sprayer reduces spray loss beyond tree canopies by 40-87 percent, reduces airborne spray drift by up to 87 percent, and reduces spray loss on the ground by 68-93 percent.

   ***Impact*:** This new intelligent spraying system significantly advances the technology for efficient variable-rate pesticide applications, and offers an environmentally responsible approach to controlling pest insects and diseases.

2. Sugarcane crops must receive proper levels of nitrogen (N) and potassium (K) for profitable yields. ARS scientists at Houma, Louisiana, conducted studies to determine if VR application of N and K could help optimize sugarcane yields, while increasing production efficiency. Results from two years of field trials indicate that VR application of both N and K may offer Louisiana sugarcane producers a viable method to decrease costs, while increasing production efficiency.

   ***Impact*:** Nitrogen rates were decreased by 15-25 percent, and this potential decrease in fertilizer costs could save Louisiana sugarcane producers from 3-4 million dollars.

3. Detection of wood-canker pathogens of grapevines, also called trunk diseases, is only possible at the late stage of infection, when disease symptoms have become obvious and the opportunity for disease prevention is lost. Towards developing an early detection tool, ARS researchers in Davis, California, developed methods to detect grape genes expressed at an early stage of infection before the fungus spreads through the stem.

   ***Impact*:** This new detection tool can be used to identify and facilitate the quick removal of infected plants and better control the disease in both nurseries and commercial vineyards. Growers will benefit who would otherwise bear the cost of unknowingly farming diseased grapevines doomed to a lifetime of low productivity.

4. Salinity tolerance is not available in cultivated potato. Increasing human demand for fresh water resources is putting pressure on fresh water resources for agricultural production, i.e., irrigation and soil salinization is increasing. The development of salt tolerant crops would allow agricultural production to continue with marginal resources (irrigation with brackish water or production on saline soils). ARS scientists in Beltsville, Maryland, have identified salinity tolerance in a wild potato species and documented the expression of several genes involved in salinity tolerance.

   Impact: This salt tolerant germplasm can be exploited to develop commercial salt-tolerant potato cultivars and foster improved production sustainability.

5. Potato Cyst Nematode (PCN) is a quarantine pest that threatens the Idaho potato industry and is extremely difficult to eliminate because it can persist in the soil for 30 years without a host. Currently, the only means of eradication is through soil fumigation. ARS scientists in Prosser, Washington, have confirmed that Litchi Tomato is an effective trap crop against PCN. An improved line with fewer thorns was developed, and large amounts of seed are being increased for use by the Animal and Plant Health Inspection Service in the first field trial in the United States in 2015. ARS scientists identified another potential trap crop in addition to the Litchi Tomato, which is being further characterized. Progress has been made in determining ways to extract compounds from potatoes that have potential to eradicate or control the nematode.

   Impact: These findings have the potential to reduce the threat posed to the U.S. potato industry by PCN without the use of environmentally harmful fumigants.

Indicator 8: ***During 2014, ARS will improve pollinator health, bee systematics and germplasm lines, and pollination.***

FY 2014 Accomplishments*:*

1. In addition to the parasites and pathogens that attack honey bees, poor nutrition adds to honey bee stress and is thought to be a contributing factor to colony decline. When pollen – a source of honey bee nutrition – cannot be collected due to the absence of flowering plants, beekeepers will often feed their honey bee colonies a protein supplement. ARS scientists in Tucson, Arizona, demonstrated that these supplements have less protein than pollen, and are not digested as well by the honey bees. Furthermore, bees in colonies fed protein supplements experienced a higher incidence of disease and queen loss and, overall, had higher mortalities than those colonies that consumed pollen.

   ***Impact*:** These findings underscore the need to supply bees with pollen, and this information will be used by beekeepers and extension agents working with honey bees to ensure colonies are receiving proper nutrition.

2. The honey bee is an important beneficial insect, pollinating crops with an added value of more than $15 billion, and producing honey for human consumption. The health of honey bee colonies is jeopardized by numerous parasites and pathogens, as well as the numerous insecticides and herbicides these plant-visiting insects come into contact with during their foraging activities. ARS scientists in Beltsville, Maryland, found that a diverse variety of chemicals applied to agricultural crops accumulated in beeswax, honey, and in the bees, themselves, and levels of one fungicide used in crops was shown to be correlated with lack of overall colony health.

   ***Impact*:** This information will inform beekeepers, extension agents, agrochemical companies, and regulatory officials interested in honey bee health.

3. Among the parasites that attack honey bees, the varroa mite is considered the most damaging and the biggest threat to honey bee colony survival. Russian honey bees, which are varroa-resistant, were evaluated over a two-year period for honey production and mite infestation in Montana, and compared to non-resistant honey bee lines. ARS scientists from Baton Rouge, Louisiana, reported that while the Russian bees produced less honey per colony (127 lbs) in the second year of the study than the non-resistant honey bees (162 lbs), they still produced more honey than the 60 to 90 lbs per colony reported nationally. Importantly, Russian bees had lower levels of parasitic mites when compared to the colony-threatening levels of mites found in the non-resistant honey bees.

   ***Impact*:** This research demonstrated that mite-resistant honey bees function well under commercial honey-producing conditions and will be useful to the entire beekeeping industry.

4. The bumble bee is a solitary bee species native to the United States. ARS scientists in Logan, Utah, evaluated the ability of different species of bumble bees to pollinate tomatoes grown in greenhouses. They discovered that not only were all species equally effective pollinators, but that tomato plants pollinated by bumble bees produced more and 13 percent larger tomatoes than those plants with no access to these bees.

   ***Impact*:** This information will allow bumble bee producers to better focus their efforts and will inform greenhouse tomato producers of the benefits of using bumble bees as pollinators.

5. The alkali bee is a ground-nesting solitary bee native to the western United States, and is a pollinator of alfalfa. ARS scientists in Logan, Utah, in collaboration with scientists in Washington State, showed that female alkali bees ate pollen at the end of each day, after they had collected nectar and pollen for rearing their offspring. The researchers extended this study to show that a species of mason bee needed to eat pollen in order to develop mature eggs.

   ***Impact*:** This information is useful to individuals and organizations that rear solitary bees for pollination services.

Performance Targets

3.1.A Develop and Maintain Superior Crop Genetic Resources and Associated Information, Genetic, Genomic, Bioinformatic, and Breeding Tools, Techniques, and Analytical Approaches, Crop Production Systems, and Technologies to Harness Crops' Genetic Potential and Optimize Productivity and Profitability of U.S. Crop Production. The Preceding Will Underpin a Safe, Affordable and Sustainable Supply of Nutritious Foods and Superior Crop Products for the U.S. and Other Nations, Protect the Environment, and Contribute Strongly to Global Market Competitiveness of U.S. Agriculture.

Baseline 2012	Target 2017
Ten new technologies are developed by ARS and used by ARS customers, leading to increased production efficiency and enhanced economic value and quality of U.S. crop production, while reducing any negative environmental impact.	Fifty new technologies are developed by ARS and used by ARS customers, leading to increased production efficiency and enhanced economic value and quality of U.S. crop production, while reducing any negative environmental impact.

Measure 1.3.1 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on fifteen new technologies adopted for uses that provide environmentally sound management practices, including crop resistance/tolerance through breeding and biotechnology, rapid and reliable diagnostics, environmentally safe pesticides, and cultural and biological control methods to protect agriculturally important plants from pests and pathogens.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Conventionally bred sweet orange-like hybrid and new rootstocks with tolerance to citrus greening	ARS researchers in Fort Pierce, Florida, released a new hybrid sweet orange with high-quality fruit that displays excellent tolerance to HLB disease. Nine new citrus rootstocks have also been developed that display much higher sweet orange fruit productivity and tree health in field trials in areas that have been severely affected by HLB.	U.S. citrus growers	Release of the tolerant hybrid and rootstocks offers a new option for citrus growers for production management in the presence of citrus greening.
New apple rootstock with tolerance to apple replant disease	ARS and Cornell University researchers in Geneva, New York, have developed and released a new apple rootstock, named G.814, a dwarfing, productive, early bearing, and highly yield-efficient tree. This rootstock is resistant to fire blight and crown rot, two serious diseases that infect apple trees with serious economic consequences. Most importantly, G.814 has shown tolerance to the apple replant disease complex.	U.S. apple producers	G.814 will increase production of larger, high-quality fruit in marginal replanted orchard land, which will help apple producers increase yields and profits.
New common bean with tolerance to low soil fertility	In collaboration with researchers at the University of Puerto Rico, and Cornell University, ARS researchers in Mayagüez, Puerto Rico developed TARS-LFR1, a multiple disease-resistant common bean with superior performance in low-nitrogen soils and with root rot resistance. In addition to root rot, this germplasm has resistance to common bacterial blight and Bean common mosaic virus, and it yields well in association with rhizobia through biological nitrogen fixation.	U.S. and international bean breeders, growers, and consumers	This combination of traits will be valuable for plant breeders who seek to target low-input and organic production systems, in which little to no fertilizer is applied.
Software tool developed to analyze the genetic diversity and relationships in maize.	ARS researchers in Ames, Iowa; Ithaca, New York; and their collaborators developed the software tool TypSimSelector, accessible on the web via the ARS Maize Genome Database, which enables genebank managers, researchers, and breeders to rapidly retrieve highly accurate	Genebank managers, researchers, and breeders	Knowledge of the lines' genetic make-up will enable curators to better manage the U.S. national maize genebank collection and requestors to choose the best genetic

	genetic comparisons of maize lines.		materials for advancing their research or breeding programs.
Eight new high quality cotton germplasm lines.	ARS researchers in Florence, South Carolina, released eight high quality cotton germplasm lines with broad adaptation across the U.S. cotton growing area, to be used for developing the next generation of high quality, commercial cotton cultivars.	U.S. cotton growers, commercial cotton industry	Ultimately, these high quality germplasm lines will serve as a genetic resource to increase U.S. cotton fiber quality and grower profitability.
Pre-harvest sprouting tolerant white wheat developed.	ARS researchers in Pullman, Washington, have developed Zak ERA8, spring white wheat germplasm with improved pre-harvest sprouting tolerance. This is a non-GMO technology that was based on selection for increased sensitivity to the seed dormancy hormone abscisic acid during grain germination.	Wheat farmers	Because this line has increased seed dormancy at maturity, it shows reduced sprouting when it rains, but it loses dormancy rapidly after maturity, allowing farmers to replant their winter wheat grain within 6-8 weeks of harvest without negative consequences.
Herbicide-tolerant lettuce varieties	ARS researchers in Salinas, California, in collaboration with researchers at University of California, transferred resistance to sulfonylurea herbicide (found by scientists at University of Idaho) into five common commercial lettuce types: butterhead, crisphead, green leaf, red leaf, and romaine. Sulfonylurea herbicide effectively controlled weeds but did not damage plants or reduce yield of the herbicide-resistant lettuces.	Lettuce growers	Provides lettuce growers a new tool for weed control and has the potential to establish a novel system of weed management.
Soybean genes that retard cyst nematode development.	Toward providing a longer-term source of genetic resistance, ARS researchers in Beltsville, Maryland, designed and evaluated multiple DNA constructs to provide resistance to both soybean cyst and root-knot nematodes. The DNA segments successfully decreased galls formed by root-knot nematode and cysts formed by the soybean cyst nematode by approximately 70–90 percent.	Soybean breeders and U.S. soybean industry	This new strategy using several gene constructs can now be exploited by soybean breeders to combat nematodes that lower soybean yields, and could be adopted for use with other crop species.
Grapevine yield estimation can be automated	ARS scientists at Prosser, Washington, developed a trellis tension monitoring system that can be used to estimate crop yields that is as good as or better than the current labor-intensive method used for estimating yield. This system monitors the tension in	Grape growers and juice grape industry	Fruit yields can now be estimated before veraison (the onset of ripening) to within 20 percent of actual yields.

	the trellis wire as the fruit increases in size.		
Rotating cross-arm trellis system for blackberry production	ARS researchers at Kearneysville, West Virginia, developed a rotating, cross-arm (RCA) trellis system that allows the vines to be rotated to the ground and covered with a protective, floating row cover as needed to protect dormant vines from extreme temperatures. This new production system reduces the risk of blackberry crop failure and crop losses from extreme and untimely cold temperatures.	Blackberry growers from the Midwest	Since 2010, 120 ha of new blackberry plantings on 40 farms (1- to 10-ha size) have been established from Pennsylvania to Iowa with the RCA trellis system. It is projected that the RCA trellis production system will expand to over 500 ha by 2018.
Gasified rice hull biochar is a source of phosphorus and potassium for container-grown plants.	ARS researchers at Wooster, Ohio, documented that gasified rice hull biochar (GRHB), a waste byproduct of rice processing, could be used as a source of phosphorus in production of ornamental crops in containers.	Greenhouse and nursery producers	Use of this recycled form of phosphorus will reduce reliance on traditional phosphorus fertilizer supplies.
Profitable practices for organic production of highbush blueberries identified.	ARS scientists in Corvallis, Oregon, conducted a long-term field study in collaboration with Oregon State University to evaluate management practices for organic production of highbush blueberry. The cultivars included 'Duke' (early-season) and 'Liberty' (mid- to late-season) and the practices included flat or raised planting beds, two fertilizers at different rates, and three different types of mulch.	Organic blueberry growers	Adoption of these practices will increase growth and early production of the crop, and improve weed control.
What's really in your black raspberry supplements?	Black raspberry products marketed as supplements were analyzed for authenticity and anthocyanin concentration by ARS researchers at Parma, Idaho.	Black raspberry growers and consumers	Results indicate that food sources may be a more reliable method of obtaining dietary phenolics than dietary supplements.
Establishing the host status of litchi and rambutan for the West Indian fruit fly.	An extensive survey of mature fruit collected from the field by ARS researchers in Mayagüez, Puerto Rico, yielded no tephritid fruit fly larvae or pupae. This is a robust indication that litchi and rambutan fruit exported from Puerto Rico do not pose a risk of transporting the West Indian fruit fly to trade destination countries.	Fruit growers in Puerto Rico	As a result of this research, the regulatory agency USDA-APHIS has changed its policies concerning the eligibility of rambutan for exportation from Puerto Rico.
Nest attractant developed for the blue orchard bee	ARS scientists in Logan, Utah, in collaboration with ARS scientists in Fargo, North Dakota, and a pollination company in California identified chemicals that attracted BOB to artificial nesting materials, which led to better nest establishment and improved management of this bee.	Blue orchard bee producers and growers of crops such as almonds, apples, and cherries.	A patent has been filed for this chemical attractant. This information is useful to companies and individuals involved in almond pollination using native bees.

Measure 1.3.1: Develop knowledge, strategies, systems and technologies that maximize the production efficiency of our annual, perennial, greenhouse and nursery cropping systems. Develop new technologies and tools contributing to improving these systems to meet current and future food crop production needs of diversified consumers, while ensuring economic and environmental sustainability and production efficiency, health, and value of our nations crops.

During FY 2015, ARS will:

Breed superior new crops, varieties, and enhanced germplasm.

Devise innovative approaches to crop genetic improvement and trait analysis.

Expand crop genomic information resources and advanced bioinformatic capabilities.

Conserve and encourage the use of plant and microbial genetic resources and associated information.

Expand fundamental knowledge of plant biological and molecular processes.

Develop more effective means for plant biotechnology risk assessment.

Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.

Improve pollinator health, bee systematics and germplasm lines, and pollination.

During FY 2016, ARS will:

Breed superior new crops, varieties, and enhanced germplasm.

Devise innovative approaches to crop genetic improvement and trait analysis.

Expand crop genomic information resources and advanced bioinformatic capabilities.

Conserve and encourage the use of plant and microbial genetic resources and associated information.

Expand fundamental knowledge of plant biological and molecular processes.

Develop more effective methods to enhance biotechnology for crop improvement.

Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.

Improve pollinator health, bee systematics and germplasm lines, and pollination.

During FY 2017, ARS will:

Breed superior new crops, varieties, and enhanced germplasm.

Devise innovative approaches to crop genetic improvement and trait analysis.

Expand crop genomic information resources and advanced bioinformatic capabilities.

Conserve and encourage the use of plant and microbial genetic resources and associated information.

Expand fundamental knowledge of plant biological and molecular processes.

Develop more effective methods to enhance biotechnology for crop improvement.

Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.

Improve pollinator health, bee systematics and germplasm lines, and pollination.

GOAL 3.2 – PROTECT OUR NATION'S CROPS (PLANT DISEASES, CROP PROTECTION & QUARANTINE – NP 303 & 304)

Introduction and Background to Crop Protection: Economic losses of agricultural crops and natural ecosystems due to arthropods, plant pathogens, nematodes and weeds are considerable, with estimates in the tens of billions of dollars each year to agriculture, landscapes, and forests in the United States. Losses are due to reduced yields, lower product quality or shelf-life, decreased aesthetic or nutritional value, and food and feed contaminated with toxic compounds. Pest management strategies include cultural, biological, physical, and chemical methods. Non-chemical methods based on biological knowledge continue to expand, but the United States continues to depend heavily on chemical control to produce agricultural commodities. For instance, in 2007 over 850 million pounds of pesticides (including herbicides, insecticides, fungicides, and nematicides) were applied to agricultural crops in the United States to protect these commodities from pests and pathogens (Pesticides and Industry Sales and Usage; 2007 and 2007 Market Estimates, EPA).

Maintenance of our arsenal of valuable management strategies is a constant challenge, as inherent disease and pest resistance in crops declines while pests become resistant to chemical controls, new pest problems emerge, new regulatory requirements are enacted, and production costs increase with rising energy costs. Further, the problem of losses due to pests and plant diseases does not end in the field or with the harvest. Insects and diseases reduce the quality of stored grain and other stored products, and it is estimated that post-harvest losses to corn and wheat alone amount to as much as $2.5 billion annually. Pests and diseases can also impede foreign trade. Imported commodities as well as those destined for export must be protected from endemic and exotic pests. Exotic insect, disease, and weed pests that threaten our food, fiber, and natural ecosystems are another mounting concern, as world trade and travel continues to expand. Invasive species such as the brown marmorated stinkbug and the Asian soybean rust directly threaten our agricultural crops, while other invasive insects transmit devastating viral and bacterial diseases, like citrus greening, that threaten entire agricultural industries. Still other invasive insects such as the Asian longhorned beetle and the sudden oak death pathogen decimate our forests and urban landscapes, while invasive weeds reduce biodiversity, displace native species, and cost billions of dollars to control annually. Management of arthropod pests, plant diseases, and weeds is essential for providing an adequate supply of food, feed, fiber, and ornamental crops, but effective control depends on understanding the biology and ecology of these deleterious organisms as well as beneficial ones.

The Action Plan Guides Strategic Plan Development:

- **Plant Pathogens and Nematodes**: Numerous, diverse approaches are needed to protect our crops from arthropods, plant pathogens, nematodes and weeds. To manage plant pathogens and nematodes, ARS will: 1) develop and improve rapid and reliable methods for detection and identification of plant pathogens and nematodes.; 2) enhance knowledge of the etiology of plant diseases and systematics of their pathogens; 3) provide in-depth knowledge of the biology, ecology, and epidemiology of plant pathogens and their interactions with hosts and vectors to identify targets for new disease management strategies; 4) develop and deploy host resistance against plant diseases and nematodes, and 5) develop biologically-based and integrated disease management strategies.

- **Weeds:** To reduce the impact of weeds on the nation's agricultural and natural systems, ARS will 1) develop novel weed management solutions to control the reproduction and spread of invasive and weedy plants—based on new knowledge derived from plant genomics, biochemistry, and physiology; 2) expand integrated weed management programs by incorporating newly identified natural products or natural enemies, such as fungi, bacteria, viruses, nematodes, and insects; 3) determine the mechanisms of herbicide resistance in weeds and enhance knowledge of the biology, physiology, and ecology of weeds, so as to develop cropping system methods that mitigate herbicide resistance development and spread; 4) develop spatial models to

monitor and control invasive plants in complex landscapes; 5) develop recommendations for restoring natural systems in ways that prevent weed invasions following effective biological control; and 6) identify effective weed management solutions for reduced tillage, low herbicide input, and organic production systems.

- **Arthropods:** To ensure the cost effective management and control of native and invasive arthropod plant pests, ARS will 1) develop new bioinformatic tools that enhance insect species identification; 2) identify genetic, biological, and ecological determinants of plant insect pests that can be manipulated to improve their control; 3) determine critical factors involved in disease transmission by insects; 4) improve insect monitoring and capturing methodologies by identifying, synthesizing, and field-testing semiochemicals, 5) develop new biological, chemical, and cultural methodologies to control plant insect pests, 6) improve or develop sterile insect technique technologies to eradicate insect pests; and 7) develop systems for rearing natural enemies that have been demonstrated to be effective and safe biological control agents.

Key Outcomes: The key outcomes of this research will be the knowledge and improved capacity needed to protect plants in agricultural and natural systems –including the safe production and trade of food, feed, fiber, ornamentals, industrial products, and biofuels. This research and the transfer of resulting technologies will provide globally competitive and sustainable agricultural systems, safe and nutritious food, and healthy landscapes.

Performance Measure

4.3.2 Provide scientific information to increase our knowledge of plant genes, genomes and biological and molecular processes to protect crops and cropping systems from the negative effects of pests and infectious diseases. Develop sustainable control strategies for crop pests and pathogens based on fundamental and applied research that are effective and affordable, while maintaining food safety and environmental quality.

Indicator 1: ***During 2014, ARS will continue to identify and characterize genes of insect, nematode, and plant pathogen resistance in crop plants, closely related non-crop species, and other species, to enhance opportunities for developing host plant resistance, and to incorporate such genes into commercially acceptable varieties.***

FY 2014 Accomplishments*:*

1. Sugarcane producers and industry need access to new genetic crop diversity to thwart numerous endemic and invasive pests, to diversify onto marginal land, and to adapt to climatic change. However, sugarcane germplasm imports to the United States have been restricted to “seed cane,” or cane pieces, which has limited U.S. access to genetic diversity. In 2014, ARS scientists in Houma, Louisiana, and in Canal Point, Florida, working with university and international sugarcane researchers, determined the risk of importing pathogens on true seed (termed “fuzz”), which was previously unknown. All test results were negative, and no seedling from parents infected with known pathogens was found to be infected. These results contributed to a decision made by APHIS that fuzz can now be imported into the United States under approved protocols.

   ***Impact*:** Major new genetic diversity can now be provided to all sugarcane breeding projects in the United States which will help cane producers manage disease, respond to climate challenges, and protect profits.

2. Ug99 wheat stem rust has not yet been found in the United States, but it is spreading overseas and is considered a potential threat to up to 90 percent of the wheat varieties currently available that do not

have genetic resistance. Durable resistance to wheat stem rust in adult wheat plants is highly desired to protect wheat production from major stem rust losses. In 2014, ARS scientists in St. Paul, Minnesota, identified and determined that a combination of genetic factors can confer adult resistance to wheat stem rust in wheat varieties adapted for the United States.

Impact: Results can be used by wheat breeders to develop new wheat varieties with even more effective genetic resistance to Ug99 and other wheat stem rusts.

3. In the western United States, sugarbeet yields can be reduced by fungal infections of powdery mildew. The quinone outside inhibitor (QoI) class of fungicides is typically used to control powdery mildew, but in some experimental plots near Parma, Idaho, researchers noted a reduction in its efficacy. ARS scientists in Fargo, North Dakota, and industry plant pathologists determined that this is the first identification of QoI resistance in powdery mildew in the United States. They also identified a specific gene mutation in all QoI-resistant strains of the fungus, a discovery that provides the foundation for using molecular-based techniques to identify QoI-resistance.

   ***Impact*:** These findings will enhance efforts to manage fungicide resistance in sugarbeet production and support efforts to optimize fungicide rotations for effective disease control.

4. The potato cyst nematode (PCN) is increasingly responsible for economic losses in the U.S. potato industry, and the most effective and environmentally sound approach for controlling the PCN is improving host resistance. ARS researchers in Ithaca, New York, in collaboration with potato breeders in Aberdeen, Idaho, have developed Huckleberry Gold, a specialty market potato cultivar with resistance to PCN and potato virus X.

   ***Impact*:** Potato producers can use this new resistant cultivar to reduce losses associated with PCN and support eradication efforts in the United States.

5. In the United States, combined soybean yield losses from the soybean cyst nematode (SCN) and several damaging fungal diseases (charcoal rot, stem canker, sudden death syndrome, and Frogeye leaf spot) are estimated to be nearly $1 billion. Although soybean cultivars with SCN resistance have stabilized some yield losses, nematode populations have evolved that are now able to infest the resistant cultivars. ARS researchers in Jackson, Tennessee, developed and released a new soybean line, JTN-5110, that yields from 62 to 66 bushels/acre and has resistance to SCN and the fungal diseases.

   ***Impact*:** Growers have been anticipating a cultivar with these combined traits and are adopting the new release for more effective SCN management. This release also is being used by soybean breeders as an excellent breeding parent to develop improved cultivars.

Indicator 2: ***During 2014, ARS will continue to develop fundamental knowledge about biology and ecology that provides the foundation for strategies to exclude, accurately detect and identify, and mitigate arthropod and nematode pests, weeds, and plant pathogens.***

FY 2014 Accomplishments*:*

1. Although many nematodes cause significant crop losses, other species feeding on fungi or other microorganisms are beneficial to agriculture. One major agricultural problem is that the beneficial species of nematodes that might be used as biological control are often unknown. ARS scientists in Beltsville, Maryland, in collaboration with scientists from England, described six new species of nematodes (called Rugoster species) associated with rice, weeds, and forests in Nigeria, Ivory Coast,

India, and Australia. They also developed a new diagnostic key for identifying these nematodes and related species.

***Impact*:** This diagnostic key can help scientists advance the use of beneficial nematodes in agricultural soils.

2. Citrus variegated chlorosis, which is caused by Xylella fastidiosa, is an important bacterial disease of citrus in South America and a potential threat to citrus producers in the United States. ARS researchers in Beltsville, Maryland, collaborated with citrus researchers and Fundecitrus of Sao Paulo, Brazil, to determine if chlorosis can be transmitted by seed. Researchers at Fundecitrus extracted seeds from healthy and diseased sweet orange fruit and sent the seeds to Beltsville, where ARS researchers determined that the Xylella fastidiosa pathogen is not transmitted to seedlings through infected seed.

   ***Impact*:** Results provide new information on how citrus diseases are transmitted and help the citrus fruit producers involved in international trade manage threats posed by plant disease.

3. Citrus greening is now found in all citrus growing regions of Florida and has reduced the production of marketable fruit by more than 50 percent. This disease is transmitted by a small insect that sucks plant juices, the citrus psyllid. However, in 2014, ARS researchers at Ft. Pierce, Florida, identified natural products that block the ability of the psyllid to feed, providing a promising strategy for blocking disease spread. These scientists developed non-transgenic, interfering RNA (RNAi) that blocks feeding, inhibiting the transmission of the disease and the viability of the psyllid. The RNAi can be applied to trees as a root drench or by trunk injection, killing psyllids within 2 to 4 weeks.

   ***Impact*:** These results can now be exploited by scientists to develop new effective methods to combat the spread of citrus greening disease.

4. Boll weevil eradication programs rely on pheromone traps to detect incipient weevil populations and to identify when insecticide treatments are needed. Nevertheless, substantial weevil infestations developed in some cotton fields where the surrounding pheromone traps failed to detect any. ARS researchers at College Station, Texas, in collaboration with the Texas Boll Weevil Eradication Foundation (TBWEF) and the National Cotton Council, investigated the quality of pheromone lures used by TBWEF. They determined that some weevil populations produce a unique blend of pheromone and no longer respond to the commercial formulation. As a result of this research, TBWEF adopted a stringent quality testing program and shorter replacement interval for lures in problematic areas, resulting in the successful eradication of boll weevils from the desired areas within three years after implementing the change.

   ***Impact*:** This research eliminated the need for further insecticide applications and led to a reduction of $9 million per year in grower assessments.

5. Invasive, aquatic weeds are severely impacting waterways in the Sacramento-San Joaquin River Delta, increasing water loss due to evapo-transpiration, clogging irrigation and navigation systems, negatively affecting fisheries and mosquito abatement programs, and crowding out rare and endangered species. For example, giant reed (Arundo) and pepperweed cover thousands of acres and consume scarce water resources. However, in 2014, ARS scientists at Albany, California, released two biological control agents in this region. One agent was previously established by ARS in the Lower Rio Grande Basin of Texas, where it is beginning to impact the weed; the other agent is new. ARS scientists also provided scientific input that allowed State and Federal resource managers to implement spatially-specific management

methods for a pepperweed invasion, methods that focused control only where needed, avoiding native plants.

***Impact*:** After three years of treatment, pepperweed has been reduced to trace levels, and an endangered plant in the affected area has increased more than two-fold. These results can now be used to facilitate further collaborative weed control efforts.

Indicator 3: ***During 2014, ARS will perform applied research and development to provide new, useful and safe products to exclude, accurately detect and identify, and mitigate arthropod and nematode pests, weeds, and plant pathogens.***

FY 2014 Accomplishments*:*

1. ARS scientists in Beltsville, Maryland, have built upon existing disease classification systems to develop a Universal Plant Virus Microarray (UPVM) that recognizes all known plant viruses. This virus detection microarray contains DNA material collected from 9,556 individual virus-specific probes, and it was validated for at least 44 plant virus genera and taxonomic groups representing at least 15 virus families. In addition, the correct genus was identified for two recently-described viruses not represented by species-specific probes.

   ***Impact*:** This new assay will be especially valuable for detecting viruses in plants imported to the United States.

2. Cyst nematodes are among several types of plant-parasitic nematodes that reduce yields in dryland wheat fields in the Pacific Northwest and cause over $50 million in annual losses. There are no chemical controls or resistant varieties to control this emerging pathogen. ARS scientists in Pullman, Washington, screened locally adapted germplasm and varieties for resistance in infested fields and optimized a greenhouse screening technique for resistance.

   ***Impact*:** Using these new methods, they were able to successfully identify resistant wheat varieties that can be immediately grown by producers to avoid nematode losses. Wheat breeders can now use these new screening methods to develop improved varieties with even better nematode protection.

3. ARS researchers in Charleston, South Carolina, discovered CGMMV infecting greenhouse cucumbers from Alberta, Canada. This seed- and soil-borne virus was subsequently identified by others in cucurbit seed production fields in California, causing a major concern to the vegetable seed industry and cucurbit producers in the United States. CGMMV is primarily limited to cucurbit species, including watermelon, melon, cucumber, pumpkin, squash, and gourds. CGMMV can be especially problematic due to the ease with which it is transmitted and its stability and long viability in plant debris, in soil, or on greenhouse or equipment surfaces. The damage it causes to the host plant and fruit can be extensive, resulting in substantial yield losses, and limited resistance to the virus exists in commercial cultivars. A real-time molecular diagnostic method was developed by the researchers.

   ***Impact*:** This diagnostic method reliably detects CGMMV isolates and can be applied for seed and plant health tests.

4. Virus populations in U.S. corn and wheat have not been surveyed in Ohio for several decades, but the high-impact outbreak of Maize Lethal Necrosis virus in East Africa now requires monitoring and rapid pathogen detection in the United States. ARS researchers in Wooster, Ohio, surveyed and used DNA

genome sequence data from maize and wheat viruses in the United States and East Africa, working with Ohio State University bioinformaticists, to develop an in-house plant virus DNA identification pipeline. Partial and complete genome sequence data for maize viruses were obtained, including African isolates of Maize Chlorotic Mottle Virus and Sugarcane Mosaic Virus and Ohio isolates of the major U.S. maize viruses, Maize Chlorotic Dwarf Virus and Maize Dwarf Mosaic Virus, as well as new viruses including a maize luteovirus in Africa and the first appearance of Wheat Mosaic Virus (causal agent of High Plains disease) in Ohio.

***Impact*:** Development of these new DNA methods that identify corn and wheat viruses will enable rapid detection of viral strains in the U.S. and help researchers develop more effective control methods to protect corn and wheat from disease losses.

5. The potato psyllid is an insect pest that vectors a potato disease called zebra chip. Potato growers of the Pacific Northwest struggle to control this pest because it invades fields in large numbers every spring, but no one knows where these pests come from. Thus, it is difficult to break the life cycle of this pest and keep populations under control. ARS scientists in Yakima, Washington, discovered that the potato psyllid overwinters as reproductively mature females on bittersweet nightshade, an invasive perennial weed common in the potato growing regions of the Pacific Northwest. The psyllids complete a full reproductive cycle on this weedy host in the spring, before the potato crop emerges.

   ***Impact*:** Knowing where the potato psyllid overwinters will assist growers and pest managers in predicting when and in what numbers the psyllid will colonize their fields, and provide alternative control strategies for this pest.

Performance Target

3.2.A Develop sustainable control strategies for crop pests and pathogens based on fundamental and applied research that are effective and affordable, while maintaining food safety and environmental quality.

Baseline 2012	Target 2017
Technologies produced by ARS were transferred to growers and producers, action agencies, the research community, and exporters and importers of agronomic products to exclude, eradicate and/or better manage disease and pest outbreaks as they occur in the United States or prior to their arrival on our shores.	At least 30 new or improved technologies produced by ARS will be transferred to growers and producers, action agencies, the research community, and exporters and importers of agronomic products to exclude, eradicate and/or better manage disease and pest outbreaks as they occur in the United States or prior to their arrival on our shores.

Measure 4.3.2 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on eleven new technologies adopted for uses that provide rapid and reliable diagnostics; pesticide and cultural and biological control developed and used to protect agriculturally important plants from pests and pathogens; and improved knowledge and understanding of quarantine pest and pathogen biology and epidemiology to mitigate risk of pests and pathogens, resulting in expanded export markets while protecting the safety and security of American agriculture.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
New screening method for severe strains of Citrus tristeza virus (CTV)	ARS researchers receive CTV isolates from the Central California Tristeza Eradication Agency so that the researchers can screen for potentially severe strains	Citrus growers, citrus industry	Being able to identify which trees carry severe strains of CTV ensures that growers only remove trees which will show severe disease symptoms; unaffected trees remain productive
New, patented technology which provides nematode resistance in potatoes	ARS researchers employed plant mediated RNAi technology to silence genes critical for nematode infection, resulting in a nematode resistance potato cultivar	Potato growers, potato industry	Potato growers and the industry are protected from costly losses due to nematode infection
Effective screening tools to accelerate sclerotinia protection in sunflower	ARS researchers with Sclerotinia Initiative-funded collaborators developed field scale inoculation procedures and misting systems to identify sunflower hybrids with resistance to sclerotinia	U.S. sunflower growers of the Northern Great Plains, regional nurseries, oilseed industry	Growers can identify which newly released commercial hybrids have resistance, thus facilitating the release of new oilseed sunflower genetic lines with improved head rot resistance
Identification guides produced for agriculturally important insects and mites	ARS researchers published a book on the Emerald Ash Borer and related species which will be an important tool to aid in the rapid ID of potentially invasive beetles; they also published treatises on new species of parasitic wasps that attack pest moths which may be useful in biological control program and for identification of predatory insects and mites	Farmers, extension agents, State and University researchers, government agencies, and quarantine specialists	Information given is essential to the management of pest insects and mites that attack crops
A new biopesticide containing spinosad and methyl eugenol which is safer to handle than conventional pesticides for	ARS scientists, with USDA-APHIS and state cooperators demonstrated efficacy of the new biopesticide which is now certified and registered in FL and CA	California and Florida fruit growers	New biopesticide can be used in eradication programs should the Oriental fruit fly invade the U.S. mainland

eradication of the Oriental fruit fly			
New lures improve detection of the navel orangeworm	ARS researchers with industry scientists developed the first pheromone lure for the orangeworm; traps baited with it performed better than existing traps	Almond, walnut, and pistachio nut growers in the southwestern United States	Using this lure in detection and monitoring programs will enable growers to more efficiently target control measures
Technique for the cryopreservation of honey bee sperm that yields 100 percent survival after thawing	ARS and NDSU researchers developed the technique which will enable the conservation of honey bee genetic diversity and other bee pollinators	Honey bee and solitary bee industries	Genetic diversity and species preservation, despite the recent drastic decline in numbers of honey bees and bee pollinators
Improved biocontrol strategy for the emerald ash borer (EAB)	ARS scientists developed a mass-rearing procedure for a tiny wasp which parasitizes the EAB, and ARS with US Forest Service and Univ. of Michigan scientists also developed a trap for the wasp	Homeowners, arborists, and tree-care professionals	Reduction in the mortality of ash trees in the United States and in Canada
Post-harvest treatments to control spotted wing drosophila in specialty fruit crops	Post-harvest treatments, including fumigation with phosphine, protect the fruit against destruction by these flies	Growers and exporters of grapes, stone fruits, blueberries, cherries, blackberries, raspberries, and strawberries	Treatments of post-harvest fruit result in retention and expansion of U.S. export markets for specialty crops
Post-harvest treatment controls Hessian fly on hay bales	ARS researchers developed a new quarantine treatment for hay destined for export; the new treatment allows for faster movement of hay bales from processing plants to domestic ports	Hay producers and exporters	Ensures premium quality of U.S. hay exports
Methyl bromide alternative developed for walnut planting	An 8-year trial has been on-going to test whether 1,3-dichloropropene or 1,3-dichloropropene plus chloropicrin are effective as methyl bromide alternatives; the first year yield roughly doubled that obtained by any other combination of alternatives	Walnut growers and industry	Walnut orchard managers will be able to effectively replant walnut orchards in the absence of methyl bromide

4.3.2: Provide scientific information to increase our knowledge of plant genes, genomes and biological and molecular processes to protect crops and cropping systems from the negative effects of pests and infectious diseases. Develop sustainable control strategies for crop pests and pathogens based on fundamental and applied research that are effective and affordable, while maintaining food safety and environmental quality.

During FY 2015, ARS will:

Continue to identify and characterize genes of insect, nematode, and plant pathogen resistance in crop plants, closely related non-crop species, and other species, to enhance opportunities for developing host plant resistance, and to incorporate such genes into commercially acceptable varieties.

Continue to develop fundamental knowledge about biology and ecology that provides the foundation for strategies to exclude, accurately detect and identify, and mitigate arthropod and nematode pests, weeds, and plant pathogens.

Perform applied research and development to provide new, useful and safe products to exclude, accurately detect and identify, and mitigate arthropod and nematode pests, weeds, and plant pathogens.

During FY 2016, ARS will:

Continue to identify and characterize resistance genes in crop plants for insect, nematode, and plant pathogens, to enhance opportunities for developing host plant resistance, and to incorporate such genes into commercially acceptable varieties.

Continue to develop fundamental knowledge about biology and ecology that provides the foundation for strategies to exclude, accurately detect and identify, and mitigate arthropod and nematode pests, weeds, and plant pathogens.

Perform applied research and development to provide new, useful and safe methods and products to accurately detect, identify and diagnose, arthropod and nematode pests, weeds, and plant pathogens.

During FY 2017, ARS will:

Continue to identify and characterize resistance genes in crop plants for insect, nematode, and plant pathogens, to enhance opportunities for developing host plant resistance, and to incorporate such genes into commercially acceptable varieties.

Continue to develop fundamental knowledge about biology and ecology that provides the foundation for strategies to exclude, accurately detect and identify, and mitigate arthropod and nematode pests, weeds, and plant pathogens.

Perform applied research and development to provide new, useful and safe methods and products to accurately detect, identify and diagnose, arthropod and nematode pests, weeds, and plant pathogens.

Strategic Goal Area 4:
Animal Production and Protection

The mission of the ARS Animal Production and Protection (APP) national programs is to provide the scientific information and tools to help support the U.S. food animal industries to continue to compete successfully in worldwide trade, provide the supply of nutritional animal products required by the Nation, and contribute toward global food security. APP will accomplish this mission by maximizing production efficiency and animal health through scientific innovation and the discovery and development of new technologies focused on national priorities. Strategic public-private partnerships will be established to achieve our mission, including support of government action and regulatory agencies responsible for trade, biodefense, and global food security. Emphasis will be given to genetic improvements of traits related to production and production efficiencies and germplasm conservation; understanding the mechanisms of disease resistance, and the development of tools to prevent, control, or eradicate diseases that threaten our food supply and public health; and identifying and developing sustainable systems for production of high quality meat, fish, milk, and eggs that also ensure animal health and well-being. The portion of the program that produces new solutions to the many veterinary problems created by arthropod pests and vectors will be leveraged to solve related problems affecting human health and the well-being of American citizens.

GOAL 4.1 – PROVIDE SCIENTIFIC INFORMATION AND BIOTECHNOLOGIES TO ENHANCE MANAGEMENT PRACTICES THAT WILL ENSURE AN ABUNDANT SUPPLY OF COMPETITIVELY PRICED ANIMAL AND AQUACULTURE PRODUCTS: (ANIMAL PRODUCTION AND AQUACULTURE - NP 101 & 106)

U.S. production systems for food animals and aquaculture face formidable challenges. One of the most exacting challenges is successful adaptation to the accelerating demands of society that impact animal productivity and product quality, including increased production, improved production efficiencies, economic and environmental sustainability, ensuring animal well-being and improved product quality and healthfulness for consumers.

The demands placed on the national system of food animal production by a rapidly changing world can only be met by technologies that optimally harness the inherent genetic potential of animal germplasm in concert with industry stakeholders. Production systems that successfully harness that genetic potential will maximize profits, secure supply, increase market competitiveness, sustain small and mid-sized producers, maintain genetic diversity and increase consumer confidence. These optimized production systems will also ensure the economic and environmental sustainability of animal agriculture while enabling production of animal products adequate to meet the dramatically increased demand for animal products worldwide.

Consequently, the overall mission of ARS animal production and aquaculture systems is to 1) safeguard and utilize animal and microbial genetic resources, associated genetic and genomic databases, and develop robust bioinformatics tools; 2) develop a basic understanding of the physiology of livestock, poultry, and aquaculture; 3) develop improved understanding of nutritional requirements for animals, particularly in aquaculture and improve the efficiency of nutrient utilization for animals; and 4) develop information, tools, and technologies that can be used to improve animal production systems, all to ensure an abundant, safe, and inexpensive supply of animal products produced in a healthy, competitive, and sustainable animal agriculture sector of the U.S. economy.

Performance Measure

1.4.1 Provide scientific information to maximize the production efficiency of our food animal production systems. Develop new technologies and tools contributing to improve those systems to meet current and future food animal production needs of diversified consumers, while ensuring economic and environmental sustainability and animal well-being.

Indicator 1: ***During 2014, ARS will identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.***

FY 2014 Accomplishments*:*

1. With global climate change and increasing demands for animal protein worldwide, there is a need to understand and accelerate the adaptation of agricultural animals to the environment. Cattle breeds in subtropical and tropical regions maintain a stable internal deep body temperature that is indicative of a genetic predisposition toward heat tolerance; furthermore, variations in heat tolerance are evident among different tropical breeds. ARS scientists in Beltsville, Maryland, in collaboration with scientists at United States and foreign universities, identified distinct mutations in genes regulating skin formation, hair growth, and cooler body temperature.

   ***Impact*:** These results are being used by cattle producers to guide breeding decisions and by researchers to better understand the biological processes involved in adaptation to climate change.

2. Maximizing the number of successful pregnancies and live births of healthy offspring are important for sheep farmers. Ewes that lamb for the first time at 1 year of age are more productive over a lifetime than ewes that lamb for the first time at age 2, but there is a low rate of conception in wool-type ewes younger than 1 year. ARS researchers in Dubois, Idaho, with cooperators at Virginia Tech University, developed a genetic-based measurement to establish the rate of pregnancy in a wool breed and identified rams with specific genetic backgrounds that yield a greater number of daughters capable of lambing at 1 year of age.

   ***Impact*:** These measurements will enable wool sheep producers to select elite rams that provide genetic improvement of ewe lifetime productivity by increasing fecundity and decreasing time to lamb production.

3. Commercial salmon producers in the United States use stocks that are only several generations removed from wild, unselected stocks. Because salmon are an endangered species, producers on the East Coast are legally required to culture certified stocks of North American salmon. ARS researchers at the National Cold Water Marine Aquaculture Center in Franklin, Maine, in collaboration with industry, generated a broodstock of fish with North American origin and compared the growth of 4-year classes of salmon from their breeding program with a control line of fish in commercial sea cages. Salmon that were selected for greater growth, resistance to sea lice, and better fillet color, averaged approximately 90 percent larger than the control fish.

   ***Impact*:** Using improved salmon genetics increases the cost-effectiveness, profitability, and sustainability of cold water marine aquaculture in the United States and provides a quality seafood product to consumers.

Indicator 2: ***During 2014, ARS will develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals.***

1. Marek's disease is an extremely contagious viral disease that is capable of causing major losses of chicken, one of the largest agricultural animal commodities in the United States. The disease is currently controlled through vaccines and biosecurity, but enhancing genetic resistance to it would be a more effective mode of disease control. ARS scientists in East Lansing, Michigan, in collaboration with scientists at Purdue University, demonstrated that a subset of genetic markers of Marek's disease had higher accuracy (61 percent improvement) in identifying birds with superior genetic resistance compared with current state-of-the-art methods.

   ***Impact*:** If confirmed in commercial poultry lines, this approach could efficiently select for elite, healthy poultry to generate more economical poultry products for U.S. producers and consumers. The model may also have application in addressing genetic resistance to other infectious pathogens.

2. Ovine progressive pneumonia, a viral disease, is one of the most costly sheep diseases in North America and management schemes to minimize and eliminate the prevalence of this disease are labor-intensive and expensive. ARS researchers in Clay Center, Nebraska, demonstrated that sheep with an unfavorable form of a specific gene associated with susceptibility to ovine progressive pneumonia had a much higher rate of infection compared with sheep that lacked that form of the gene. The scientists developed technology to identify animals with the high-risk gene.

   ***Impact*:** Sheep producers can selectively breed and generate flocks that are genetically less susceptible to ovine progressive pneumonia. This should enhance the health of sheep flocks and increase economic profits for producers.

3. Milk production, one of the largest agricultural animal-based commodities in the United States, is dependent on successful pregnancies and calving. Fertility rates in Holstein cattle, the primary dairy breed in the United States, was declining until recently; this has increased the cost of milk. To improve the prediction of fertility in dairy cattle, ARS scientists in Beltsville, Maryland, have developed computer models from extensive data sets going back to the 1960s that go beyond the previous single-trait, single-breed model to incorporate multiple traits, multiple breeds, inclusive of crossbreds and purebreds, and environment to more accurately predict the effect of genetic backgrounds associated with fertility.

   ***Impact*:** Inclusion of the new model is expected to improve the accuracy of predictions of genetic merit for fertility traits and allow breeders to make faster progress to reverse the decline in pregnancy and calving.

4. Technology to use genomic information for improving selective breeding in dairy cattle and poultry has not yet been developed for rainbow trout. ARS researchers at the National Center for Cool and Cold Water Aquaculture in Leetown, West Virginia, worked with international partners to develop a commercially available genetic marker tool (SNP chip) for rainbow trout. By incorporating genome information, this tool improves performance prediction accuracy for individual fish versus traditional family-based estimates.

   ***Impact*:** Commercial producers will find this information useful and it will accelerate genetic improvements in trout.

Indicator 3: ***During 2014, ARS will develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.***

FY 2014 Accomplishments*:*

1. Submerged aquatic vegetation such as eelgrass provides valuable habitat for fish and invertebrates in estuaries, particularly for juvenile salmon on the west coast of the United States. ARS researchers in Newport, Oregon, used layers of geographic information on tidal heights, cumulative wave stress, salinity, distance to the river mouth, and distance to the nearest channel to quantify the distributions of eelgrass and bivalve aquaculture in Willapa Bay, Washington. The effect of bivalve aquaculture on eelgrass at the landscape scale was measured over a period of 5 years. Although oyster harvest methods had demonstrable effects on eelgrass over time at the individual bed scale, oyster aquaculture reduced eelgrass cover by less than 1 percent in any given year over the entire estuary.

   Impact**:** This information promotes sustainable shellfish culture and is enabling managers and regulators to evaluate the potential effects of existing and expanded oyster aquaculture on estuarine habitat.

2. The primary method for producing fuel ethanol from grains results in a co-product known as distiller's dried grains with solubles (DDGS), which is a low-value ingredient for animal feeds. The standard method results in distiller's grains of high fiber and low protein digestibility, and only a single product being produced. These problems reduce the total revenue from ethanol production and limit the use of the co-product in animal feeds. To improve the value of this co-product, ARS scientists in Aberdeen, Idaho, determined the fate of many nutrients during traditional processing and devised a new method to recover multiple co-products, including a high-protein feed ingredient, a high-ash fraction for mineral supplementation, an oil fraction, and a glycerol fraction.

   Impact**:** Greater value of co-products from ethanol production increases the value generated by using renewable energy and provides valuable nutrients for animal production.

Indicator 4: ***During 2014, ARS will characterize nutrient requirements of food animals; measure nutrient availability of traditional and nontraditional feedstuffs; and develop strategies for improving nutrient use efficiency.***

FY 2014 Accomplishments*:*

1. Temperature and ammonia levels (ammonia is a waste product secreted by fish) often increase dramatically in ponds during summer production of hybrid striped bass in the southern United States. Extended periods of high ammonia result in fish stress, disease, mortality, and significant loss of feeding days as producers attempt to reduce ammonia to manageable levels by reducing feeding or using lower protein diets. ARS scientists in Stuttgart, Arkansas, and Hagerman, Idaho; and U.S. Fish and Wildlife Service scientists in Bozeman, Montana, demonstrated better fish growth and nutrient retention feeding an overall lower (35 percent) protein diet supplemented with limiting amino acids compared with fish fed a higher protein diet. Overall protein levels were decreased, and nutrient retention increased.

   Impact**:** Because protein is the most expensive nutrient, this research has led to lowering feed costs to producers. Feeding less protein also reduces the amount of ammonia secreted by fish.

2. Nitrogen is a key component of protein in diet rations for dairy cattle. Maximum absorption of protein in the gut is crucial to reducing excretion of excessive nitrogen-containing compounds that may constitute greenhouse gases, affect air quality, and ultimately, human health and natural ecosystems. ARS scientists in Madison, Wisconsin, found that milk urea nitrogen (MUN) measures from a lactating cow were significantly correlated with excreted nitrogen values. Previously, MUN was only a method used to monitor feed efficiency in dairy herds or to evaluate the relationships between protein intake of a lactating cow and nitrogen compounds in milk.

   ***Impact*:** These findings demonstrate that monitoring of MUN on dairy farms can be used to optimize animal use of protein in dietary rations; which in turn, can be used to reduce feed costs and negative effects on the environment.

Indicator 5: ***During 2014, ARS will characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.***

FY 2014 Accomplishments*:*

1. Although significant advancements have been made in swine production, better reproduction processes, specifically the identification of newborn females that will be reproductively competent in adulthood, have lagged behind. Previous reports have indicated that a newborn piglet's environment can affect its growth, body composition, and reproductive potential as an adult female pig. In an experiment funded by the National Pork Board, ARS scientists in Clay Center, Nebraska, in collaboration with scientists at Iowa State University and Murphy Brown LLC, identified three criteria that collectively could be used to determine a delay in puberty, increased puberty failure, and detrimental changes in the uterus.

   ***Impact*:** Incorporation of measurements for these criteria in the production setting could be used for early selection of female pigs destined for the breeding herd.

2. The genetic resources archived in the national collection held at Fort Collins, Colorado, underpin the livestock sector and provide researchers with tools for their research. Biodiversity within the collection has increased across food animal species. Of specific interest, six rare breeds of chickens, as well as a valuable research line of chickens, have been preserved through cryopreservation of ovaries and testes from day old chicks.

   ***Impact*:** Underserved chicken producers, who typically raise these specialized rare breeds, now have secured populations through an archived source of conserved biodiversity.

Performance Targets

4.1.A Provide scientific information to maximize the production efficiency of our food animal production systems.

Baseline 2012	Target 2017
Seven research studies on production efficiency published in peer-reviewed scientific journals that contribute evidence to improve food animal production systems.	Cumulatively, 35 new scientific papers will be published in this area of research.

4.1.B Develop new technologies and tools contributing to improved precision animal production systems to meet current and future food animal production needs of diversified consumers, while ensuring economic and environmental sustainability and animal well-being.

Baseline 2012	Target 2017
One new technologies developed and used by ARS customers to increase production efficiency and enhance the economic value and well-being of U.S. food animal production while decreasing the environmental footprint of production systems.	Cumulatively, five new technologies developed and used by ARS customers

Measure 1.4.1 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on five new technologies adopted for uses that provide producers with new or improved means to farm sustainably.

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Novel use of enzyme antimicrobials to cure infections	Invention disclosure; patent filed describing the use of staphylococcal antimicrobial to eradicate staph infections	Dairy farms with Staphylococcus aureus infected herds	Provide a non-antibiotic cure for staph infections
Rainbow trout resistant to bacterial cold water disease	Eyed eggs for fish of this line were provided to	Clear Springs Foods, Inc. Troutlodge, INC.	Resistant fish have higher survival rate under disease

were released to industrial partners	interested stakeholders	Utah Dept. Fish and Wildlife	pressure from Bacterial Cold Water disease
Feed grade oilseed protein concentrates and production methods	Patent filed	U.S. soy producers, fish feed manufacturers	Improved, low cost method was developed to provide inexpensive protein concentrates to the feed industry
Arctic charr line of fish was developed	Germplasm released through a material transfer agreement	Commercial arctic charr producers	Use of improved germplasm will increase the profitability and sustainability of coldwater fish production
Development of split pond production system for catfish	Many written publications and numerous presentations at scientific and industry conferences, personal visits to farms	Commercial catfish farmers	Split pond systems have been rapidly adopted by catfish farmers with over 2000 acres installed in the last 3 years

Measure 1.4.1: Provide scientific information to maximize the production efficiency of our food animal production systems. Develop new technologies and tools contributing to improved systems to meet current and future food animal production needs of diversified consumers, while ensuring economic and environmental sustainability and animal well-being.

During FY 2015, ARS will:

Identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.

Develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals

Develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.

Characterize nutrient requirements of food animals; measure nutrient availability of traditional and non-traditional feedstuffs; and develop strategies for improving nutrient use efficiency.

Characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.

During FY 2016, ARS will:

Identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.

Develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals

Develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.

Characterize nutrient requirements of food animals; measure nutrient availability of traditional and nontraditional feedstuffs; and develop strategies for improving nutrient use efficiency.

Characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.

During FY 2017, ARS will:

Identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.

Develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals

Develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.

Characterize nutrient requirements of food animals; measure nutrient availability of traditional and nontraditional feedstuffs; and develop strategies for improving nutrient use efficiency.

Characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.

GOAL 4.2 - PREVENT AND CONTROL PESTS AND ANIMAL DISEASES THAT POSE A THREAT TO AGRICULTURE, PUBLIC HEALTH, AND THE WELL-BEING OF AMERICAN CITIZENS (ANIMAL HEALTH, VETERINARY, MEDICAL & URBAN ENTOMOLOGY, AND AQUACULTURE NP – 103, 104 & 106)

Investments in animal protection research are critical to the growth and resilience of the supply of food for tomorrow and feed the future initiatives. Enhancing the health of animals in agricultural production systems will directly impact food quality and ensure a sufficient supply of macro and micro-nutrients to meet people's basic needs worldwide. When combined with other investments in agricultural development, research-based innovations will address some of the fundamental constraints that give rise to food insecurity by reducing production risks associated with pests and diseases.

Achieving results in animal protection research in the 21st century will demand a systems biology approach in which knowledge obtained from animal genomes, functional genomics, clinical trials, and epidemiology are integrated in the discovery and development of countermeasures for preventing and controlling disease outbreaks.

Entomological research will concentrate on priority problems affecting animal production, human health, and the well-being of American animals and citizens. The research aims to dedicate 30% of resources to basic research that provides relevant information about target pests and 70% to applied research and product development. The program seeks to attain a balance of skills among its scientists so that it can take full advantage of the latest developments in biology at the same time as applying its efforts to solution of practical problems.

Accordingly, the goal of the ARS animal protection research programs is to protect and ensure the safety of the Nation's agriculture and food supply through improved disease detection, prevention, control, and treatment. Basic and applied research approaches will be applied to solve animal health problems of high national priority. Emphasis will be given to methods and procedures to control animal diseases through the discovery and development of:

- Diagnostics and tools for identification of pests/vectors
- Vaccines
- Biotherapeutics
- Pesticides, repellents, attractants, traps, and other innovative products for pest/vector control
- Animal, pest, and vector genomics applications
- Disease management systems and integrated pest/vector management systems
- Animal disease models
- Farm biosecurity measures
- Applications of global information systems
- Chemical ecology of pests and vectors

Animal protection national programs have eight strategic objectives:

1. Develop an integrated animal, arthropod, and microbial genomics research program
2. Launch research programs to provide alternatives to antibiotics in food animal production
3. Build a technology-driven vaccine and diagnostic discovery research program
4. Develop core competencies in field epidemiology and predictive biology
5. Develop expert collaborative research laboratories recognized by the World Organization for Animal Health (OIE) and the United Nation's Food and Agriculture Organization (FAO)

6. Develop a model technology transfer program to achieve the full impact of our research discoveries
7. Perform the full spectrum of research for improvement of veterinary, public, and military entomology
8. Develop safe and effective methods for prevention of damage caused by arthropods to homes and households

Performance Measure

4.4.2 Provide scientific information to protect animals, humans, and property from the negative effects of pests and infectious diseases. Develop and transfer tools to the agricultural community, commercial partners, and government agencies to control or eradicate domestic and exotic diseases and pests that affect animal and human health.

Indicator 1: ***During 2014, ARS will describe 5 new discoveries or developments significant for their scientific or applied value.***

FY 2014 Accomplishments:

1. Throughout much of the world, mosquitoes transmit a wide variety of disease causing agents that pose a risk to U.S. military personnel deployed overseas. ARS scientists in Gainesville, Florida, worked with the Department of Defense personnel to test the repellent longevity of U.S. Marine Corp and Navy military uniforms impregnated with the insecticide permethrin. The scientists demonstrated that after 50 washings, the treated uniforms still retained their ability to repel biting mosquitoes.

   ***Impact*:** This information is essential to the U.S. Department of Defense in their effort to protect U.S. deployed troops from arthropod-borne diseases.

2. The use of cytokines that stimulate the immune system as alternatives to antibiotics is a promising area for biotherapeutic use to prevent and combat infectious disease. ARS scientists at the National Animal Disease Center (NADC), Ames, Iowa, have investigated the potential value of using the granulocyte-colony stimulating factor (G-CSF) as a potential alternative to antibiotics in food-animal production as a possible candidate for pathogenic bacteria in which neutrophils (white blood cells that are the first line of defense against bacterial infections) can provide protection. G-CSF enhances the production and release of neutrophils from bone marrow and is already licensed for use in humans. A limitation of cytokines is their short half-life, which may limit their usefulness as a one-time injectable in production-animal medicine. ARS scientists found that the administration of recombinant G-CSF induced a transient increase in neutrophils (neutrophilia) in pigs; however, delivery of porcine G-CSF inserted in a replication-defective adenovirus (Ad5) vector significantly increased the neutrophilia pharmacodynamics effect. Pigs given one injection of the Ad5-G-CSF had a neutrophilia that peaked between days 3-11 post-treatment and neutrophil counts remained elevated for more than 2 weeks. Neutrophils from Ad5-G-CSF treated pigs were fully functional based on laboratory tests.

   ***Impact*:** This study demonstrated that porcine G-CSF may be an effective alternative to antibiotics for treating bacterial pathogens that are susceptible to neutrophils.

3. Asian highly-pathogenic porcine reproductive and respiratory syndrome virus (HP-PRRSV), foreign to this country, is a serious threat to our nation's swine and agricultural economy. HP-PRRSV causes more severe disease than the PRRSV strains we have circulating in the United States, but we do not know why. ARS scientists at the National Animal Disease Center in Ames, Iowa, in collaboration with scientists at the University of Denver examined the enzymatic activity of a small part of a viral protein, referred to as a protease. Proteases are enzymes that break down proteins. The scientists found that the HP-PRRSV

region was 40 times more capable of cleaving specific types of a cellular protein called ubiquitin than that of a U.S. strain of PRRSV that causes only mild disease in pigs. Ubiquitin has been implicated in the regulation of many cellular processes, including the control of immune responses.

***Impact*:** This study identifies a potential virulence determinant that may be used to provide a target for vaccine design.

4. Swine influenza A virus is an endemic and economically important pathogen in pigs with the potential to infect other host species including humans. Pigs may also become infected with human influenza A viruses. The viral hemagglutinin (HA) protein binds virus to cells and is the primary target of protective immune responses and the major component in swine influenza A vaccines. However, as a result of genetic mutations known as antigenic drift, vaccine virus strains must be regularly updated to reflect currently circulating strains. Characterizing how different virus strains in pigs are to the seasonal influenza virus strains in humans is also important in assessing the relative risk of interspecies transmission. ARS scientists at the National Animal Disease Center in Ames, Iowa, found that two primary swine influenza virus strains are currently circulating in the U.S. pig population, but with enough diversity between the HA proteins to suggest updates in vaccine strains are needed. ARS scientists identified specific changes in the HA protein that are likely responsible for differences between the two viruses. These changes may be useful in predicting when vaccines need to be updated. The differences between current seasonal influenza H3N2 strains in humans and those endemic in swine is enough that population immunity is unlikely to prevent the introduction of human viruses into pigs and vice-versa, reinforcing the need to continuously monitor and prepare for influenza A viruses.

   ***Impact*:** This study provides key information for predicting the strains of influenza viruses needed to produce effective vaccines against emerging animal influenza viruses that circulate between humans and pigs.

5. Equine piroplasmosis was eradicated from the United States in the late 1980's. However, a recent outbreak in Texas caused significant economic loss to the equine industry and suggested that some ticks indigenous to the United States could play a role in transmission. ARS scientists in Pullman, Washington, in collaboration with Texas A&M University, collected and colonized ticks from horses where the outbreaks occurred. The scientists demonstrated that these indigenous ticks were able to acquire and transmit the parasite to other horses.

   ***Impact*:** These studies confirm that introduction of infected horses into areas of the United States containing competent indigenous vector ticks can result in dissemination of the parasite and thus disease to the equine population in the United States.

Indicator 2: ***During 2014, ARS will form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification.***

FY 2014 Accomplishments*:*

1. The screwworm is a devastating insect pest of cattle that has been successfully eradicated in the United States; however, the rapid and reliable identification of suspected infestations of screwworm maggots is essential in preventing reintroduction. ARS scientists in Kerrville, Texas, collaborated with scientists in Lincoln, Nebraska, to develop a molecular technique for confirming the identity of screwworm maggots

in the first few stages of their development. Using this technique, the researchers were able to distinguish between screwworm larvae and the larvae of other closely-related flies that often infest livestock wounds. This molecular approach provides an important method for the screwworm eradication program when rapid identification and verification of suspicious maggot samples are needed.

***Impact*:** This molecular technique for the morphological identification of immature screwworms will eliminate the unnecessary treatment of outbreaks that are not linked to screwworms, and will save thousands of dollars each month. In the case of a real screwworm outbreak, the reliable identification will ensure a rapid response that contains and eliminates the potentially deadly pest and prevent millions of dollars in livestock production losses.

2. Ovine progressive pneumonia virus is a small ruminant lentivirus that causes long-term, progressively worsening pneumonia and mastitis in domestic sheep. Some sheep have a genetic predisposition resulting in less severe disease from the virus, but there have been no specific genetic tests to predict which sheep these might be. ARS scientists in Pullman, Washington, and Dubois, Idaho, in collaboration with Washington State University, demonstrated that sheep with two copies of a small deletion near the ZNF389 gene were able to control viral replication. This result was observed in multiple sheep flocks under widely differing management and viral load conditions.

   ***Impact*:** This is the first validated genetic marker test for post-infection control of ovine progressive pneumonia virus, which can now be used to breed sheep with better ability to control the virus.

3. *Mycobacterium bovis* is the primary causative agent of tuberculosis (TB) in cattle. A program to eradicate bovine TB began in 1917, however eradication is elusive. Diagnosis of bovine TB remains problematic, especially in the early stages of the disease, where current detection methods rely on skin tests that are not always reliable. Recent work by ARS scientists in Ames, Iowa, discovered several potential biomarkers in the blood of infected cattle that may enable more accurate diagnosis of bovine TB.

   ***Impact*:** Blood tests will facilitate ease of detection and may potentially improve our ability to eradicate this zoonotic disease.

Indicator 3: ***During 2014, ARS will form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.***

FY 2014 Accomplishments*:*

1. The red (RIFA) and black (BIFA) imported fire ants and their hybrids infest over 320 million acres in 14 States, including California, and Puerto Rico. These aggressive, stinging ants are present in high densities and affect multiple economic sectors, including agriculture resulting in greater than $6 billion annually in control and damage repair costs. ARS researchers in Gainesville, Florida, developed a novel approach to pest control based on technology that silences the functioning of a gene critical to the survival of pest ants. The method utilizes a molecular technique (double stranded RNA) to interfere with the target gene's ability to produce a product critical to an insects' survival. This process is called RNAi (RNA interference), and the scientists characterized an insect specific gene in fire ants. Suppression of this gene in fire ants led to significant immature mortality even when the dsRNA was fed first to workers who then subsequently fed developing larvae.

   ***Impact*:** This information supports the use of gene silencing techniques as a method to control fire ants.

2. Enteric septicemia is the most devastating disease affecting the catfish industry. The development of a new vaccine and feed-based delivery platform has resulted in providing exceptional protection against enteric septicemia of catfish with dramatic increases in production efficiency and economic returns. Mississippi State University scientists working in collaboration with ARS scientists developed a mechanized vaccine delivery system that consistently delivered target-immunizing doses in experimental pond trials. The vaccine delivery system was used in commercial field trials during the 2013 production season with excellent results; 2014 production season trials are ongoing.

   ***Impact*:** This vaccine will support catfish producers in efforts to control diseases and manage production costs.

3. From 2009 to the present, outbreaks of motile aeromonad septicemia (MAS) in market-size catfish have occurred in western Alabama and eastern Mississippi with losses estimated to be greater than $12 million. Currently, there are no vaccination methods available to prevent MAS, but they are urgently needed. ARS scientists in Auburn, Alabama, identified secreted extracellular proteins of the bacterium that trigger protective immune responses. Their results show that catfish immunized with the extracellular proteins are resistant to infection and that this immunity persisted for at least seven weeks.

   ***Impact*:** This research provides the foundation for developing an effective vaccine to prevent MAS disease and may help catfish producers contain production losses.

4. Anthelmintic resistance is a major problem in controlling parasites in production animals. Parasites produce proteins that modulate and suppress the host's immune responses providing an environment that is conducive to the parasite's survival. ARS scientists in Beltsville, Maryland, conducted a trial using a recombinant protein against the parasite, Ostertagia. The protein was used to vaccinate a number of animals, which had a high degree of protection against parasite infection and damage. Future studies on a larger number of animals are being planned. In addition to the protein used in these studies, additional potential vaccine candidates have been identified.

   ***Impact*:** Developing vaccines against parasites will help reduce the reliance on drugs that are becoming increasing ineffective in controlling parasites.

Performance Targets

4.2.A Provide scientific information to protect animals, humans, and property from the negative effects of pests and infectious diseases.

Baseline 2012	Target 2017
Seven research studies that had significant impact on the scientific community and/or will lead to new technologies for protection of humans, property, and livestock from harm due to pests or diseases.	Cumulatively, 35 new scientific papers will be published in this area of research.

4.2.B Develop and transfer tools to the agricultural community, commercial partners, and government agencies to control or eradicate domestic and exotic diseases and pests that affect animal and human health.

Baseline 2012	Target 2017
One technology used by the commercial and/or government sectors relevant to the protection of humans, property, and domestic animals.	Cumulatively, transfer five technologies to the commercial and/or government sectors.

Measure 4.4.2 Summary of the Major Technologies Developed, Transferred, and Used in FY 2014:

During FY 2014, ARS reported on three new technologies adopted for uses that provide tools for controlling pests and animal diseases

Describe the Technology	Describe the Transfer	Identify the Customer	Impact
Method for fire ant control	U.S. patent issued	Public, and those affected by fire ants	A new molecular paradigm in insect control
Method for cockroach control	U.S. patent issued	Public, and pest control companies interested in cockroach control	New attractants and repellents that can be used to mitigate the impact of cockroaches
Alternative to antibiotic for treating bacterial diseases of pigs	Research collaboration with pharmaceutical partner	Pork industry	Antibiotic alternative for use in swine production

Measure 4.4.2.: Provide scientific information to protect animals, humans, and property from the negative effects of pests and infectious diseases. Develop and transfer tools to the agricultural community, commercial partners, and government agencies to control or eradicate domestic and exotic diseases and pests that affect animal and human health.

During FY 2015, ARS will:

Describe 5 new discoveries or developments significant for their scientific or applied value.

Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification.

Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.

During FY 2016, ARS will:

Describe 5 new discoveries or developments significant for their scientific or applied value.

Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification.

Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.

During FY 2017, ARS will:

Describe 5 new discoveries or developments significant for their scientific or applied value.

Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification.

Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.

Strategic Goal Area 5:
Equal Employment Opportunity

GOAL 5.1 - Develop a Model Equal Employment Opportunity (EEO) Program that will Provide Infrastructure Necessary to Create and Maintain a Diversified Workplace Free from Discrimination, Harassment, or Retaliation, and Characterized by an Atmosphere of Inclusion and Career Development Opportunities.

Performance Measure

2.5.1 Implement a Civil Rights Program that is fully compliant with all Civil Rights laws, rules, and regulations including DR 4300-010, Civil Rights Accountability Policy and Procedures and EEOC's MD-715 and other USDA and ARS regulations, policies and guidelines.

Indicator 1: ***During 2014, ARS will review and issue annual policy statements regarding EEO/civil rights, anti-harassment, and sexual harassment to promote an environment free from discrimination, sexual or non-sexual harassment, and retaliation to 100 percent of ARS' workforce.***

FY 2014 Accomplishments:

1. The Diversity/EEO, Anti-harassment, and Sexual Harassment policy statements were reviewed and revised in 2014. Each employee received electronic copies of the statements and each were posted on the website of the Office of Outreach, Diversity, and Equal Opportunity (ODEO) http://www.ars.usda.gov/AboutUs/docs.htm?docid=23092. Additionally, each Area Office posted the aforementioned policy statements on their internal websites. The ARS Administrator requires that all policy statements be visibly posted in all work areas to ensure that ARS employees and contractors are aware of their civil rights. For the second year, ODEO coordinated with HRD to place the policy statements into each employee's AgLearn profile for them to certify that they have read and understand the policies.

   Impact: Employees are continuously updated with the most recent policies regarding civil rights and EEO, which will possibly reduce EEO complaints.

Indicator 2: ***During 2014, ARS will develop and submit annual EEO Program Status reports to EEOC and the Department aimed at eliminating barriers to hire women, underrepresented groups based on the Civilian Labor Force (CLF) and persons with disabilities.***

FY 2014 Accomplishments:

1. ARS develops and submits the annual EEO Program Status Report, Management Directive 715 (MD-715) to the Equal Employment Opportunity Commission (EEOC) and the Department. The report is

sent nationwide to the Area ODEO Program Managers, Area Directors, and Business Service Directors. Reports are also submitted electronically to EEOC's newly established electronic system, Federal Sector EEO Portal (FedSEP). In addition, ARS submits a quarterly report to the Department's Office of the Assistant Secretary for Civil Rights. The annual MD-715 is posted on the ODEO website http://www.ars.usda.gov/AboutUs/docs.htm?docid=23090.

Impact: Leadership is kept abreast of the MD-715 which identifies actions to reduce/eliminate barriers preventing ARS to have a diverse workforce and other issues such as leadership grades for the underrepresented.

Indicator 3: ***During 2014, ARS will expand outreach activities in K-12 schools, universities/colleges, and minority serving institutions and organizations that support persons with disabilities providing education about scientific research to increase percentage of underrepresented groups based on the CLF. ARS' goal is to increase the annual percentage of new hires by 75 percent of the following groups compared to the new hire FY 2011 data (goal is noted in parentheses): White female (49); Hispanic male (3); Hispanic female (2); African American male (11); African American female (18); and Persons with targeted disabilities (1).***

FY 2014 Accomplishments:

1. ARS continued to conduct outreach activities in K-12 schools and colleges and universities including the 1862, 1890, and 1994 Land Grant Institutions and minority serving institutions such as Hispanic-Serving Institutions (HSIs), Historically Black Colleges and Universities (HBCUs), and Tribal Colleges and Universities (TCUs). Additionally, the Agency continued to conduct outreach activities with minority serving organizations including but not limited to Society for Advancement of Chicanos/Latinos and Native Americans in Science (SACNAS); Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS), Thurgood Marshall College Fund, Latinos for Hire, the Workforce Recruitment Program (WRP), and the USDA/1890 and 1994 National Scholars Programs.

2. ARS partnered with several student-based organizations in an effort to educate potential applicants about ARS career opportunities; decrease the negative image of agriculture; and increase the number of PhDs received in science, technology, engineering, and mathematics (STEM) disciplines. Furthermore, outreach and recruitment initiatives helped develop and strengthen partnerships with institutions of higher education and minority serving organizations. These initiatives were coordinated with the ARS Office of Outreach, Diversity, and Equal Opportunity (ODEO), including the Area ODEO Program Managers and the Area EEO/Diversity Committees and Special Emphasis Program Managers. ARS staff participated in several of the planned events, including, but not limited to, resume critiques and mentorship.

3. Professional/Science-Based Organizations: Exhibits were set up and hosted at several scientific professional society events for the purpose of showcasing ARS careers and employment opportunities as well as to serve as a major advocate to specific communities and/or organizations, providing educational materials, enhancing not only ARS but also USDA at these events while improving the overall image of USDA with increased positive exposure in order to improve understanding of access to employment opportunities and understanding of ARS's scientific mission.

Impact: Although it is difficult to determine the success of our outreach efforts, ARS continues to build strong relationships with schools and organizations that service underrepresented groups. Our continued involvement and donation of time and service shows our commitment to raising awareness of ARS careers and increasing educational experience for minority groups. Hires for 2014:

Hispanic (6 males and 2 females); ***White*** (72 males and 49 ***females***); *African American/Black* (10 males and 13 females); Asian (2 males and 1 female); Native Hawaiian or Other Pacific Islander (1 male); ***American Indian*** (1 male); and ***Two or More Races*** (2 male). **Note**: Bolded and italicized indicates groups under the Civilian Labor Force. ARS continues to build strong relationships with schools that service underrepresented groups. Our continued involvement and donation of time and service shows our commitment to raising awareness of ARS careers and increasing educational experience for minority groups.

Indicator 4: ***During 2014, ARS will use the Schedule A hiring authority for persons with disabilities and Veteran Hiring Authorities as part of strategy to recruit and retain a diverse workforce. ARS' goal is to increase the annual percentage of veteran new hires by 75 percent or 62 veterans.***

FY 2014 Accomplishments:

1. HRD has reminded hiring managers of the hiring flexibilities and resources available to them for hiring persons with targeted disabilities. The HRD Recruitment Staff developed a brochure and poster for job seekers with disabilities to be used at recruitment fairs and events targeting persons with disabilities and promoting ARS as the employer of choice. As of June 28, 2014, ARS has hired or converted 6 individuals under the Schedule A hiring authority.

2. Sixty-seven (67) veterans were hired (an increase of 8 percent or 5 since 2013). ARS employs approximately 477 veterans.

   Impact: Hiring or veterans increased 8 percent since 2013.

Performance Targets

2.5.1 Reduce/eliminate barriers identified in the MD-715, Annual EEO Program Report.

Baseline 2012	Target 2017
The FY 2011 Area Management Directive 715 (MD 715), Annual EEO Program Report was used as a management tool to identify potential barriers to creating and maintaining a diversified and qualified workplace, and to develop action plans to reduce/eliminate barriers.	Reduce/eliminate barriers identified in the MD-715, Annual EEO Program Report.

Measure 2.5.1: Implement a Civil Rights Program that is fully compliant with all Civil Rights laws, rules, and regulations including DR 4300-010, Civil Rights Accountability Policy and Procedures and EEOC's MD-715 and other USDA and ARS regulations, policies and guidelines.

During FY 2015, ARS will:

Review and issue annual policy statements regarding EEO/civil rights, anti-harassment, and sexual harassment to promote an environment free from discrimination, sexual or non-sexual harassment, and retaliation to 100 percent of ARS' workforce.

Develop and submit annual EEO Program Status reports to EEOC and the Department aimed at eliminating barriers to hire women, underrepresented groups based on the Civilian Labor Force (CLF) and persons with disabilities.

Expand outreach activities in K-12 schools, universities/colleges, and minority serving institutions and organizations that support persons with disabilities providing education about scientific research to increase percentage of underrepresented groups based on the CLF. ARS' goal is to increase the annual percentage of new hires by 75 percent of the following groups compared to the new hire FY 2011 data (goal is noted in parentheses): White female (49); Hispanic male (3); Hispanic female (2); African American male (11); African American female (18); and Persons with targeted disabilities (1).

Use the Schedule A hiring authority for persons with disabilities and Veteran Hiring Authorities as part of strategy to recruit and retain a diverse workforce. ARS' goal is to increase the annual percentage of veteran new hires by 75 percent or 62 veterans.

During FY 2016, ARS will:

Review and issue annual policy statements regarding EEO/civil rights, anti-harassment, and sexual harassment to promote an environment free from discrimination, sexual or non-sexual harassment, and retaliation to 100 percent of ARS' workforce.

Develop and submit annual EEO Program Status reports to EEOC and the Department aimed at eliminating barriers to hire women, underrepresented groups based on the Civilian Labor Force (CLF) and persons with disabilities.

Expand outreach activities in K-12 schools, universities/colleges, and minority serving institutions and organizations that support persons with disabilities providing education about scientific research to increase percentage of underrepresented groups based on the CLF. ARS' goal is to increase the annual percentage of new hires by 75 percent of the following groups compared to the new hire FY 2011 data (goal is noted in parentheses): White female (49); Hispanic male (3); Hispanic female (2); African American male (11); African American female (18); and Persons with targeted disabilities (1).

Use the Schedule A hiring authority for persons with disabilities and Veteran Hiring Authorities as part of strategy to recruit and retain a diverse workforce. ARS' goal is to increase the annual percentage of veteran new hires by 75 percent or 62 veterans.

During FY 2017, ARS will:

Review and issue annual policy statements regarding EEO/civil rights, anti-harassment, and sexual harassment to promote an environment free from discrimination, sexual or non-sexual harassment, and retaliation to 100 percent of ARS' workforce.

Develop and submit annual EEO Program Status reports to EEOC and the Department aimed at eliminating barriers to hire women, underrepresented groups based on the Civilian Labor Force (CLF) and persons with disabilities.

Expand outreach activities in K-12 schools, universities/colleges, and minority serving institutions and organizations that support persons with disabilities providing education about scientific research to increase percentage of underrepresented groups based on the CLF. ARS' goal is to increase the annual percentage of new hires by 75 percent of the following groups compared to the new hire FY 2011 data (goal is noted in parentheses): White female (49); Hispanic male (3); Hispanic female (2); African American male (11); African American female (18); and Persons with targeted disabilities (1).

Use the Schedule A hiring authority for persons with disabilities and Veteran Hiring Authorities as part of strategy to recruit and retain a diverse workforce. ARS' goal is to increase the annual percentage of veteran new hires by 75 percent or 62 veterans.

ARS Management Goals

ARS is continually assessing the relevance, quality, and performance of its research, providing agricultural information to the public through the National Agricultural Library and print and electronic media, ensuring adequate facilities to support Agency research, and ensuring a workplace conducive to personal and professional development.

MANAGEMENT GOAL 1: ENSURING THE QUALITY, RELEVANCE, AND PERFORMANCE OF ARS RESEARCH (COVERS ALL RESEARCH OBJECTIVES)

The Office of Management and Budget (OMB) has established Government-wide R&D Investment Criteria that are designed to assess the relevance, quality, and performance of Federally funded research, and ARS adopted the R&D Investment Criteria as a tool to measure its research. To establish the relevancy of the Agency's research programs, ARS relies on organized interactions with customers, stakeholders, and partners. Peer reviews conducted by the Office of Scientific Quality Review (OSQR) and the Research Position Evaluation System (RPES) ensure the quality of the Agency's research and scientific workforce. All research projects are assessed annually to determine the number of currently approved milestones that were met/not met during the preceding fiscal year. Near the end of the 5- year program cycle, National Programs are subject to retrospective reviews, which verify the scientific impact and programmatic relevance of the work conducted under each National Program Action Plan.

Performance Measures

MG 1.1 Relevance: ARS' basic, applied, and developmental research programs are well- conceived, have specific programmatic goals, address high priority national needs, and have direct relevancy in achieving ARS' long-term goals.

Performance Target

Baseline 2012	Target 2017
As assessed against the Program Action Plans, the Agency's long-term goals, and the priority needs of U.S. agriculture, 97.1% of ARS' projects were conducting highly relevant research.	100% of ARS' projects will be conducting highly relevant research.

MG 1.2 Quality: ARS' Research Projects are reviewed for Quality by National Program using Independent External Peer Review Panels at the Beginning of the 5-Year National Program Cycle.

On average, one fifth of the Agency's Research Projects are reviewed annually by external peer panels. Most projects receive initial scores of needing "No Revision", "Minor Revision", or "Moderate Revision" and are certified after any needed revisions, based on review panel comments, are made. The remaining projects, rated as needing "Major Revision" or as "Not Feasible", receive detailed comments from the review panel and are revised. When these revised projects are examined again by the panel, the majority receives scores of "No", "Minor", or "Moderate" revision needed. Those few projects (approximately 3% of all projects) still rated as needing "Major Revision" or "Not Feasible" after a second review is terminated and resources redirected to High Priority projects. A strength of this Peer Review process is the opportunity to incorporate recommendations of peer panels and enhance ARS research. The Research Position Evaluation System (RPES) conducts Peer Reviews of all ARS scientists on a three-to-five-year cycle. RPES is designed to ensure that ARS will continue to classify and evaluate scientists through a peer process to ensure the highest quality scientific workforce.

Indicator 1: ***As of the end of 2014, for the period of 2009-2014, 83.8% of plans submitted for review received a score of Moderate Revision or higher on initial review.***

FY 2014 Accomplishments*:*

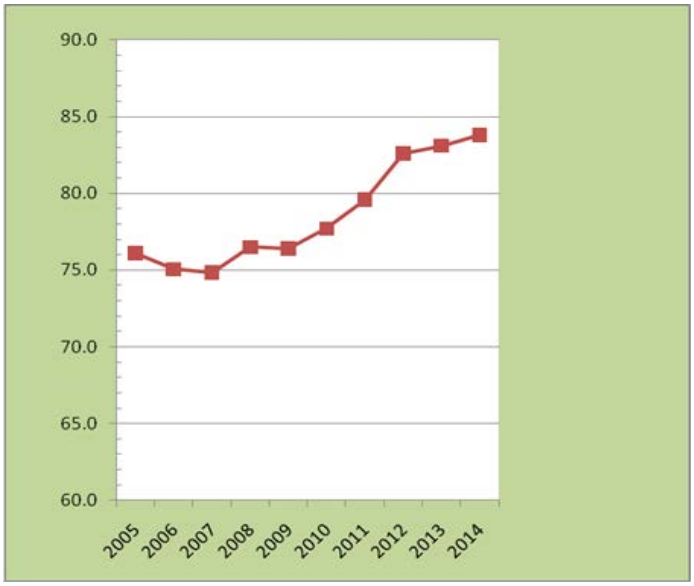

Figure 1 - Five year rolling average of per cent of plans submitted for review receiving a score of Moderate Revision or higher on initial review.

Performance Targets

Baseline 2012	Target 2017
Using an average based on cumulative scores for the past 5 years, 80% of projects received scores of No, Minor, Moderate revision need upon initial review and, overall, 98% received such scores by the completion of the review.	Using a cumulative five-year average, 85% of the projects reviewed will receive initial scores of No, Minor, or Moderate revision needed and 99% will receive such scores by completion of the review.

Baseline 2012	Target 2017
As assessed against the Program Action Plans, the Agency's long-term goals, and the priority needs of U.S. agriculture, 97.1% of ARS' projects were conducting highly relevant research.	100% of ARS' projects will be conducting highly relevant research.

OSQR and the Peer Review Process

The Office of Scientific Quality Review (OSQR) manages the ARS peer review system for research projects, which gives researchers the opportunity to obtain constructive feedback from their external peers. These reviews are conducted by panels made up almost entirely of non-ARS scientific professionals, including an external chairperson with expert knowledge pertinent to the research being reviewed. In their evaluations, panels assess each Project Plan's research methodology, probability of success, and scientific merit. The peer review panel provides comments and scores each project as needing "No Revision", "Minor Revision", "Moderate Revision", and "Major Revision" or as "Not Feasible".

MG 1.3 Performance: ARS will monitor the percentage of annual research project milestones met.

All research projects are assessed annually to determine the number of currently approved milestones that were met/not met during the preceding fiscal year. Information as to why a milestone was not met (including mitigating circumstances) is collected and will be used for making program management decisions. ARS projects a 10 percent baseline level of milestones not met due to personnel attrition. Thus, the maximum achievable milestone target is reduced in real terms to 90 percent. Each National Program is reviewed by external review panels at the end of its 5-year National Program cycle. The panel provides a written report on the quality of accomplishments, impact of the research, and thorough constructive critique recommendations for the next National Program cycle. Twenty percent of National Programs are reviewed annually.

Baseline 2012	Target 2017
89% of project milestones were fully or substantially met.	94% of project milestones will be fully or substantially met.

Baseline 2012	Target 2017
Office of National Programs (ONP) completed National Program Retrospective Reviews for all Programs in the first 5-year cycle and began reviews for the programs currently in the second 5-year cycle.	ONP will complete National Program Retrospective Reviews for remaining programs in the second 5-year cycle and begin reviews for programs in the third 5-year cycle.

National Program Assessment Process

The Office of Scientific Quality Review (OSQR) manages the ARS peer review system for research projects, which gives researchers the opportunity to obtain constructive feedback from their external peers. These reviews are conducted by panels made up almost entirely of non-ARS scientific professionals, including an external chairperson with expert knowledge pertinent to the research being reviewed. In their evaluations, panels assess each Project Plan's research methodology, probability of success, and scientific merit. The peer review panel provides comments and scores each project as needing "No Revision", "Minor Revision", "Moderate Revision", and "Major Revision" or as "Not Feasible".

MANAGEMENT GOAL 2: INTERNATIONAL ENGAGEMENT AND PARTNERSHIPS: EXTEND THE CAPACITY OF THE NATIONAL PROGRAMS TO ADDRESS PROBLEMS CONFRONTING U.S. AGRICULTURE

In recognition that agriculture, and agricultural research, is now a global enterprise, ARS' international office enhances the productivity, effectiveness, and impact of ARS National Programs through mutually beneficial international research activities. The United States directly benefits from international collaboration in agricultural research through access to new ideas and technologies, global germplasm collections, crucial international foreign research sites, enhancement to domestic research, and increased trade. The increasingly transboundary nature of many agricultural problems, such as emerging and re-emerging plant and animal diseases, control of invasive species through discovery and importation of biological control agents, scientific collections including genetic resources preservation, and the need to increase productivity to ensure adequate supplies of agricultural products, provides a strong incentive for greater international cooperation. International agricultural research cooperation addresses global food security by providing solutions to current and future agricultural productivity and sustainability challenges. By sharing knowledge and technology through close collaboration with national and international research institutions in other countries and in the United States to increase institutional research capacity and speed technology development, ARS collaborations enhances international relationships and provides a benign face to U.S. trade and diplomacy.

Crop Production and Protection (CPP): Because USDA does not have the capacity to maintain collections for the entire world's vital crop germplasm, international cooperation plays a critical role in germplasm conservation. In addition, USDA must continue to cooperate with several foreign and international research institutions to fully realize the promise of genomics and genetics research. To also address the concern of food security, additional, long term cooperation is needed in research to continue increasing productivity, availability and utilization of food. International cooperation is also critical for the U.S. to address the control of invasive species (diseases, weeds and insect pests) detrimental to crops, forests, and other natural areas.

Animal Production and Protection (APP): International cooperation enhances the goals of this area by increasing access to different livestock species which enables research to understand the mechanisms of disease resistance. International cooperation helps to develop and test tools to prevent, control, or eradicate diseases that threaten our food supply or public heath, and identifying and developing sustainable systems for production of high quality meat, milk, and eggs. International cooperation is particularly important in the area of animal diseases and their vectors since the approaches to controlling exotic diseases are not as well tested outside of areas where they occur endemically. It plays a key role in animal and aquaculture genomics and should continue to focus on development of tools and resources to meet productivity, efficiency and sustainability needs. International cooperation also provides access to management systems and animal species that have been developed or evolved in tropical and semi-tropical climates and manifest much greater stress and disease tolerance.

Natural Resources and Sustainable Agricultural Systems (NRSAS): Scientists from around the world are drawn to work with ARS in this arena given our current capacities and successes in developing and applying natural resources management strategies and models. ARS gains from these collaborations with additional data which helps scientists improve these techniques and models over time and prove their application in different environments. In addition, sharing these applications helps extend the impact of these technologies in a world facing critical challenges to manage natural resources, particularly water. This also extends to addressing Climate Change and how to manage its impact on U.S. agricultural production as well as how it is impacted by agricultural practices. Finally, to try and meet U.S. bioenergy targets through research on biomass production, we continue to engage our international partners to address biomass use, productivity, management and sustainability.

Nutrition, Food Safety and Quality (NFSQ): Because this area addresses many issues of concern to consumers and because of the global nature of agriculture, international cooperation can help provide a scientific

foundation, both for research and to address regulatory, trade, and consumer issues. Because of the diversity of the American population and food consumption patterns, international collaborations can leverage and greatly enhance U.S. nutrition research.

Performance Measures

MG 2.1 **Dynamic international engagement through programs, projects, co-publications and other activities that support achieving the ARS National Program goals.**

MG 2.2 **Effective engagement in multilateral and bilateral forums in ways that can help catalyze, or prevent or reduce impediments to, scientific or economic cooperation and trade.**

MANAGEMENT GOAL 3: ENSURE PROVISION AND PERMANENT ACCESS OF QUALITY AGRICULTURAL INFORMATION FOR USDA, THE NATION, AND THE GLOBAL AGRICULTURAL COMMUNITY VIA THE NATIONAL AGRICULTURAL LIBRARY.

The National Agricultural Library (NAL) has statutory mandates to identify, collect, preserve in perpetuity, and provide access to quality information relevant to agriculture; serve as one of four national libraries; serve as USDA's library; provide leadership in developing and operating a comprehensive agricultural library and information network; and provide specialized information services through such NAL information centers and programs as AGRICOLA, the LCA Digital Commons, the Animal Welfare Information Center (AWIC), Alternative Farming Systems Information Center (AFSIC), Food and Nutrition Information Center (FNIC), Food Safety Research Information Office, National Invasive Species Information Center, Rural Information Center (RIC), and Water Quality Information Center (WIC). The world's largest agricultural library and a member of the Association of Research Libraries, NAL serves a large and broad customer base, including such audiences as policymakers, researchers, agricultural specialists, farmers, members of the library, educational and agribusiness sectors, food stamp recipients, and the general public. NAL and NAL customers benefit from participation in a number of partnerships and alliances, including the Agriculture Network Information Center (AgNIC), Nutrition.gov, and CENDI.

NAL Service Delivery

The National Agricultural Library manages the world's largest agricultural information collections, designated as a USDA heritage asset, which include more than 50 million physical items as well as extensive digital information products including databases, digital full-text journals and digital full-text books and maps. AGRICOLA (AGRICultural OnLine Access), NAL's online catalog and index to the agricultural literature, serves as the finding tool for these collections and is made available free of charge by NAL at http://agricola.nal.usda.gov and by a number of commercial companies. In addition to extensive reference, research, information center, and document delivery services delivered to a global clientele, NAL provides 24/7 access for USDA staff worldwide to a large and growing array of digital information products via DigiTop (NAL's Digital DeskTop Library for USDA). NAL has initiated development of a digital collection system to preserve for perpetuity USDA publications and other essential agricultural information assets.

Performance Measures

MG 3.1 The services and collections of the National Agricultural Library continue to meet the needs of all customers.

Indicator 1:

During 2014, NAL will continue to expand and improve services based on customer usage and satisfaction data.

FY 2014 Accomplishments:

1. Provide public access to scholarly research articles authored by USDA employees.

   Impact: NAL introduced a preliminary version of PubAg, a portal for literature searches and full-text access of more than 40,000 scientific journal articles written by USDA researchers, mostly from 1997 to 2014. PubAg also provides citations of 340,000 peer-reviewed, agriculture-related scientific

articles, published primarily between 2002 and 2012. Each article citation in PubAg includes an abstract, NAL Thesaurus subject terms, and a link to the article if available from the publisher. This initial group of highly relevant, high quality literature from the 4 million bibliographic citations in the AGRICOLA Index database was used to establish PubAg. PubAg can be found at http://PubAg.nal.usda.gov.

2. Provide public access to an authoritative directory of USDA scientists and researchers that provides information on their research areas and publications.

   Impact: In FY 2014, NAL unveiled VIVO to the public. VIVO is a Web application used internally by USDA scientists since 2012 to allow for better national networking across disciplines and locations. USDA VIVO will be a "one-stop shop" for federal agriculture expertise and research outcomes. This efficient networking tool enables scientists to more easily locate others with a particular expertise that may contribute to a project's success. VIVO also makes it possible to quickly identify scientific expertise to address and rapidly mobilize a response on emerging agricultural issues, such as specific plant and animal diseases or pests.

3. Develop a pilot repository to store the genomic structure of 5,000 insect species to support on-going research and discovery.

   Impact*:* In FY 2014, NAL launched the i5K (insect 5,000 genome) Workspace (https://i5k.nal.usda.gov/) to meet the initiative's needs for genome hosting and other bioinformatics services. The Workspace currently hosts 35 genomes with several more in the pipeline. Approximately 200 researchers are involved in community annotation. Content is accessible via organism pages; genome browsers; and a completely updated and improved BLAST search engine, implemented via the open-source Tripal framework, a Web interface for the underlying Chado database schema.

4. Develop decision support tools for science-based sustainability practices.

   Impact*:* NAL successfully launched the first year of a digital data curation fellowship with the University of Maryland, College of Information Studies (iSchool). Through the course of the first project, the fellow will create a comprehensive workflow for managing the digital conversion and preservation of aerial photographs. More than 600 aerial photographs were digitized for the ARS Mandan, N.D., and Cheyenne, Wyo., labs. The labs intend to use the photographs in studies on land use change. The images will be geo-referenced, described for access and discovery, and used as data for the start-up of the Ag Data Commons.

Performance Targets

MG 3.1 The services and collections of the National Agricultural Library continue to meet the needs of all customers

Baseline 2012	Target 2017
The National Agricultural Library total annual volume of customer service transactions exceeded 95 million.	The National Agricultural Library total annual volume of customer service transactions will exceed 130 million.

Measure MG 3.1: The services and collections of the National Agricultural Library continue to meet the needs of all customers.

During FY 2015, NAL will:

Continue to expand and improve services based on customer usage and satisfaction data.

During FY 2016, NAL will:

Continue to expand and improve services based on customer usage and satisfaction data.

During FY 2017, NAL will:

Continue to expand and improve services based on customer usage and satisfaction data.

MANAGEMENT GOAL 4: DEVELOP OUTREACH ACTIVITIES THAT WILL ENABLE ARS TO BETTER SUPPORT THE USDA INITIATIVE TO INCREASE SERVICES TO LIMITED RESOURCE, SOCIALLY DISADVANTAGED, AND/OR HISTORICALLY UNDERSERVED FARMERS AND RANCHERS.

USDA has identified a number of issues related to how it serves or fails to serve that segment of the U.S. agricultural community that has been historically underserved by many Government programs. These studies did not identify specific issues or problems in the USDA research programs, but in 2000, ARS decided to take a more active approach to see how the knowledge and technologies developed through its intramural research activities could be made available to Outreach target populations (historically underserved, limited resource, and/or socially disadvantaged).

Performance Measures

MG 4.1 **Bring the benefits of ARS research to underserved populations and organizations serving these target populations by providing them with access to ARS-generated knowledge and technology that enables them to increase their productivity and profitability**.

Baseline 2012	Target 2017
ARS has an Agency Outreach Coordinator and an Outreach Coordinator in every Area. The Agency Outreach Coordinator will answer directly to the Associate Administrator of ONP. The Outreach Coordinators are responsible for actively seeking ways to reduce/eliminate internal barriers that prevent target populations from accessing ARS research products.	Area Outreach coordinators will identify organizations and individuals that serve the underserved populations who are potential users of ARS research and work to reduce/eliminate barriers to their participation.

MG 4.2 **Identify significant outreach activities and report them annually to the USDA Office of Outreach.**

Baseline 2012	Target 2017
ARS identified 20 significant Outreach activities and reported them to the Departmental Office of Outreach as requested.	ARS will cumulatively report 100 significant Outreach Activities to the USDA Office of Outreach and through the GPRA Annual Performance Report.

ARS Administrative and Financial Management (AFM) Initiatives

OVERVIEW OF AFM INITIATIVES

ARS' Administrative and Financial Management (AFM) initiatives link with USDA's management initiatives to support more efficient program operations and deliver scientific excellence and public service.

AFM expects to:

- Ensure an efficient, high performing, high quality, diverse workforce to fully accomplish the ARS mission and work cooperatively with partners and the private sector.
- Ensure ARS sustains a clean annual audit opinion and provides access to quality financial information through financial systems that meet the needs of their users.
- Enhance ARS effectiveness through effective and automated services for acquisition, personal property, and administrative management.
- Link budget decisions and program priorities more closely with program performance and consider the full cost of programs.
- Reduce improper payments by establishing targets and corrective actions.
- Efficiently and effectively manage real property through good stewardship (*i.e.*, acquisition, maintenance, and disposal) of ARS' real property assets.
- Award extramural agreements in an efficient and timely manner, and ensure they are legally and fiscally sound and in full compliance with established policies and procedures.
- Ensure systems fully meet needs for AFM information and guidance in support of the President's Management Agenda and E-Gov initiatives.

AFM Performance Measure 1: Enhance ARS effectiveness through effective and automated services for acquisition, personal property, and administrative management.

Indicator 1: ***During 2014, AFM will develop the AFM Customer Service Portal to provide an automated system for customers to request service.***

FY 2014 Accomplishments*:*

1. Completed the development and implementation of the cloud based application, AFMCSP, used to track service requests directed at AFM staff in Divisions and Business Service Centers. The application was placed into broad scale production for the functional areas of Budget, Engineering, IT, Personal Property, Real Property, Safety & Health, Space Management, and Travel. Approximately 450 service providers and 800 customers were trained to use the portal.

   ***Impact*:** Numerous benefits to customers, service providers, and leadership have been realized through the use of the portal. Those benefits include transparency of work requests, the ability to balance workload among staff, the capacity to quickly re-assign work to different staff, extensive documentation, standardization of processes, real time data analytics, cloud based and mobile capable tool for fostering engagement and discussion among virtual teams.

2. The AFMCSP Core Team worked extensively with the portal developers and functional area subject matter experts of Acquisitions, Agreements, and Human Resources to gather the specific requirements and specifications for each functional area. The team also identified and detailed the scope of work for Phase II of the AFMCSP to include a data call module, project management module, electronic forms integration, and the addition of the partner agencies as customers.

   ***Impact*:** Both the addition of the additional functional areas as well as the Phase II modules will automate and standardize processes, thus decreasing workload and errors, while increasing efficiencies.

Performance Targets

AFM Performance Measure 1: *Enhance ARS effectiveness through effective and automated services for administrative management*.

During FY 2015, AFM will:

Implement the modules of Acquisitions, Agreements, and Human Resources in AFMCSP.

The partner agencies of NASS, NIFA, and ERS will be brought on as customers to the portal.

The design and development of Phase II initiatives will be completed. Phase II modules include a data call module, project management module, partner agency customization, electronic forms integration, and location staff customizations.

During FY 2016, AFM will:

Phase III of the AFMCSP project will include integration with other ARS and USDA systems such as ARIS and IAS for the automatic feeding of data to and from the portal.

During FY 2017, AFM will:

Future proposed enhancements to the portal include integration with Outlook, development of a document repository, and additional forms integration.

AFM Performance Measure 2: Improve Acquisition and Personal Property Program.

Indicator 1: *During 2014, AFM will implement the Invoice Processing Platform for REE in accordance with APD Alert 2013-14, which will allow for the electronic processing and tracking of invoices, and provide a cost and time savings for the agencies.*

FY 2014 Accomplishments*:*

1. The Invoice Processing Platform (IPP) was implemented for REE in January 2014 which allows vendors to upload and track invoices, as well as additional oversight of the invoicing process by agency users.

   ***Impact*:** Paper copies of invoices are no longer lost on an individual's desk, but are available for all reviewers electronically. Should an invoice not be processed within a specific timeline, the invoice is escalated to another individual, thus decreasing the opportunity for a forgotten invoice. This saves the REE agencies from paying additional interest charges as more individuals are aware of, and able to act on, pending invoices. The

transparency provided by the system allows vendors to track the processing of each invoice and to be aware of pending payments.

2. With the REE IPP implementation, REE requisitioners no longer have to receipt deliveries or completions in IAS, as this function is now performed by the National Finance Center's Controller Operations Division.

   ***Impact*:** This is the removal of a task for all REE requisitioners, and thus allows them to spend additional time in their other job capacities.

Indicator 2: ***During 2014, AFM will integrate ATS and FDMIS to eliminate redundancy, create efficiency and streamline tracking and data mining.***

FY 2014 Accomplishments*:*

1. Enhancements have been incorporated into ATS to provide FDMIS functionality as requested by Contracting Officers. All AFM Contracting Officers have been instructed to solely use ATS as the procurement tracking system for AFM.

   ***Impact*:** Contracting Officers involved in construction contracting no longer have to update two systems to track procurement status. Reports now include the entirety of AFM procurement actions, thus allowing for increased readability of data.

Indicator 3: ***During 2014, AFM will provide ATS Training to the Acquisition Workforce and Administrative Officers on how to track award progress and contract closeouts.***

FY 2014 Accomplishments*:*

1. ATS Training was provided to AFM (Business Service Center) Contracting Officers both in person and via webinar.

   ***Impact*:** New AFM (Business Service Center) Contracting Officers were provided the opportunity to learn the ATS system, including the input of information and running various reports. Experienced AFM Contracting Officers were afforded the opportunity to have a refresher on system functionality and proper procedures.

2. Instruction was provided to requesting Administrative Officers on the ability to check status of requisitions and run additional reports within ATS.

   ***Impact*:** This increased customer satisfaction by allowing Administrative Officers additional system access and functionality and provides transparency of procurement actions.

Indicator 4: ***During 2014, AFM will provide guidance to assist ARS' Acquisition Workforce to report past performance contract information in the Contractor Performance Assessment Reporting System (CPARS).***

FY 2014 Accomplishments*:*

1. Guidance was provided to the Acquisition Workforce via APD Alert 2012-04 concerning the CPARS, ACASS and CCASS systems merge and training opportunities available for additional information.

***Impact*:** The CPARS merge created a driver motivate Contracting Officers to complete as many reports as possible to prevent the loss of information and re-creation of work. This decreased the number of reports to be completed after the system merge.

2. Additional CPARS tracking metrics were introduced in the monthly Status reports that are provided to the Acquisition Branches, the Administrative and Financial Management Council (AFMC) and USDA Office of Procurement and Property Management (OPPM).

   ***Impact*:** This allows for transparency of metrics being reported within AFM and at the departmental level, and creates an increased sense of urgency and drive to reduce overdue evaluations.

Indicator 5: ***During 2014, AFM will provide guidance to IAS Users on the reports and information that are available in IAS Discoverer.***

FY 2014 Accomplishments*:*

1. Guidance was provided to IAS Users concerning the availability of reports within IAS Discoverer.

   ***Impact*:** IAS Users are now capable of querying information that is collected throughout IAS, FMMI and IPP, thus allowing them to view a consolidated report of particular procurements, funding actions, and invoices.

Indicator 6: ***During 2014, AFM will implement the FAITAS Warrant Module to provide and track delegations of authority.***

FY 2014 Accomplishments*:*

1. The FAITAS Warrant Module was implemented in April 2014 with guidance issued in APD Alert 2014-09.

   ***Impact*:** This FAITAS module allows for the electronic tracking and issuance of warrant requests, the availability of detailed reports, and increased tracking ability.

Indicator 7: ***During 2014, AFM will provide guidance to Procurement Personnel for the auto-archival of FBO notices to ensure the most accurate and up-to-date information is available to potential offerors.***

FY 2014 Accomplishments*:*

1. Guidance via the May 2013 APD Spotlight was provided to Procurement Personnel in regards to the need for the auto-archival of FBO notices. Quarterly reports are also provided to the AFM Acquisition Branches to ensure continued compliance.

   ***Impact*:** Potential offerors are able to search for active procurement notices without having to filter through old notices. Thus offerors are able to easily and readily identify opportunities that are still available. No additional steps are required by Contracting Officers for notices that are set to auto-archive, thus saving time and effort of manually archiving notices.

Indicator 8: ***During 2014, AFM will provide guidance to Procurement Personnel to ensure that FPDS-NG reports are in a finalized status to accurately reflect procurement actions and funding obligations.***

FY 2014 Accomplishments*:*

1. A Status of Actions report was completed and disseminated for action among the Procurement Personnel for actions not in a finalized status between FY 2010 and FY 2014, along with the guidance that all reports are to be completed and finalized within IAS.

   Impact**:** Procurement and funding actions are now properly reported and finalized within FPDS-NG, thus improving the accuracy of all of the system's statistics and reports completed agency, departmental, and government-wide. This also provides for additional public transparency for publically-generated reports.

Indicator 9: ***During 2014, AFM will investigate the e-filing and archiving of contract documentation in IAS.***

FY 2014 Accomplishments*:*

1. After consultation with OCIO and the USDA Procurement Systems Division (PSD), as of 10/01/14 all Contracting Officers are required to upload all pre-award and post-award procurement documents within IAS per APD Alert 2014-08.

   Impact**:** This supports continuous operations in a virtual office environment, as well as the ease of transfer from one Contracting Officer to another, and conducting internal and external pre-award and post-award reviews.

Indicator 10: ***During 2014, AFM will implement a new fleet card that provides level III data for all transactions. (Level III data includes cost per gallon, total no. of gallons, total cost, fuel type, and odometer)and a new fleet card system that includes a requirement for a unique Driver ID for each driver/card user; which is required for each fleet transaction.***

FY 2014 Accomplishments*:*

1. In February 2014, REE successfully implemented the Wright Express (WEX) fleet credit card, which captures level III data on all transactions, including the driver PIN. Through an interface between the WEX card system and USDA's Fleet Management System, the WEX system updates all fleet card costs associated to each specific vehicle in the Fleet Management System.

   Impact**:** Receipt of level III data on all fleet card transactions eliminates manual data collection of odometers and operational costs associated with fleet card transactions. By requiring a unique driver PIN for each employee, including cooperators, rather than a shared PIN for each fleet card, REE has an automated mechanism to determine the specific individual that used the fleet card. This provides increased oversight and reduces opportunities for waste, fraud, and abuse.

2. Through the WEX credit card, agencies receive immediate tax savings at the point of sale, and through a robust tax recovery process as allowed by State and local laws.

   Impact**:** In FY2014, which only included 7 months of card use, REE offices received a total of $33,000 in immediate tax savings at the point of sale and an additional $145,000 of savings that is credited back to the accounts.

Indicator 11: ***During 2014, AFM will conduct training on the Fleet Card On-line system.***

FY 2014 Accomplishments*:*

1. The BSC Fleet Managers received webinar training addressing the use of the WEX Fleet Card System. Training sessions included pre-implementation training and post implementation training covering system reports.

   Impact**:** As having primary responsibility for the fleet card inventory and oversight, fleet managers gained immediate awareness of the overall system. Fleet managers were able to use the system immediately upon implementation. Post-implementation training served as a refresher, and allowed users to better understand the reporting capabilities while using data from actual transactions.

2. WEX System training was also offered to Administrative Officers, financial technicians, and other location personnel.

   Impact**:** As needed, location personnel obtained "read-only access" to the WEX System that allowed users to generate financial reports, showing the tax exemptions, and locating participating WEX card merchants, and locating alternative fuels. This helped increase customer satisfaction in the WEX card by being able to quickly locate participating merchants.

Indicator 12: ***During 2014, AFM will develop Quick Guide materials on the fleet card system.***

FY 2014 Accomplishments*:*

1. Guidance was provided to local fleet program coordinators to help use the WEX Card system and generate standard oversight reports.

   Impact**:** Local fleet card program coordinators had access to reference materials that were specific to REE fleet needs and provided short-cuts in using the system. It also ensured consistent standard reports across the Business Service Centers.

2. Guidance and Communication Documents were provided to employees/drivers to help ensure drivers were aware of various card functionalities such as requesting Driver PINs, Driver PIN training, Alternative Acceptance Process, Road-side Assistance, etc.

   Impact**:** Guidance allowed drivers to better understand the specifics of the WEX fleet card functionality versus a generic credit card. The guidance helped drivers to work with non-participating merchants to significantly reduce the wait time to process a transaction. This increased employee/driver satisfaction with the WEX card.

Indicator 13: ***During 2014, AFM will conduct User Acceptance Testing for USDA's new personal property system CPAIS-Personal Property***

FY 2014 Accomplishments*:*

1. USDA did not offer User Acceptance Testing for CPAIS-Personal Property in FY2014. USDA plans to announce User Acceptance Testing in FY2015.

   Impact**:** N/A

Indicator 14: ***During 2014, AFM will implement USDA's new personal property system CPAIS-Personal Property based on USDA's confirmed implementation schedule.***

FY 2014 Accomplishments*:*

1. USDA did not implement CPAIS-Personal Property in FY2014. USDA has scheduled implementation in FY2015.

   Impact**:** N/A

Indicator 15: ***During 2014, AFM will continue to serve as an Agency subject matter expert to assist USDA's Office of Procurement and Property Management address CPAIS-Personal Property issues post-implementation.***

FY 2014 Accomplishments*:*

1. USDA did not implement CPAIS-PP in FY2014. USDA has scheduled this for FY2015.

   Impact**:** N/A

Performance Targets

AFM Performance Measure 2: Improve Acquisition and Personal Property Program.

During FY 2015, AFM will:

Provide ATS Training to all Business Service Center Contracting Officers and Leadership.

Fully implement the e-filing and archiving of contract documentation by requiring all open procurement files to be uploaded into IAS by the end of FY 15.

Provide training and guidance to IPP Users on Invoice Processing procedures and best practices.

Provide guidance to assist ARS' Acquisition Workforce to report past performance contract information in the Contractor Performance Assessment Reporting System (CPARS).

Participate in User Acceptance Training for CPAIS-PP to ensure USDA's system meets REE personal property needs.

Develop CPAIS-PP implementation plan that will have the least negative impact on the locations.

Develop quick guide training materials for Business Service Centers (BSC) and assist in BSC's in training location personnel.

Continue to serve as an Agency subject matter expert to assist USDA's Office of Procurement and Property Management address CPAIS-Personal Property issues post- implementation.

Conduct refresher training and materials on the WEX Fleet Card System to help improve oversight of fleet transactions.

During FY 2016, AFM will:

Provide ATS Training to all Business Service Center Contracting Officers and Leadership.

Provide training and guidance to IPP Users on Invoice Processing procedures and best practices.

Provide guidance to assist ARS' Acquisition Workforce to report past performance contract information in the Contractor Performance Assessment Reporting System (CPARS).

Continue to develop CPAIS-PP quick guide training materials for Business Service Centers (BSC) and assist BSC's in training location personnel to help ensure financial integrity of the property management program.

Continue to serve as an Agency subject matter expert to assist USDA's Office of Procurement and Property Management address CPAIS-PP post implementation issues.

Continue to serve as an Agency subject matter expert to assist USDA's Office of Procurement and Property Management to determine the feasibility of developing the fleet module of CPAIS-PP to ensure that it offers the same level of reporting requirements as FedFMS, allowing the agency to have all personal property asset data in one system.

Continue to conduct refresher training and materials on the Fleet Card System to help improve oversight of fleet transactions.

Conduct annual vehicle use survey to identify under-utilized vehicles that could be removed from the fleet, reducing overall fleet fuel/maintenance costs; reassign vehicles as needed within the agency.

During FY 2017, AFM will:

Provide ATS Training to all Business Service Center Contracting Officers and Leadership.

Provide training and guidance to IPP Users on Invoice Processing procedures and best practices.

Provide guidance to assist ARS' Acquisition Workforce to report past performance contract information in the Contractor Performance Assessment Reporting System (CPARS).

Continue to develop training materials to help ensure financial integrity of the personal property program.

Continue to serve as an Agency subject matter expert to assist USDA's Office of Procurement and Property Management addressing CPAIS-PP post implementation issues.

Continue to conduct refresher training and materials on the Fleet Card System to improve fleet card oversight.

Conduct annual vehicle use survey to identify under-utilized vehicles that could be removed from the fleet, reducing overall fleet fuel/maintenance costs; reassign vehicles as needed within the agency.

AFM PRIORITY GOALS

PRIORITY GOAL 1 - IMPROVE HUMAN CAPITAL MANAGEMENT

The AFM strategic plan contains objectives related to improved management of ARS human capital. The plan focuses on strategic workforce planning, leadership development, optimizing organizational structures to address current and future challenges, and improving performance management to maximize employee performance. The AFM strategic plan identifies human capital challenges and implements an accountability system to monitor and address these challenges. Such challenges include meeting the demand for cutting edge research talent, creating a workforce with a combination of skills not previously required, and fully supporting the Department's mission.

In managing its human capital and delivering its services to customers, ARS will continue to focus on ensuring civil rights and equal employment opportunity for everyone, regardless of race, color, national origin, gender, religion, age, sexual orientation, disability, political belief, marital or familial status, or any other factor. ARS is committed to continuous civil rights progress in the workplace, program delivery, and the efficient processing of complaints.

AFM plans to:

- Identify current and future skill gaps through an effective workforce planning process.
- Deliver human resource services through the implementation of e-HR tools.
- Improve individual and organizational performance through the development of position descriptions, standard performance plans, and training and knowledge management strategies.
- Ensure that ARS fosters a workplace atmosphere conducive to achieving the Agency's mission.

Objective: Research, Education, and Economics Agencies have a highly qualified diverse workforce to fully accomplish the REE mission.

Performance Measure

AFM PG 1.1 Fill critical positions and hire people with agency-desired skill sets into positions as they are approved to be filled.

Indicator 1: ***During 2014, AFM will identify current and future staffing gaps within each REE agency.***

FY 2014 Accomplishments*:*

1. A Draft Diversity Workforce Recruitment Strategy has been established to serve as a foundation for addressing the workforce challenges and opportunities that face ARS today. The plan will serve as a companion document to ARS' Strategic Plan, Federal Equal Opportunity and Recruitment Plan as well as the Human Capital Plan.

   Impact: These plans will enable ARS to make significant contributions towards achieving and maintaining a highly skilled and diverse workforce. The plan sets forth goals, strategies and action items to ensure ARS' ability to successful recruit, hire, promote, educate and retain a diverse workforce and to create a culture that encourages and support collaboration, flexibility, and equity to enable individuals to participate to their full potential.

2. AFM established a Hiring and Placement Strategy to attract the best qualified candidate to preserve, and maintain a highly-qualified, well-trained, and diverse workforce that mirrors the relevant civilian labor force, while also seeking to provide opportunities to Veterans and persons with disabilities.

   ***Impact*:** The implementation of this plan allows the agency's Administrative and Financial Management Units to hire the right people, for the right jobs, at the right locations, to best serve and provide support to our hiring managers to ensure the delivery of timely, effective and efficient administrative services and products.

3. AFM continue to utilize the Vacancy Status System in conjunction with the AFM Customer Service Portal to track and monitor status of all high priority recruitments in REE mission area.

   Impact: Enable managers to have real-time information on the status of recruitments which enable the management of effective resources and keep account of where recruitments are in the process. This also ensures staff accountability for providing support to our hiring managers to ensure the delivery of timely, effective and efficient administrative services and products.

Indicator 2: ***During 2014, AFM will work with hiring managers to identify desired skill sets in critical positions.***

FY 2014 Accomplishments*:*

1. AFM continue to educate and train REE hiring managers on the utilization of the REE certification agreement and Appendix A which is used to develop the recruitment and outreach strategy to obtain required skill sets for each sought position.

   Impact: Enable managers to identify required skill sets for each individual position and target recruitment. This enables the agency to successfully deliver the scientific mission.

Indicator 3: ***During 2014, AFM will develop an integrated marketing and recruitment strategy to attract diverse candidates with top skill sets from sources that provide maximum opportunity for all.***

FY 2014 Accomplishments*:*

1. The Human Resources Division developed and distributed informational material to REE Leadership and Human Resources (HR) specialists on the following topics: Presidential Management Fellows (PMFs), Pathways, special hiring authorities (including authorities for veterans and people with disabilities), the Summer Youth Employment Program, and the USDA Veterans and People with Disabilities Portal.

   ***Impact*:** Distribution of this material increased awareness of special hiring authorities for both hiring managers and HR specialists. The Summer Youth Employment Program was widely used by managers in the National Capital Region and provided eighteen young men and women in the District of Columbia and Prince George's County with career exploration opportunities.

2. In collaboration with OHRM, the Human Resources Division conducted two information sessions for students interested in working for USDA. The sessions focused on the various careers available within the REE Mission Area.

   ***Impact*:** The sessions provided students with valuable information to guide them in their career paths and encourage them to begin their Federal careers with REE.

3. A Draft Diversity Workforce Recruitment Strategy has been established to serve as a foundation for addressing the workforce challenges and opportunities that face ARS today. The plan will serve as a companion document to ARS' Strategic Plan, Federal Equal Opportunity and Recruitment Plan as well as the Human Capital Plan.

   Impact: These plans will enable ARS to make significant contributions towards achieving and maintaining a highly skilled and diverse workforce. The plan sets forth goals, strategies and action items to ensure ARS' ability to successful recruit, hire, promote, educate and retain a diverse workforce and to create a culture that encourages and support collaboration, flexibility, and equity to enable individuals to participate to their full potential.

4. AFM established a Hiring and Placement Strategy to attract the best qualified candidate to preserve, and maintain a highly-qualified, well-trained, and diverse workforce that mirrors the relevant civilian labor force, while also seeking to provide opportunities to Veterans and persons with disabilities.

   Impact: The implementation of this plan allows the agency's Administrative and Financial Management Units to hire the right people, for the right jobs, at the right locations, to best serve and provide support to our hiring managers to ensure the delivery of timely, effective and efficient administrative services and products.

Indicator 4: ***During 2014, AFM will develop an evaluation plan, including appropriate metrics, to guide improvement in the hiring process.***

FY 2014 Accomplishments*:*

1. Established and implemented standardized performance goals, expectations and metrics pertaining to recruitment outputs and accountability for HR professionals. in order to facilitate an effective and efficient hiring process.

   Impact**:** The implementation of the standardized performance goals and objectives facilitates an effective and efficient hiring process.

2. Established and recruited for 3 Accountability specialists in order to evaluate and validate accurate recruitment analysis and onboarding process.

   Impact**:** The hiring of the 3 Accountability specialists will allow the evaluation and validation of accurate recruitment analysis and onboarding processing.

3. Conducted accountability audits of overall recruitment programs.

   Impact: This allows the agency to establish improvement strategies to close gaps in deficient areas and to implement measures that best align with governing rules and regulations.

4. Trained and educated HR professionals and hiring managers on the hiring process.

   Impact: This training increases HR professionals and hiring managers' awareness on their role and responsibilities in helping the agency reach recruitment goals and advancing the agency's mission.

AFM PG 1.2 Emphasize employees' continuous development.

Indicator 1: ***During 2014, AFM will develop career development templates for targeted critical occupations to assist employees to grow in the agency.***

FY 2014 Accomplishments*:*

1. ARS has created a preliminary list of Critical Occupations as part of its proposed Human Capital Plan. This list is currently under leadership review.

   Impact**:** By identifying the critical occupations required for ARS to effectively and efficiently meet its missions, we will be able to focus our resources and target efforts on developing specific educational developmental plans to support the maximum impact and growth of our employees within the agency.

2. Developed Administration Officer Training Curriculum.

   Impact**:** The training curriculum will help build the proficiency of key administrative personnel in an ever-changing work environment to promote the smooth and efficient operation of our administrative services provided to our customers.

3. The agency established prototype templates to include standardized position descriptions, performance plans and Individual Development Plans for key positions.

   Impact: Once the manager identifies the critical position this help facilitates the recruitment process and provide consistency in the training plan for those employees.

Indicator 2: ***During 2014, AFM will develop and implement an employee continuous education requirement.***

FY 2014 Accomplishments*:*

1. AFM has fully implemented the USDA Cultural Transformation Plan to track and monitor the REE agencies performance for establishing Individual Development Plans (IDPs) for all agency employees as well as mid-term counseling/review requirements.

   Impact**:** Utilization of IDPs fosters partnership between the managers and employees to ensure appropriate training needs' are identified to close skill gaps that are required to advance the mission.

2. AFM provided classroom and webinar-based IDP training for REE employees, as well as customized or individualized trainings.

   Impact**:** This improves the quality of individual plans by creating more realistic IDPs, properly framing expectations and empowering employees to better meet their personal developmental goals.

Indicator 3: ***During 2014, AFM will retain and share corporate knowledge by defining/developing and implementing Knowledge Management strategies.***

FY 2014 Accomplishments*:*

1. AFM implemented a streamlined process improvement initiative to increase the effectiveness and efficiency of each individual work center.

***Impact*:** This created a knowledge management reservoir in which employees are able to readily access information to increase in the delivery of service.

2. AFM is in the process of developing a REE Phased Retirement Program.

   ***Impact*:** Implementation of the REE Phased Retirement Plan will enable managers to effectively transfer knowledge to existing staff. This will allow the agency to retain valuable knowledge as employees' transition into full retirement.

AFM PG 1.3 REE Agencies work toward achieving/retaining top ranking in USDA as "Best Places to Work" as reported in the Federal Human Capital Survey.

Indicator 1: ***During 2014, AFM will monitor retention rates and develop additional metrics for REE Onboarding program/process to ensure effectiveness and efficiency of assimilation and support for new employees.***

FY 2014 Accomplishments*:*

1. HRD is currently testing One USDA EOD-online System for FY 15 implementation.

   ***Impact*:** This integrated system will make the onboarding process more efficient**.**

2. HRD is partnering with USDA to access and utilize the OPM/OHRM Exit Survey that will be issued to those employees leaving the agency.

   ***Impact*:** Utilization of the Exit Survey will allow the agency to monitor retention rates, mitigate employee's concerns and develop retention strategies.

Indicator 2: ***During 2014, AFM will continue implementation of the Performance Appraisal Assessment Tool (PAAT) in order to improve performance management and reward processes and actions***

FY 2014 Accomplishments*:*

1. Human Resources Division developed and implemented a performance metric tool to evaluate/audit performance plans to ensure compliance with Performance Appraisal Assessment Tool (PAAT) measures.

   ***Impact*:** Metrics revealed deficiencies in the performance management program; and assisted in the development of corrective measures to ensure results-focused, accountability, and equal employment opportunity performance standards are established.

2. Human Resources Division conducted a sample audit of 4% of mission area employees' performance plans, in accordance with OPM's PAAT, to evaluate the effectiveness of the performance management program.

   ***Impact*:** Audits identified discrepancies and inconsistencies in policies and procedures among the mission area agencies; thus facilitating evaluation of current performance management programs, and development of standardized guidance and training throughout the mission areas. Ensured performance plans included performance elements and standards incorporating credible measure of quality, quantity, timeliness, and/or cost effectiveness.

3. Human Resources Division developed and conducted performance management training with REE agency representatives to target deficient areas identified during PAAT audit of performance plans and appraisals. In addition, PAS administered the newly implemented Performance Management Departmental Regulation 4040-430.

   ***Impact*:** Training and guidance provided to REE agencies to promote compliance with OPM's and Departmental Regulations necessary to create a results-oriented performance culture.

4. Human Resources Division implemented Phase 1 of the Performance Accountability Database (PAD) program.

   ***Impact*:** Standardization in monitoring and tracking of REE agencies performance programs. PAD ensured 100% compliance of the establishment of performance plans, mid-year progress reviews, and performance appraisals, as directed in the USDA Cultural Transformation Plan.

Indicator 3: ***During 2014, AFM will expand/implement maxiflex, telework, and other programs and flexibilities to assist employees in balancing work and personal responsibilities.***

FY 2014 Accomplishments*:*

1. Obtained senior leadership approval to offer all ARS employees the same set of Employee Assistance Program (EAP) services through Federal Occupational Health (FOH). Also gained approval to centrally fund and offer the companion WorkLife4You services to all ARS employees in FY15.

   ***Impact*:** This ensures all agency employees have access to the same resources and services.

2. Expanded use of the Child Care Tuition Assistance Program (CCTAP) to the National Agricultural Statistics Service (NASS).

   ***Impact*:** ARS and NASS' employees have access to child care assistance to further balance work/life challenges.

3. Developed and communicated quarterly telework summary spreadsheets to provide REE agency Administrators.

   Impact: These reports allowed REE Administrators to identify and better target closure of telework data gaps and monitor their agencies' progress toward meeting USDA Cultural Transformation Goals.

4. Developed and delivered webinar, classroom or customized telework trainings for REE agencies.

   Impact: These trainings help raise awareness about the benefits of telework and clear up misconceptions about the policy. Additionally, this helps manager to make better decisions about telework eligibility and participation.

Indicator 4: ***During 2014, AFM will evaluate and analyze Federal Employee Viewpoint Survey to target key areas to be addressed.***

FY 2014 Accomplishments*:*

1. AFM staff conducted an ARS agency-level analysis of FEVS 2014 results with recommendations.

***Impact*:** The agency implemented several recommendations to include establishing an ARS Employee Engagement Council, the Year of the Research Leader initiative (focused on improving the job of this mission-critical role in ARS), and development of a comprehensive training program for Administrative Officers in ARS. These initiatives were implemented to improve employee engagement.

2. FEVS results data were shared with each agency Administrator.

   ***Impact*:** REE Agency Administrators used the data to task their own staffs with analysis and action planning to increase employee engagement, commitment and satisfaction.

3. AFM staff provided guidance and assistance to all REE leaders to help them use their FEVS results data more effectively.

   Impact: REE agencies increasingly creating sustained momentum and focus on analysis and use of FEVS data to improve employee engagement, commitment and satisfaction.

Indicator 5: ***During 2014, AFM will establish action plan to close gaps to create a positive, results-oriented workforce.***

FY 2014 Accomplishments*:*

1. AFM identified a comprehensive, innovative customer service training program that will be mandatory for all AFM staff and developed a roll-out plan. The training involves one day of face-to-face training and seven weeks of follow up virtual meetings to discuss how employees are implementing what they learn and deepen the learning.

   ***Impact*:** This initiative will ensure a uniform understanding of customer service expectations and techniques for AFM staff across all administrative functions. The training is expected to help AFM staff work more effectively together and individually to improve and continue to deliver exceptional service.

2. AFM established an AFM Employee Engagement Council as a sub-component of the ARS Employee Engagement Council.

   ***Impact*:** The AFM Council will expand the reach and continue the great work done by the Employee Advisory Council which has been in operation for several years. The focus will be to identify initiatives and activities to improve employee engagement, commitment and satisfaction throughout AFM.

3. AFM continued to provide extensive support to ARS's Your Two Cents (Y2C) program, an employee engagement and feedback site now in its fifth year of operation. AFM staff sits on the Y2C Committee, continually helping to refine and improve this tool. Many staff throughout AFM also provides responses to the Y2C Committee on the many administrative ideas, questions and comments posted by ARS employees.

   ***Impact*:** Y2C provides a direct line of communication and feedback between ARS employees and their senior leaders. Employees are encouraged to submit their ideas and feedback about various elements of ARS's mission and organizational environment and culture. This tool has fostered employee engagement throughout ARS and resulted in implementation of many great ideas to improve life in ARS.

Performance Targets

AFM PG 1.3: REE Agencies work toward achieving/retaining top ranking in USDA as "Best Places to Work" as reported in the Federal Human Capital Survey.

During FY 2015, AFM will:

Evaluate and refine REE Onboarding program/process and metrics to ensure effective assimilation and support for new employees to increase retention.

Develop metrics and monitor the Performance Appraisal Assessment Tool (PAAT) in order to determine whether performance management and reward processes and actions have improved.

Expand/implement maxiflex, telework, and other programs and flexibilities to assist employees in balancing work and personal responsibilities.

Evaluate and Implement Performance Appraisal Assessment Tool (PAAT) in portions throughout the fiscal year, focusing on areas of the Federal Employee Viewpoint Survey (FEVS) with unsatisfactory scores, to ensure early identification of program deficiencies; thus enabling continuous, ongoing, development of corrective actions to improve performance and awards processes.

Support the delivery of human resources services through the implementation of e-HR tools by implementing Phase-2 of the Performance Accountability Database (PAD) program, emphasizing on the development of electronic performance plans, and incorporating new data fields, based on lessons learned, to improve the efficiency of the program. In addition, ensures the greatest adoption of the AFM Customer Service Portal.

Develop and issue to REE agencies a single policy that includes performance plans, mid-year reviews, and performance appraisals. This will enable agencies to review, anticipate, and comply with policies throughout the performance year.

Improve employee and leadership engagement goal by identifying and establishing effective measures to increase engagement; review FEVS data to identify low performance engagement, and develop action plan to increase engagement.

Analyze current CCTAP income eligibility limits to determine whether changes will be recommended.

Duplicate the Department's participation calculation methodology and refine telework summary reports to provide more comprehensive and targeted data to the REE agency Administrators. The target is to ensure that 95% of REE agency employees have an eligibility determination and, if eligible, a telework agreement in place.

Continue to develop and deliver training as needed and as requested to promote and encourage use of telework as a strategic tool in REE.

Participate in development and administration and analysis of data from a Department-initiated survey to identify barriers to full implementation of telework and meeting the Department's core telework participation goal.

Raise awareness and market the availability of FOH EAP and WorkLife4You services throughout ARS, ERS,

and NIFA. (NASS uses a different provider.) This will be done by arranging quarterly trainings, developing website content to be posted on the REE Intranet (Axon) that will be continually refreshed with new information, and use various communication tools to inform managers and employees about the benefits available to them.

Identify an ARS network of points of contact for health and wellness promotion and development of local activities. This is in anticipation of a new Departmental Regulation on Health and Wellness Programs to be published in FY15.

Conduct a trend study of EAP utilization rates using 3 to 5 years of data. The goal of this study is to show whether and how utilization rates have changed and to indicate whether marketing efforts result in increased utilization in FY15.

Continue to support ARS with FEVS data analysis and recommendations when FY2015 results are published.

Provide AFM support to the various administrative initiatives associated with the Year of the Research Leader.

Develop and implement a wide variety of administrative trainings to support the Administrative Officer training initiative.

Continue to support and participate in FEVS action planning and implementation.

Facilitate achievement of a 70% USDA FEVS participation goal for REE.

Begin to roll-out the customer service training program throughout AFM.

The AFM Employee Engagement Council will define its roles and responsibilities with respect to the ARS Employee Engagement Council.

The AFM Employee Engagement Council will develop and begin implementation of an action plan targeted at specific AFM initiatives to improve employee engagement, commitment, and satisfaction.

Continue AFM participation and support of the Y2C Committee to implement a complete refresh of the Y2C site to keep up with trends in employee engagement technologies, improve response time and quality to employee submissions and more closely integrate Y2C data and results with FEVS data and action planning.

During FY 2016, AFM will:

Evaluate and refine REE Onboarding program/process and metrics to ensure effective assimilation and support for new employees to increase retention.

Evaluate and refine the Performance Appraisal Assessment Tool (PAAT) as needed to ensure the tool is improving management and reward processes and actions.

Evaluate and refine workplace flexibility programs designed to assist employees in balancing work and personal responsibilities.

Continue to access and developed performance metric tool to evaluate/audit performance plans to ensure compliance with Performance Appraisal Assessment Tool (PAAT) measures.

Implement Phase-2 of the Performance Accountability Database (PAD) program by incorporating the use of electronic performance plans. This effort will continue to support the delivery of human resources services through the implementation of e-HR tools.

Ensure the complete adoption of the AFM Customer Service Portal; and continue to evaluate and implement measures for improvement by eliminating barriers to program reliability and customer service.

Develop and implement performance and awards training courseware for new Administrative Officers.

Implement revised income eligibility limits for the CCTAP, if approved.

Collaborate with REE agency leadership to maintain the focus on closing data gaps and promoting telework to move closer to meeting or exceeding the 60% Departmental participation goal.

Continue to develop and deliver customized telework training to focus on eliminating barriers identified

Continue to monitor EAP utilization rates and identify whether more intensive marketing efforts are needed.

Create an implementation plan for the new Departmental Regulation on Health and Wellness Programs (anticipated to be published in FY2015).

Continue to support REE with FEVS data analysis and recommendations to reach USDA mandated FEVS goals.

Continue to support and participate with REE agencies in FEVS action planning and implementation.

Support and facilitate FEVS 2016 Action Planning activities.

Complete delivery of the AFM Customer Service training.

The AFM Employee Engagement Council will assess the impact of its FY2015 actions and develop an FY2016 action plan responsive to organizational needs identified by the Council. Action plans will be grounded in FEVS 2015 results, Y2C feedback, employee listening sessions, and other quantitative and qualitative data.

Assess the impact of changes to Y2C made in FY2015 and identify any needed changes.

During FY 2017, AFM will:

Evaluate and refine REE Onboarding program/process and metrics to ensure effective assimilation and support for new employees to increase retention.

Gather and analyze ARS workforce data in order to update the ARS Succession and Human Capital Plan to reflect the newly reorganized field structure.

Develop and administer a survey within ARS to solicit leadership input to refine current list of Mission

Critical Occupations and identify necessary interventions to close gaps.

Conduct a sample audit of 4% of mission area employees' performance plans, in accordance with OPM's PAAT, to evaluate the effectiveness of the performance management program.

Continue with the integration into the AFM Customer Service Portal; access the probability and practicality of conducting all performance plans, mid-year, appraisals, and awards accountability through the Portal and eliminating the employment of PAD.

Continue to improve and develop performance and awards training courseware.

Identify any outstanding barriers to full telework implementation and achieving the Department's core telework participation goal. Develop strategies to mitigate the barriers and promote telework participation.

Continue to promote and encourage utilization of EAP, WorkLife4You, CCTAP, and other work/life flexibilities.

Develop and implement a comprehensive Health and Wellness Program in ARS and offer AFM guidance and assistance to the client agencies to do the same.

Assess impact of the AFM Customer Service training program and identify any necessary follow up actions.

The AFM Employee Engagement Council will continue to gather and use available data to develop an FY2017 action plan responsive to AFM needs.

Continue to monitor and assess the impact and effectiveness of Y2C and identify any needed changes.

AFM PG 1.4 Improve "Leading People" skills of all leaders, supervisors, and managers.

Indicator 1: ***During 2014, AFM will develop ARS Succession Plan and Ensure all REE Succession Plans developed.***

FY 2014 Accomplishments*:*

1. Preliminary work (agency information and data) has been completed on the Succession Plan as a part of the overall Human Capital Plan.

   ***Impact*:** This work will provide the overarching framework and foundation to develop the Succession Plan for ARS.

Indicator 2: ***During 2014, AFM will fully implement a supervisory training program.***

FY 2014 Accomplishments*:*

1. AFM provided training on the key components of the Supervisory Training Program including: Crucial Conversations (getting to dialog as a tool to accomplish results), Myers Briggs Type Indicator (understanding and leveraging diversity) and Question Behind the Question (personal accountability).

***Impact*:** Employees completed one or more of these courses, providing them with leadership-based competencies that have a positive and immediate impact in the workplace.

2. AFM is currently developing a curriculum to support the implementation of USDA's New Supervisor and Experienced Supervisor Training Programs, which will be promulgated in FY 15.

***Impact*:** AFM now has multiple options to choose from to ensure meeting departmental goals/requirements in a flexible manner that can be customized down to the needs/situations of individual supervisors.

Performance Targets

AFM PG 1.4: Improve "Leading People" skills of all leaders, supervisors, and managers.

During FY 2015, AFM will:

Implement Succession Activities in ARS and provide administrative support to NASS, NIFA and ERS in the implementation of their Succession Plans.

Complete implementation of and develop an evaluation plan for a supervisory training program that meets USDA New Supervisor and Experienced Supervisor Training Program requirements.

Initiate the Supervisor 360 Degree Assessment Program as directed by USDA

Implement a Mentoring Program IAW USDA directives

Use data gleaned from the Supervisor 360 and Federal Employee Viewpoint Survey (FEVS) among other sources to identify specific training requirements for all supervisors

Gain a perspective on how agency currently identifies, develops, attracts, and retains employees as well as research current factors that help and hinder these efforts in order to enhance efforts in succession planning and management. The succession plan will formalize succession management strategies to prepare for anticipated leadership turnover and successfully staff mission critical occupations.

During FY 2016, AFM will:

Evaluate REE Succession Plans for continued relevance and adjust as needed.

Evaluate supervisory training program and adjust/adapt as needed.

Continue the Supervisor 360 Assessment Program

Continue the Mentoring Program

Develop additional supervisory courses, as required

During FY 2017, AFM will:

Continue the Supervisor 360 Assessment Program

Continue the Mentoring Program

Develop additional supervisory courses, as required

AFM PG 1.5: Enhance ARS effectiveness through effective and automated services for acquisition, personal property, and administrative management.

During FY 2015, AFM will:

Identify current and future skills gaps within each REE agency

Develop metrics to guide improvement in the hiring process

Evaluate and refine marketing and recruitment strategy to attract diverse candidates with top skill sets from sources that provide maximum opportunity for all

Implement evaluation plan to guide improvement in the hiring process.

During FY 2016, AFM will:

Re-evaluate marketing and recruitment strategies to ensure they are producing desired candidates and agency results, and revise/refine as needed.

Continue to identify current and future staffing and skills gaps.

Adjust hiring process as indicated from evaluation and continue to monitor for effectiveness and potential improvements.

AFM PG 1.6: Emphasize employees' continuous development.

During FY 2015, AFM will:

Implement career development templates for targeted critical occupations and continue to develop additional templates to assist employees to grow in the agency.

Develop and implement tools for managers to use at local levels to facilitate meeting employees' continuous education requirements.

Continue to develop and implement effective corporate knowledge management strategies.

Continue to enforce Cultural Transformation Plan requirements with the aim of attaining 100% compliance for implementation and review of IDPs for all employees.

Continue to offer virtual/live IDP classroom courses as well as individualized IDP counseling for REE employees.

Continue the "On-the-Road" Training Program initiative that brings AFM Employee and Leadership

Development (ELDS)-supplied training to work locations across the country.

Implement a Mentoring Program IAW USDA directives.

Increase the number of courses in the ELDS library of courses that can be offered virtually.

During FY 2016, AFM will:

Evaluate career development templates in use and refine as needed; continue to develop additional templates as needed based on proven models.

Evaluate and refine effectiveness and efficiency of process/tools to foster employees' continuous education requirements.

Evaluate and refine corporate knowledge management strategies.

During FY 2017, AFM will:

Evaluate career development templates in use and refine as needed; continue to develop additional templates as needed based on proven models.

Evaluate and refine effectiveness and efficiency of process/tools to foster employees' continuous education requirements.

Evaluate and refine corporate knowledge management strategies.

Continue to enforce Cultural Transformation Plan requirements with the aim of attaining 100% compliance for implementation and review of IDPs for all employees

Continue to offer virtual/live classroom courses as well as individualized IDP counseling for REE employees

Continue the "On-the-Road" Training Program initiative that brings AFM Employee and Leadership Development (ELDS)-supplied training to work locations across the country

Continue the Mentoring Program

Increase the number of courses in the AFM Employee and Leadership Development (ELDS) library of courses that can be offered virtually

PRIORITY GOAL 2 - IMPROVE FINANCIAL MANAGEMENT

Effectively managing the use of taxpayer dollars is a fundamental Federal responsibility. ARS intends to ensure that all funds spent are accounted for properly to taxpayers, Congress, and the Government Accountability Office (GAO). The AFM Financial Management Division (FMD) works to improve financial management in partnership with the USDA Office of the Chief Financial Officer (OCFO).

AFM-FMD plans to:

- Ensure that ARS meets all appropriation level accounting and reporting requirements, and ensure that all reports continue to indicate an accurate financial picture and that reporting difficulties are rapidly resolved.
- Continue to improve financial system business processes and financial reporting capabilities.
- Provide support to ARS travelers with professional customer-oriented travel and transportation staff and a Web-based travel system.
- Ensure financial management bulletins and undocumented business practices are incorporated into policies and procedures for the agency.

Performance Measure

AFM PG 2.1 **REE meets all monthly, quarterly, and annual appropriation level accounting and reporting requirements. Appropriated fund (obligation) and cash reports continue to evidence an accurate financial picture.**

Indicator 1: ***During 2014, AFM will support the quarterly financial statements process, and actively respond to annual OIG audit of REE-wide financial statements and resolve relevant audit concerns.***

FY 2014 Accomplishments*:*

1. USDA received an unqualified "clean" audit opinion for the FY 2014 consolidated statements.

***Impact*:** A clean audit opinion indicates that USDA's financial statements correctly portray in all material respects USDA's financial condition, and that proper financial and reporting controls are in place to support this opinion.

2. REE met the quarterly and annual reporting requirements

***Impact*:** By meeting the reporting requirements REE's financial reports provided accurate and meaningful data to the users of these reports.

Performance Targets

AFM PG 2.1: REE meets all monthly, quarterly, and annual appropriation level accounting and reporting requirements. Appropriated fund (obligation) and cash reports continue to evidence an accurate financial picture.

During FY 2015, AFM will:

Support the quarterly financial statements process, and actively respond to annual OIG audit of REE-wide financial statements and resolve relevant audit concerns.

During FY 2016, AFM will:

Support the quarterly financial statements process, and actively respond to annual OIG audit of REE-wide financial statements and resolve relevant audit concerns.

During FY 2017, AFM will:

Support the quarterly financial statements process, and actively respond to annual OIG audit of REE-wide financial statements and resolve relevant audit concerns.

AFM PG 2.2 ARMPS and CATS are fully implemented on ARIS/ORACLE platform, meets needs of ARS users, and maximizes opportunities for financial data integration.

Indicator 1: ***During 2014, AFM will continue updating the ARMPS system to implement the data exchange opportunities that have been identified to ensure the system is up to date and utilizing current technology to increase efficiency.***

FY 2014 Accomplishments*:*

1. Based on customer feedback, updated the ARMPS system and guidance.

   ***Impact*:** Package requirements were refined to ensure relevant data is collected.

2. Continue to review and improve reports.

   ***Impact*:** Issues with reports (such as multiyear analysis) were corrected to ensure data was accurate and minimal manual adjustments were necessary.

Indicator 2: ***During 2014, AFM will continue to identify multiple data exchange opportunities between SAMS, ARMPS, CATS, ARIS and other non-financial ORACLE-based applications to reduce the need for duplicate data entry and increase operating efficiency*.**

FY 2014 Accomplishments*:*

1. Area Reorganization of Mode Codes

   ***Impact*:** All mode codes were updated in ARIS, ARMPS, CATS and SAMS to ensure all current data exchanges remained in sync with minimal disruption to the system users (including account rollover, initial financial plan import from ARMPS)

2. Coordination of CAM and ARIS in regards to soft funds

   ***Impact*:** Earlier access to carryover soft funds by eliminating the need to wait for CAM to be completed. Users had immediate access to their soft funds in ARIS for the purpose of establishing outgoing agreements.

Performance Targets

AFM PG 2.2: ARMPS and CATS are fully implemented on ARIS/ORACLE platform, meets needs of ARS users, and maximizes opportunities for financial data integration.

During FY 2015, AFM will:

Continue updating the ARMPS system to implement the data exchange opportunities that have been identified to ensure the system is up to date and utilizing current technology to increase efficiency.

Continue to identify multiple data exchange opportunities between SAMS, ARMPS, CATS, ARIS and other non-financial ORACLE-based applications to reduce the need for duplicate data entry and increase operating efficiency.

During FY 2016, AFM will:

Identify multiple data exchange opportunities between SAMS, ARMPS, CATS, ARIS and other non-financial ORACLE-based applications to reduce the need for duplicate data entry and increase operating efficiency.

During FY 2017, AFM will:

Identify multiple data exchange opportunities between SAMS, ARMPS, CATS, ARIS and other non-financial ORACLE-based applications to reduce the need for duplicate data entry and increase operating efficiency

PRIORITY GOAL 3 - PROCESS IMPROVEMENT FOR EXTRAMURAL AGREEMENTS PROGRAM

USDA promotes the improvement and development of systems of accountability that encourage all employees to achieve high standards of performance and customer service. ARS recognizes the need for improved business process to achieve this high level of customer service and employee performance. The AFM Extramural Agreements Division further supports this initiative through the review and improvement of the extramural agreements process to provide a streamlined and consistent agreements process throughout the Agency.

Objective: Extramural agreements are awarded and administered in an efficient and timely manner to ensure accomplishment of mission and program goals and objectives. All agreements are legally and fiscally sound and are in full compliance with established extramural policies and procedures.

AFM PG 3.1 **Ensure effective use and administration of extramural agreements including fiscal and programmatic responsibility for ARS-PIs, Authorized Departmental Officers (ADOs), Grant Management Specialists (GMS) and administrative support professionals.**

Indicator 1: ***During 2014, AFM will finalize training programs on authorized uses of Extramural Agreements for ARS-PIs for deployment on AgLearn.***

FY 2014 Accomplishments*:*

1. Extramural Agreements Training for ARS-PI was finalized for deployment on AgLearn.

   ***Impact*:** Improves ARS-PIs understanding of ARS extramural agreements policies and processes and ensures successful accomplishments of duties and responsibilities of the ARS PI**.**

Performance Targets

AFM PG 3.1: Ensure effective use and administration of extramural agreements including fiscal and programmatic responsibility for ARS-PIs, Authorized Departmental Officers (ADOs) and Grant Management Specialists (GMS).

During FY 2015, AFM will:

Deploy AgLearn training programs on authorized uses of Extramural Agreements for ARS-PIs.

Develop Levels 1 and 2 ADO training program and deploy on AgLearn.

Develop extramural agreements training specific for the administrative support professionals.

During FY 2016, AFM will:

Continue AgLearn training programs on authorized uses of Extramural Agreements for ARS-PIs and Levels 1 and 2 ADOs.

Develop ARS specific training for GMS (Levels 3 and 4 ADOs).

During FY 2017, AFM will:

Deploy ARS specific training for GMS (Levels 3 and 4 ADOs) on AgLearn.

AFM PG 3.2 **Ensure ARS Extramural Agreements Regulations; Policies and Procedures (P&Ps) comply with applicable Government-wide standards as prescribed by OMB.**

Indicator 1: ***During 2014, AFM will finalize updating Extramural Agreements P&Ps, and publish as necessary.***

FY 2014 Accomplishments*:*

1. Updated and issued revised Extramural Agreements Policies and Procedures

   ***Impact*:** Ensures proper management of ARS Extramural Agreements during award, administration and close out of the agreement**.**

Performance Targets

AFM PG 3.2: Ensure ARS Extramural Agreements Regulations; Policies and Procedures (P&Ps) comply with applicable Government-wide standards as prescribed by OMB.

During FY 2015, AFM will:

Revise 7CFR550 and incorporate all Government-wide regulations into ARS' extramural agreements.

During FY 2016, AFM will:

Monitor new OMB Guidelines, Departmental Regulations, and revise and publish 7CFR550 and ARS Extramural Agreements P&Ps, as necessary.

During FY 2017, AFM will:

Continue Monitoring of new OMB Guidelines, Departmental Regulations, and revise and publish 7CFR550 and ARS Extramural Agreements P&Ps, as necessary.

PRIORITY GOAL 4 - ELIMINATE IMPROPER PAYMENTS

Based on recent audit estimates, Federal agencies make more than $45.1 billion in improper payments annually. This USDA initiative requires agencies to measure their improper payments annually, develop improvement targets and corrective action plans, and track the results annually to ensure that corrective actions are effective.

AFM will work with the Department plan to:

- Work with Department and Agency officials to reduce the number of improper payments made.
- Recover, where possible, overpayments made to individuals and organizations.

PRIORITY GOAL 5 - IMPROVE ASSET MANAGEMENT

It is the policy of USDA to promote the efficient and economical use of the Department's real property assets and to assure management accountability for implementing Federal real property management reforms. Based on this policy, ARS recognizes the importance of real property resources through increased management attention, the establishment of clear goals and objectives, improved policies and levels of accountability, and other appropriate actions. AFM supports the Department's real property asset management program and the following strategic objectives used for real property management improvement:

- Develop a capital investment strategy that incorporates both facility needs as well as program needs.
- Maximize facility utilization and co-locate Agency operations when possible.
- Use performance measures as part of the asset management decision process.
- Provide management information to determine the appropriate levels of investment.
- Dispose of unneeded assets.
- Use appropriate public and commercial benchmarks and best practices to improve asset management.
- Provide for safe, secure, and healthy workplaces.

Objective: Agencies receive effective and automated services for acquisition and personal property management.

AFM PG 6.1 **REE Agencies realize cost savings and receive best value through leveraging their energy buying power.**

Indicator 1: ***During 2014, AFM will coordinate between APD and FD to develop and implement a comprehensive energy buying plan.***

FY 2014 Accomplishments*:*

1. In FY 2014 FD again sent the Location Energy and Water Consumption spreadsheet from the Annual Greenhouse Gas and Sustainability Report to GSA and DLA Energy to request to be included in any auctions for 3rd party utility commodities in deregulated states. GSA did market research to find new opportunities for natural gas at Maricopa, Salinas, Albany, Ames, Ft Collins, Peoria, Manhattan, Stillwater, El Reno, East Lansing, and Stoneville. Electricity procurement was investigated for USNA, Newark, Peoria, Urbana, Boston, BARC, Franklin, Orono, Ithaca, Geneva, Wooster, Columbus, Wyndmoor, University Park, College Station, Lubbock, Temple, Bushland, Kerrville, Riesel and Houston. Current contracts that came up for re-competition were put in the auctions.

   ***Impact*:** Current contracts were re-competed and delivery orders were awarded to vendors that represented the best interests of the location through GSA and DLA Energy. A new delivery order for electricity was awarded for Ithaca that will save about $60,000/year. A new delivery order for Franklin was also awarded saving about $10,000/year.

Indicator 2: ***During 2014, AFM will continue to work with the General Services Administration (GSA) to expand existing GSA area-wide contracts for utilities to include regions in which ARS is located.***

FY 2014 Accomplishments*:*

1. In FY 2012 APD sent GSA a request for GSA Area-wide contracts to be negotiated on ARS' behalf for utilities where ARS procurement was over the simplified acquisition threshold.

***Impact*:** GSA signed an Area-wide agreement with HELCO to cover the territory in which Hilo is located that included an exhibit that enabled interconnection of PBARC's photovoltaic panels. GSA also signed an Area-wide Contract with Southwest Gas that authorized the development of a Utility Energy Service Contract for Tucson and Maricopa. A new GSA Area-wide was also signed for Kansas Gas Service that covered Manhattan. Service Contract for Tucson and Maricopa. A new GSA Area-wide was also signed for Kansas Gas Service that covered Manhattan.

Performance Targets

AFM PG 6.2: REE Agencies realize cost savings and receive best value through leveraging their energy buying power.

During FY 2015, AFM will:

Coordinate between APD and FD to develop and implement a comprehensive energy buying plan.

APD and FD will continue to work with the General Services Administration (GSA) to expand existing GSA area-wide contracts for utilities to include regions in which ARS is located.

APD and FD will continue to work with the General Services Administration (GSA) and DLA Energy to procure natural gas and electricity from 3rd parties in deregulated states.

FD and FMAD will work with Ameresco to use the AXIS utility bill payment system to reduce the cost of utilities.

During FY 2016, AFM will:

Coordinate between APD and FD to develop and implement a comprehensive energy buying plan.

APD and FD will continue to work with the General Services Administration (GSA) to expand existing GSA area-wide contracts for utilities to include regions in which ARS is located.

APD and FD will continue to work with the General Services Administration (GSA) and DLA Energy to procure natural gas and electricity from 3rd parties in deregulated states.

FD and FMAD will work with Ameresco to use the AXIS utility bill payment system to reduce the cost of utilities.

During FY 2017, AFM will:

Coordinate between APD and FD to develop and implement a comprehensive energy buying plan.

APD and FD will continue to work with the General Services Administration (GSA) to expand existing GSA area-wide contracts for utilities to include regions in which ARS is located.

APD and FD will continue to work with the General Services Administration (GSA) and DLA Energy to procure natural gas and electricity from 3rd parties in deregulated states.

FD and FMAD will work with Ameresco to use the AXIS utility bill payment system to reduce the cost of utilities.

AFM PG 6.3*:* Provide a safe and healthful workplace free of recognized hazards that may cause injury, illness, and/or environmental property damage by strengthening the biosafety, safety, health and environmental management programs.

During FY 2015, *AFM will:*

Spearhead an agency-wide initiative to conduct a hazardous material sweep to ensure that all materials are accounted for and that unnecessary hazardous materials are disposed of in an environmentally safe manner.

Ensure ARS employees conduct safety-related operational and training activities to raise biosafety, safety, health and environmental management awareness.

Ensure ARS safety professionals have uniform, agency specific, biosafety, safety, health and environmental management training.

Conduct comprehensive assessments of several ARS centers and/or laboratories by a multidisciplinary team of safety professionals.

Continue to participate in the Leadership Safety Committee and sub committees to continue define and to improve the safety culture within ARS.

During FY 2016, *AFM will:*

Continue to develop and implement program improvement strategies once vetted thru the Leadership Safety Committee.

During FY 2017, *AFM will:*

Continue to develop and implement program improvement strategies once vetted thru the Leadership Safety Committee.

AFM PG 6.4*:* Perform Facility Assessments over the next 7 years on ARS facilities analyzing both condition and functionality to determine the appropriate levels of both short term (High Priority Requirement List projects) and long term (Capital Investment Strategy projects) investments.

During FY 2015, *AFM will:*

Establish a standard of workmanship for assessing facility condition and functionality and perform assessments on 10 percent of ARS facilities.

Work with Business Service Center engineering staff to introduce them to the new assessment program and facilitate their involvement.

Conduct training for Facilities Division and Business Service Center staff for both assessment procedures and programming.

During FY 2016, *AFM will:*
Continue the facility assessment program.

During FY 2017, *AFM will:*
Continue the facility assessment program.

PRIORITY GOAL 6 - SUPPORT FAITH-BASED AND COMMUNITY INITIATIVE

This initiative strives to support the essential work of faith-based and community organizations. AFM supports this initiative by ensuring the acquisition process allows these organizations to compete on equal footing for ARS contracts.

ARS Office of the Chief Information Officer (OCIO) Management Initiatives

OVERVIEW OF MANAGEMENT INITIATIVES

ARS works through its Office of the Chief Information Officer (OCIO) to enable more effective and efficient research mission delivery through a strengthened information and technology management program. The premise of this program is based on the following vision statement:

"ARS information systems are mission driven and responsive to customer needs; they are reliable, secure, user friendly, relevant, innovative, well planned, and managed effectively."

Effective information systems flow from mission requirements. This relationship dictates a structured, comprehensive, and ongoing review of information systems and the technology needed to support ARS mission and internal and external customer needs. Because ARS is the government entity uniquely responsible for creating new knowledge and the data, information, and technology necessary for a sustainable and globally competitive American agriculture, the Agency's information technology program must provide a safe and reliable environment to support the creation, storage, and dissemination of this
knowledge.

The ARS OCIO works in consultation with the ARS Executive Information Technology (IT) Steering Committee to define the strategic direction of the Agency's information technology program in the ARS IT Strategic Plan, which defines ARS' IT strategic goals, objectives, and strategies. The plan identifies key information management issues and provides the framework for developing integrated information systems and technology through further definition and specification of architecture components and information elements. OCIO then works in coordination with the Agency's IT specialists to implement these IT strategies with broad Agency wide impact.

EXPAND ELECTRONIC GOVERNMENT

OCIO facilitates the Agency's implementation of broad Federally and USDA-mandated IT programs focused on expanding electronic government. OCIO will continue to work with the USDA Office of the Chief Information Officer (USDAOCIO) to achieve this goal. Specifically, OCIO will work with the USDA-OCIO on key areas for effective IT management, such as Enterprise Architecture, Federal Information Security Management Act (FISMA), and Capital Planning and Investment Control, as well as on network efficiency, reliability, and capacity to ensure support of E-Government projects.

Appendix A:
Strategic Consultations & Inter-Agency Working Groups

ARS regularly consults with external groups – from customers to policy experts, to industry and consumer groups – about the effectiveness of its programs and the need for improvement. While many of these consultations are not conducted expressly for the purpose of the strategic plan, they influence strategic goals, objectives, strategies, and targets. ARS Associate Administrators, Deputy Administrators, and National Program Leaders serve on many committees, taskforces and inter-agency working groups where they lend their expertise to solving agricultural problems on both a domestic and global scale.

ARS Inter-Agency Working Group Participation

Group name	Sponsoring Organization	Brief purpose
Academy of Finland	USDA/Finland	Collaborate on food safety research; share food safety information
ADODR on Confidentiality Agreements	Food Companies	To discuss mutual interests related to functional foods
Agricultural Air Quality Task Force	Chief of NRCS, Office of the Secretary	FACA dealing with air quality, climate change and sometimes bioenergy research & policy
Agricultural Trilateral Working Group Pakistan, Afghanistan (NEW)	FSA	To promote food security for Pakistan and Afghanistan in partnership with USDA
Air Quality Research Subcommittee	CENR	Federal agency information sharing
Alternative Feeds for Aquaculture Initiative	USDA/NOAA	Spur progress in development of aquaculture feedstuffs not reliant on marine pelagic fisheries
American Bakers Association	ABA	To exchange information and assess industry research needs and priorities.
American College of Veterinary Preventative Medicine	AVMA	board certification association for veterinary preventive medicine- I'm a diplomat
American Leather Chemists Association	ALCA	To share information and assess priority needs of the hides and leather industries
American Meat Science Association	Meat and Livestock Industry and Universities	Coordinate public research in meat quality, and safety
American Society of Microbiology	ASM	share microbiologic information
American Veterinary Medical Association	AVMA	sharing of information on veterinary medicine
AMI Scientific Steering Committee	American Meat Institute (AMI)	Set research priorities and review grants
AMI, NCBA, AMI, Pork Board, UFFV,	Commodity	Exchange information on priorities
APHIS Plant Protection and Quarantine Board of Advisors	USDA, APHIS, PPQ	Coordination and Customer Needs for APHIS PPQ
APHIS Research Priorities Steering Committee	APHIS, ARS, NIFA	Interagency Coordination
APHIS Technical Advisory Group for Biological Control Agents for Weeds	APHIS	Provide Technical guidance to APHIS on risks associated with biological control agent releases
Aquatic Nuisance Species Task Force	Federal Interagency	Provide Technical Guidance to Federal Invasive Species Response (Aquatic Nuisance Species)
Armed Forces Pest Management Board	DoD	Consultant

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
ARS Liaison to FSIS Biosecurity Division	USDA	Coordinates biosecurity related research conducted for DHS or FSIS by ARS. Assist in conducting Carver-Shock analysis on biosecurity agents
ARS MOU with DMI, Inc.	DMI, Inc.	To cooperate in developing innovative new products to expand markets for U.S. dairy producers and processors
ARS MOU with the United Soybean Board	United Soybean Board	To improve coordination between the two organizations to better leverage resources applied to the research necessary to develop value-added non-food, non-feed, products using soybeans as a feedstock
ARS partnership with DMI, Inc., the National Dairy Council, and the Department of Defense, Combat Feeding	DMI, Inc.	Designed to leverage government, industry and university resources to greater overall effectiveness and efficiencies, increase collaboration, and help to achieve a more profitable dairy industry
Asian Tiger Mosquito Areawide IPM Project	ARS	Coordination and consultant
ASM Steering Committee for Research Colloquium	American Society of Microbiology (ASM)	To occur in 2011 on Meeting Global Water Needs (includes food safety)
Association of Public Health Veterinarians	AVMA	Communicate public health information among veterinarians working in state, local and federal govt
BEP Animal Health Initiatives	ARS, DoS	Scientific Diplomacy
Biobased Products and Bioenergy Coordination Council	REE Undersecretary	The Biobased Products and Bioenergy Coordination Council (BBCC) was established by the Secretary of Agriculture to provide a forum through which USDA agencies will coordinate, facilitate and promote research, development, transfer of technology, commercialization, and marketing of biobased products and Bioenergy using renewable domestic agricultural and forestry materials. This includes promoting information sharing, strategic planning and providing policy advice to the Secretary. (see www.ars.usda.gov/bbcc)
Biochem 20/20	Contractor	Biosecurity
Biodefense Backstopping	subPCC - DoD	Coordinate International collaborative efforts in developing countries
Bioenergy Crop Assistance Program (BCAP) Project Area Selection Criteria Working Group	Farm Service Agency	BioEnergy Science Team assisting FSA in developing science-based criteria for evaluation BCAP proposals
Biofuels Sustainability Criteria and Indicators Sub-committee	Biomass Research & Development Board	Develop criteria and indicators for sustainable biomass production
Biological Threat Reduction Program	DOD	Coordinate international collaborative efforts to enhance the development of a veterinary infrastructure and animal health research in developing countries
Biomass Conversion Interagency Working Group	Biomass R&D Initiative Board	coordinate Federal-wide efforts in support of converting ligno-cellulosics to fuels
Biomass R&D Board - Environmental Health & Safety	Congress/EPA/USDA	Identify EH&S hazards and benefits related to practices and technologies of components of the biofuels supply chain
Biosurety working group	NSABB	Advise federal government on developing personnel reliability standards
Biotechnology Coordinating Committee	Across USDA	Consistent communication regarding Biotech w/in USDA
Borlaug Global Rust Initiative	USDA, CG Centers, Gates Foundation, multiple wheat growing countries	Address Ug99 and other virulent wheat stem rusts
Cattle Fever Tick Eradication Program	APHIS	Coordination of research and operations
CBRN Countermeasures	Federal	Biosecurity Research

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
CEAP Working Group	NRCS	coordinate grazingland CEAP activities
Citrus Greening Coordinating Group	ARS, APHIS, Florida Citrus Mutual	To coordinate research to combat citrus greening disease in cooperation with APHIS, University collaborators, and IFAS.
Citrus Greening Research Planning Taskforce	ARS	Plan national research programs to develop and implement management strategies for citrus greening and canker.
Classified Life Sciences Research Interagency Working Group	ARS, HHS, DHS, NIH, CDC, USAF, OSTP, FPA, FSIS	To coordinate interagency activities related to classification of research.
Climate Change Carbon Cycle Interagency Working Group	US Climate Change Science Program	Info sharing, research coordination
Climate Change Ecosystems Interagency Working Group	US Climate Change Science Program	Info sharing, research coordination
Climate Change Land Use/Land Cover Interagency Working Group	US Climate Change Science Program	Info sharing, research coordination
Climate Change North American Carbon Project Steering Committee	US Climate Change Science Program	Research coordination
Climate Change Water Cycle Interagency Working Group	US Climate Change Science Program	Info sharing, research coordination
Codex Alimentarius	Codex- FDA coordinating US group	Intergovernmental Task Force on Antimicrobial Resistance
Colony Collapse Disorder Steering Committee	ARS	Coordination of research for Colony Collapse Disorder.
Combase	USDA/FSA-UK	Collaborate on food safety research: share food safety information
COMEXA (Comision Mexicano-Estados Unidos Para La Eradicacion del Gusano Barrenador de Ganados)	APHIS	Coordination
Committee on Environment, Natural Resources, & Sustainability (CENRs) Subcommittee on Water Availability & Quality (SWAQ)	OSTP (USGS and EPA are co-leads)	Coordinate water activities across all Federal agencies with water missions.
COPEG (Comision Panameno-Estados Unidos Para La Eradicacion del Gusano Barrenador de Ganados)	APHIS	Coordination
Core Group	Office of Pest Management Policy (USDA ARS) (participants include all USDA agencies involved in pesticide research or policy development)	Provide coordination of pesticide related issues across USDA
CRWG committee on Practices for Enhancing Personnel Reliability and the Culture of Responsibility in High Containment Labs	Interagency	Evaluate standards for personnel for high containment laboratories
Department of Defense Biological Threat Reduction Program (BTRP) Review	DoS, DoD, HHS, and USDA	Interagency Coordination
Deployed Warfighter Protection Program	DoD	Coordination of research and development
DHS AG/Food Sub IPT	Interagency	Coordination of research and development
DHS Chemical-Biological Capestone IPT	Interagency	Coordination of research and development

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
DHS S&T Chemical Countermeasures	USDA	The mission of the committee is to enhance and coordinate the nation's capability to anticipate, prevent, and protect, respond to and recover from chemical threat attacks through innovative research, development, and transition capabilities. Specific focus NSTC Task Force on Non-Traditional Chemical Agents: Research and Development Plan
DHS/NTA	USDA	The committee identifies and evaluates food and water capability, and countermeasure gaps for non-traditional agents (NTAs)
DHS-OMB-MAX	USDA	3 groups: Coordinating Homeland Security Science and Technology; Agriculture; and Rapid Detection Working Group
Diabetes Mellitus Interagency Coordinating Committee	NIH	Provide input on plans for research/treatment/education of diabetes
Dietary Guidance Working Group	USDA	Review federal nutrition publications for compliance with Dietary Guidelines for Americans
USDA Combined Drought and Water Team	USDA	Coordinate drought research, monitoring, and water-based decision making in USDA; advise Sec'y and agencies.
Dual Use Research working group	NSABB	Advise federal government on developing Dual use research guidelines
EFSA Scientific Colloquium on Assessing HealthBenefits of Controlling Campylobacter in the Food Chain ASM Research Colloquium on Global Food Safety	EFSA	Provide guidance on potential interventions in poultry for Campylobacter
EU-US Safe Food	EC	Share food safety information
FADT Subcommittee, Veterinary Countermeasures	ARS, DHS, APHIS, EPA, DoD	IWG
Fed Emergency Response Network	Federal	Coordinate Emergency responses to biosecurity: methods validation
Federal Experts Security Advisory Panel (FESAP)	Interagency	Security of Select Agent Policies
Federal Interagency Committee for Management of Noxious and Exotic Weeds (FICMNEW)	Federal Interagency	Provide Technical Guidance to Federal Invasive Species Response (Weeds)
Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens (ITAP)	Federal Interagency (USDA and DOI Co-Chair)	Provide Technical Guidance to Federal Invasive Species Response (Invertebrates, Vertebrates, Plant and Animal Pathogens)
Federal-State Potato Research Program	ARS-National Potato Council	To conduct research on emerging pests of potato in a Federal-State partnership to address high priority areas
Feedstock Production Interagency Working Group, Genetic Improvement	Biomass Research & Development Board	Develop Interagency Strategic Plan for Bioenergy
Food Allergy Clinical Guidelines Coordinating Committee	NIAID	Oversee process of developing guidelines on food allergy
Food Defense R&D Interagency Committee	USDA	Coordination of Food Defense research and development between DHS, USDA, HHS, and any other pertinent agencies
Foreign Animal Disease Threat (FADT) Subcommittee, Basic Research Working Group	ARS, NSF, DHS, HHS	IWG
Foreign Animal Disease Threat Subcommittee	NSTC	Coordinate Foreign Animal Disease countermeasures and research
Forest Service	Forest Service	Interagency Coordination

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
FSU Animal Health Initiatives	ARS, DoS	Scientific Diplomacy
Garden Rose Council	Rose Nursery industry	To coordinate research efforts to address issues of high priority to the Garden Rose industry
Global Change Task Force	Office of Chief Economist	Information sharing among USDA agencies with climate change activities
Global Foot-and-Mouth Disease Research Alliance (GFRA)	ARS, APHIS, DHS	Global Foot-and-Mouth Disease Research Alliance to support FAO/OIE global control and eradication initiative
Global Health Initiative (GHI) Interagency Research Committee	ARS, NIH, CDC, NIFA, OSTP	1. To identify several high-impact research questions and potential "game changers" in global health; 2. To determine how the GHI Interagency Research Committee (IRC) can facilitate GHI plus partner country implementation of GHI's Principle #7, "Promote Research and Innovation;"3. To identify how individual agencies/initiatives can align current and planned global health research efforts to advance GHI principles and targets;
Global Research Alliance on Agricultural Greenhouse Gases		To bridge gaps in research on agricultural greenhouse gas emissions, and to coordinate such research on an international scale, ensuring that scientists share their findings with research communities and farmers in other countries as well as their own. Shafer is international Croplands coordinator
Global Water Cycle Interagency Work Group	Climate Change Science Program (CCSP)	Develop new, innovative science concepts to incorporate into the CCSP global water cycle science plan
Human Nutrition Coordinating Committee	USDA	Share information among USDA agencies whose mission includes nutrition-chaired by ARS
Human Studies Review Board	EPA	Expert consultation
ICT-Prague`	USDA/Czech Republic	Collaborate on food safety research; share food safety information
ILSI Carbohydrates Committee	International Life Sciences Institute	Focus on issues of importance to food industry
Implementation Team for Joint China National Energy Administration (NEA)-DOE-USDA MOU	Foreign Agricultural Service	Implement Joint NEA-DOE-USDA MOU for advanced biofuels production research.
Informal interagency group for responding to OIG study on USDA control of genetically-engineered crop holdings	Office of the Secretary, APHIS, ARS	Developed USDA-wide response to OIG study of how USDA managed holdings of genetically-engineered crops
Informal interagency group on OECD biosecurity and biobanks	State Department	Develops US government positions on OECD developed guidelines for biological resource center and related topics
Inter Agency Residue	Federal	Share food safety information
Interagency Cross-Cutting Group on Climate change and Human Health	USGCRP (OSTP)	Develop priorities, outreach, and strategies for adaptation to climate change
Interagency Feedstock Production Working Group	Bioenergy R&D Initiative Board	co-chair, Identify research needs and make recommendations
Interagency Grazinglands Working Group	USDA (ARS & NIFA)	Coordinate grazingland activities between USDA & DOI
Interagency Native Plant Conservation Alliance (PCA)	DOI	Promote & develop interagency and private partnerships
Interagency Water Working Group	State Department	Coordinate federal water agencies/international focus
Interagency Working Group on Climate Change and Public Health	EPA, NIH	Coordination

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
Interagency Working Group on Domestic Animal Genomics	OSTP	Review progress, needs & opportunities in animal genomics research
Intergovernmental Risk Assessment Consortium	All Federal agencies- FDA runs it	Share information on risk assessment
Intergovernmental Select Agents and Toxins Technical Advisory Board	Interagency	Interagency Coordination
International Association for Food Production	IAFP	sharing information on food safety and science issues- yearly meeting and journal
International Bioengagement Program	subPCC- State Department	Coordinate international collaborative animal health research and biosafety activities
IR-4	USDA, NIFA, and ARS (participants include university researchers and crop industry reps,)	Generate data needed to develop research data to support new EPA tolerances and labeled product uses for minor crops (specialty crops)
IWG Molecular Vaccines	DoD, ARS, NIH, FDA	IWG
IWG on Prion Science	NIH, ARS, APHIS, EPA, NSF	IWG
JCR: Food Agriculture Sector, DHS Team	DHS	Biosecurity
Joint Subcommittee on Aquaculture	OSTP	Coordination of Aquaculture activities across federal agencies
Judicious Use of Antibiotics	USDA	Development of action and research goals
Methyl Bromide Alternatives Outreach Conference Program Committee	ARS, EPA, and industry	To plan and organize the annual International Methyl Alternatives and Emissions Control Research Outreach Conference
Methyl Bromide Quarantine taskforce (NEW)	State /EPA/USDA	To provide technical input to State/EPA policy makers on methyl bromide quarantine issues.
Methyl Bromide Technical Options Committee [MBTOC]	United Nations Environmental Programmes	Provide technical input to the signatories of the Montreal Protocol.
Microbe Project Inter- Agency Working Group	Federal	Genomics of organisms
MOST-SJTU	USDA/China	Collaborate food safety Res
MOU with GIPSA/FGIS	GIPSA/FGIS	To address the research priorities of GIPSA/FGIS in development measurement technologies for grain quality
National Barley Improvement Committee/American Malting Barley Association	Barley producers/industry	Barley stakeholder groups
National Berry Crop Initiative	Berry industry (ARS and NIFA participate)	To coordinate industry efforts to address issues of importance, including research, to the berry industry.
National Clean Plant Network	APHIS	Protects U.S. specialty crop agriculture and the environment from the spread, through asexual propagation, of targeted plant pathogens and pests that cause economic damage
National Coalition for Childhood Obesity Research	HHS	Collaboration among USDA, NIH, CDC and Robert Wood Johnson Foundation on prevention of childhood obesity
National Corn Growers Assoc./USDA Corn Germplasm Committee	Corn producers/industry	Corn stakeholder group
National Culture Collection Initiative	American Phytopathological Society	Develop a National System for Preservation and Distribution of Plant-associated Microbes
National Dairy Research Program	Dairy Management Inc., USDA (ARS and NIFA), HHS (National Institutes of Health) and DOD	Coordinate research on issues of importance to the dairy industry

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
National Dairy Research Program, Dairy Management	ARS/NIH/DoD	Partnership to advance research on nutrition and food processing issues of concern to the dairy industry.
National Environmental Protection Act Interagency Working Group	EPA	Info sharing, training
National Grape and Wine Initiative	National Grape and Wine Initiative (participants include representatives from table grape, raisin, wine, and juice sectors of the grape industry, ARS, NIFA, Extension, universities)	Identify industry needs that can be addressed through agricultural research, identify resources for the research, coordinate and conduct the research, transfer new knowledge and technologies from researchers to the industry
National Meeting Program Planning Committee for Plant Breeder Coordinating Committee	Several	Planning 2009 annual meeting at the Monona Terrace Convention Center in Madison, Wisconsin
National Oat Improvement Committee	Oat producers, industry	Oat stakeholder group
National Plant Breeding Coordinating Committee	NIFA	Support of plant breeding
National Plant Disease Recovery System	ARS and Land Grant University Institutions, DHS	As directed by HSPD-9, ARS is lead institution to develop a National Plant Disease Recovery system to respond to intentional and/or natural plant disease outbreaks.
National Plant Germplasm Coordinating Committee	ARS, NIFA, ESCOP	Communicates the value of the National Plant Germplasm System and strives to enhance its support
National Science and Technology Council	Chair – Ann Mills, Deputy Under Secretary for NR&E	Information exchange between Federal agencies on ecosystem services research, programs, and projects.
National Sclerotinia Intitiative	ARS with United Soybean Board, National Sunflower Association, National Canola Association, Peanut Council	To conduct research in partnership with Universities to address white mold related diseases and disorders.
National Sorghum Producers Assoc./USDA Sorghum Germplasm Committee	Sorghum producers, industry, researchers	Sorghum stakeholders
National Swine Improvement Federation	Swine Industry and Universities	Coordinate public swine genomics research and develop infrastructure to incorporate genomics information into the swine genetic evaluation system
National Vegetable Crops Initiative	NIFA	To develop a strategic plan for the continued growth and sustainability of vegetable crop production in the United States.
National Wheat Improvement Committee/National Association of Wheat Growers	Wheat industry, producers, researchers	ARS provides information on the funding needs of the wheat quality labs to the National Improvement Committee to be considered for recommendation to the National Association of Wheat Growers among their legislative priorities
NIDDK Advisory Council	NIDDK	Provide advice to NIDDK director -ARS is one of three ex officio agencies represented (DoD and VA are others)
NIFA	NIFA	Interagency Coordination
NIFA Grant Award External Steering Committee	Kansas State University	Provides scientific and stakeholder input
NIFA/ARS Biotech Risk Assessment Grants Program	ARS, NIFA	Biosafety research grant management and ARS/NIFA coordination
NIFA-FSRRN	USDA	Share food safety information
NIH Nutrition Coordinating Committee	HHS, NIH	Information sharing among NIH Institutes and other federal agencies conducting nutrition research.

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
NIH Trans-Agency Complementary and Alternative Medicine Coordinating Committee	NCCAM	Share information on complementary and alternative medicine research in federal government
Northwest Small Fruit Research Center	Northwest Center for Small Fruit Research	To coordinate high impact research which is responsive to the needs of the small fruit and nursery industries in the Northwest US
NSABB (National Science Advisory Board for Biosecurity)	Interagency	Coordination
NSABB Personnel Reliability Working Group	NIH	Review existing mechanisms and make recommendations for improvements
NSTC Subcommittee on Standards	Interagency	Develop standards for CBRN equipment
Nutrition Coordinating Committee	NIH	Share nutrition information among HHS agencies -ARS is USDA representative
OECD Scientific Collections Activity	OECD (International)	Develop Plan for Managing Collections of OECD Members
Office of Dietary Supplements Inter-agency work group	NIH	Information sharing among federal agencies conducting nutrition research and dietary supplements research
Office of Pesticide Programs	EPA	Development of research goals
Organic Working Group	USDA	Information exchange between USDA agencies on organic programs.
OSTP/IWG on Plant Genomes	OSTP	Coordination of plant genomics research among U.S. federal agencies
OSTP/IWG on Scientific Collections	OSTP	Develop a Plan for Maintaining Federal Scientific Collections
Overseas Biological Control Laboratories	ARS	Administration
Pest Information Platform for Education and Extension (PIPEE) Strategic Planning Committee	NIFA, RMA	To develop an integrated national system facilitated by information technology to provide centralized, useful tools with reliable information for IPM practitioners. Mapping of Soybean rust and soybean aphid
Pierce's Disease Task Force	Wine and Grape Industry	Coordinate ARS Pierce's Disease Research
Plant Breeder Coordinating Committee	Several	The PBCC serves as a forum for issues and opportunities of national and global importance to the public and private sectors of the U.S. national plant breeding effort.
POC for ARS Veterinary Workforce Planning Committee	Interagency (All govt agencies with Veterinarians)	Interagency Coordination
PROCINORTE	ARS	Scientific Diplomacy
Program Planning Committee for Soybean Rust Symposium	ARS	Planning 2009 Soybean Rust Symposium
Public Health Pesticide Committee	CDC	Coordination
RAC Biosafety Working Group	NIH	Provide support and recommendations to the NIH Recombinant DNA Advisory committee on biosafety issues
Rift Valley Fever Coordination	DoS and ARS	Workshop
Risk Assessment Consortium	Federal	Share food safety information
SARE – Sustainable Agriculture, Research & Extension, National Operations Committee	NIFA	Coordinate and communicate SARE activities among regions and other Federal agencies.
Science and Technology task force of JSA	JSA	Develop a strategic research and technology development plan for aquaculture across federal agencies
Science of Science Policy Interagency Task Group	OSTP, NSF	Address the need for better tools, methods, and data for improving our understanding of the efficacy and impact of science and technology policy decisions.

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
Scientific Committee for National Foundation for Infectious Diseases	NFID	Coordinate yearly scientific meetings in infectious disease
Scientific Forum on Invasive Species	APHIS, FS	Coordinate Research and Response to Invasive Species of Forest Areas
Screwworm Eradication Program	APHIS	Coordination of research and operations
Secretary's Bioenergy Decision Tool	Office of Energy Policy and New Uses, Office of the Chief Economist	Develop a place-based decision tool that provides information about USDA programs and resources that can be used by rural communities and investors to develop renewable energy projects.
Select Agent Tiering Committee	Interagency	Tier Select Agents
Small & Beginning Farm Coordinators	USDA	coordinate USDA activities to meet group's needs
South Atlantic Methyl Bromide Areawide project	ARS, EPA, and industry	To plan and prioritize research projects.
Steering Committee for the Food Safety Research and Response Network	USDA	Facilitate university based research food safety
Subcommittee on Sedimentation	USGS, Dept of Interior, Advisory Committee on Water Information, Water Information Coordination Program	Supports development of equipment, methodologies, and calibration for the collection, analysis, interpretation, and interchange of fluvial-sediment data and related technical information.
Sub-PCC on International Bioengagement	DoS, DoD, HHS, and USDA	Interagency Coordination
Sugarcane Research Planning Taskforce	ARS	Provides innovative solutions for sustainable sugarcane production.
Technical Representative to National Beef Cattle Evaluation Consortium	Beef Industry and Universities	Coordinate cattle genomics research and develop infrastructure to incorporate genomics information into the beef cattle genetic evaluation system
Technical Representative to National Pork Board Animal Science Committee	Swine Industry and Universities	Coordinate public swine research for traits relating to production efficiencies, pork quality and genomics
Tekes/Academy Finland	USDA/Finland	Collaborate food safety Res; share food safety information
Transfederal Biosafety Taskforce	USDA-HHS	Assess the current federal biosafety program, identifies gaps and solutions to improve the biosafety system
U.S. Wheat & Barley Scab Initiative	USDA, wheat/barley producers, millers, bakers	Reduce wheat mycotoxins and scab losses
Ug99 Wheat Stem Rust Action Team	ARS, APHIS, NIFA, OPMP	Coordinate Ug99 Wheat Stem Rust Response
UK-Food Standards	USDA/UK	Collaborate on food safety research; share food safety information
UK-International Food Research	USDA/UK	Collaborate on food safety research; share food safety information
US Animal Health Association	USAHA	Share information on animal health and related fields
US Group on Earth Observations (USGEO)	CENR	Fed agency info sharing & coordination; US rep to International GEO
US/EC Taskforce on Biotechnology	USDA, EU	Coordinates US and EC Biotechnology Research
USDA Barley Germplasm Committee	USDA	Barley researchers/industry
USDA BioEnergy Science Team (BEST)	REE, FS, AMS, OEPNU	Provide science support by ARS, ERS, NASS, NIFA, FS, AMS, and OEPNU to other agencies in the Department.
USDA Biotechnology Coordinating Group	USDA (USDA Coordinator, Michael Schectman)	Coordinate Plant and Animal Biotech Regulatory Policy and Research
USDA Corn Germplasm Committee	USDA	Corn researchers/industry

ARS Inter-Agency Working Group Participation		
Group name	**Sponsoring Organization**	**Brief purpose**
USDA Global Research Alliance Steering Committee	USDA	
USDA Invasive Species Coordinator Committee	USDA (USDA Coordinator Hilda Diaz-Soltero, Director)	Coordinate USDA Invasive Species Response
USDA Know Your Farmer Committee	USDA Dep. Sec.	Coordinate efforts to connect citizens with agriculture and nutrition
USDA Market-Based Environmental Stewardship Coordination Council	USDA OSEC	Provide agency-level advisory to the USDA Office of Ecosystem Services and Markets and the Secretary, who co-chairs the interdepartmental Environmental Services Board. Establish guidelines and science-based methods to measure the environmental benefits from conservation and land management activities in support of emerging environmental services markets.
USDA One Health Joint Working Group	ARS, APHIS, FAS, NIFA	Technical group to support One Health MAC
USDA Peoples' Garden	USDA	Promote citizens' involvement with agriculture through the Peoples' Garden
USDA Pollinators' Committee	ARS	Coordinating response to pollinators decline
USDA Remote Sensing Coordination Committee	Office of Chief Economist	Information sharing among USDA agencies
USDA Rice Germplasm Committee	USDA	Rice researchers/industry
USDA Risk Assessment Group	USDA	Share risk assessment info among USDA agencies
USDA Sorghum Germplasm Committee	USDA	Sorghum researchers/industry
USDA Sustainable Development Council	Chief Economist's Office	Coordinate USDA-wide sustainable activities
USDA Water Team	USDA	Coordinate USDA's water activities to meet Secretary's High Priority Performance Goals for Water Chair - Ann Mills, Deputy Under Secretary for NR&E
USDA Wheat Germplasm Committee	USDA	Wheat researchers/industry
USDA-ARS-FDA	USDA	Collaborate on food safety research; share food safety information
USDA-ARS-FSIS	USDA	Collaborate on food safety research; share food safety information
USDA-ARS-NIFA	USDA	Share food safety information
USDA-wide committee	Committee on Environmental & Natural Resources (NSTC)	Advises Executive Office on science and technology to support water availability
US-EC Biotechnology Task Force	OSTP	Foster US-EC science collaborations
USGEO Architecture & Data Mgmt Sub Group		Facilitate data sharing among agencies & others
USGEO Policy Sub Group	CENR	Develop US earth observations policy
USGEO Strategic Assessments Sub Group	CENR	Assess & prioritize US earth observation needs (air, land, sea)
Various committees/ task groups of Office of Environmental Markets	USDA	OEM has a unique role in the federal government's efforts to develop uniform standards and market infrastructure that will facilitate market-based approaches to agriculture, forest, and rangeland conservation.
West Coast Methyl Bromide Areawide project	ARS, EPA, and industry	To plan and prioritize research projects.
Working Group within the risk assessment consortium on nanotechnology	IRAC	Produce recommendations for federal agencies for research and policy