2015 President's Budget
Agricultural Research Service

Contents

Purpose Statement

The Agricultural Research Service (ARS) was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

ARS is the principal in-house research agency of the U.S. Department of Agriculture (USDA). Congress first authorized Federally supported agricultural research in the Organic Act of 1862, which established what is now USDA. That statute directed the Commissioner of Agriculture "to acquire and preserve in his department all information he can obtain by means of books and correspondence, and by practical and scientific experiments." The scope of USDA's agricultural research programs has been expanded and extended more than 60 times since the Department was created.

ARS research is authorized by the Department of Agriculture Organic Act of 1862 (7 U.S.C. 2201 note); Agricultural Research Act of 1935 (7 U.S.C. 427); Research and Marketing Act of 1946 (P.L. 79-733), as amended (7 U.S.C. 427, 1621 note); Food and Agriculture Act of 1977 (P.L. 95-113), as amended (7 U.S.C. 1281 note); Food Security Act of 1985 (P.L. 99-198) (7 U.S.C. 3101 note); Food, Agriculture, Conservation, and Trade Act of 1990 (P.L. 101-624) (7 U.S.C. 1421 note); Federal Agriculture Improvement and Reform Act of 1996 (FAIR) (P.L. 104-127); and Agricultural Research, Extension, and Education Reform Act of 1998 (P.L. 105-185). ARS derived most of its objectives from statutory language, specifically the "Purposes of Agricultural Research, Extension, and Education" set forth in Section 801 of FAIR.

The ARS mission is to conduct research to develop and transfer solutions to agricultural problems of high national priority and to 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.

ARS is committed to addressing the Department's priorities:

- Assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving.
- Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.
- Help America promote agricultural production and biotechnology exports as America works to increase food security.
- Ensure that all of America's children have access to safe, nutritious, and balanced meals.

The agency's research programs – New Products/Product Quality/Value Added; Livestock/Crop Production; Food Safety; Livestock/Crop Protection; Human Nutrition; and Environmental Stewardship – are described under the "Status of Program" section.

ARS' Headquarters Offices are located in the Washington, D.C. metropolitan area. The agency's research is organized under 17 national programs. Field activities are managed through eight area offices. Research is conducted at field locations in the United States, Puerto Rico, the Virgin Islands, and several foreign countries. Much of the work is conducted in direct cooperation with State Agricultural Experiment Stations, other State and Federal agencies, and private organizations.

As of September 30, 2013, there were 5,758 permanent, full-time employees including 506 in the Headquarters offices and 5,252 in field offices.

OIG Reports - Completed

50024-0003-13, 6/14/2013, Review of the Department’s Travel Card Data.

50099-11-HY, 4/11/2013, Implementation of Research Misconduct Policy within the USDA.

50099-84-HY, 2/28/2013, USDA Response to Colony Collapse Disorder.

50401-03-11, 11/14/2012, Department of Agriculture’s Consolidated Financial Statements Audit for Fiscal Years 2012 and 2011.

50501-0003-12, 11/15/2012, FY 2012 Federal Information Security Management Act Audit.

50601-01-22, 4/5/2013, Effectiveness of the Department’s Recent Efforts to Enhance Agricultural Trade.

50703-02-13, 11/30/2012, Data Quality Review of American Recovery and Reinvestment Act Jobs Reported for USDA Programs.

OIG Reports - In Progress

02601-1-CH, Adequacy of Controls over the Release of Sensitive Data.

50024-01-13, Review of the Department's U.S. Bank Purchase and Travel Charge Card Data.

50401-06-11, Department of Agriculture’s Consolidated Financial Statements Audit for Fiscal Years 2013 and 2012.

50501-0004-12, FY 2013 Federal Information Security Management Act Audit.

50601-6-TE, Controls over Plant Variety Protection and Germplasm Storage.

50601-10-AT, Follow-up Report on the Security of Biological Agents at U.S. Department of Agriculture Laboratories.

50601-17-TE, Controls over Importation of Transgenic Plants and Animals.

50703-01-HQ, Oversight and Control of USDA American Recovery and Reinvestment Act Activities.

89901-0001-13, Contractor Databases.

GAO Reports - Completed

320886, 2/26/2013, Feed the Future Initiative (closed without issuing a report).

361302, 6/20/2013, Pesticides and Food Safety (USDA involvement in the audit terminated).

830842, 11/5/2012, Cost Savings in Federal Government Satellite Programs (closed without issuing a report).

GAO-12-880, 10/15/2012, Energy-Water Nexus: Coordinated Federal Approach Needed to Better Manage Energy and Water Tradeoffs.

GAO-13-14, 12/19/2012, Federal Real Property: Improved Cost Reporting Would Help Decision Makers Weigh the Benefits of Enhanced Use Leasing.

GAO-13-136, 3/11/2013, Wind Energy: Additional Actions Could Help Ensure Effective Use of Federal Financial Support.

GAO-13-154, 1/31/2013, Overlap and Duplication: Federal Inspections of Entities Registered with the Select Agent Program.

GAO-13-255, 4/12/2013, Two USDA Agencies Can Enhance Safeguards Against Project Duplication and Strengthen Collaborative Planning.

GAO-13-424, 5/21/2013, Homeland Security: An Overall Strategy Is Needed to Strengthen Disease Surveillance in Livestock and Poultry.

GAO-13-466R, 2/25/2013, High-Containment Laboratories: Assessment of the Nation's Need is Missing.

GAO Reports - In Progress

361439, USDA's Pilot Inspection System.

361444, Human Capital Management and Restructuring Efforts.

361454, Freshwater Supply Update.

361481, Programs to Clean Up Contaminated Federal Property.

361488, Ocean Acidification Effects.

361531, USDA Climate Change Efforts.

460615, Technical and Scientific Methods Used in the FBI's Investigation of the 2001 Anthrax Attack.

540257, Alternative Fuels for Aviation.

542214, Federal Government's Management of Federal Structures.

Available Funds and Staff Years (SYs)
(Dollars in thousands)

Item	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Salaries and Expenses:								
Discretionary Appropriations	$1,094,647	6,986	$1,101,853	6,381	$1,122,482	6,773	$1,104,403	6,773
Buildings and Facilities:								
Discretionary Appropriations	-	-	-	-	-	-	-	-
Rescission	-	-	-29,838	-	-	-	-	-
Sequestration	-	-	-55,067	-	-	-	-	-
Transfers In	111	-	102	-	-	-	-	-
Adjusted Appropriation	1,094,758	6,986	1,017,050	6,381	1,122,482	6,773	1,104,403	6,773
Balance Available, SOY	16,943	-	14,217	-	12,524	-	-	-
Other Adjustments (Net)	2,383	-	970	-	-	-	-	-
Total Available	1,114,084	6,986	1,032,237	6,381	1,135,006	6,773	1,104,403	6,773
Lapsing Balances	-5,218	-	-2,739	-	-	-	-	-
Balance Available, EOY	-14,217	-	-12,524	-	-	-	-	-
Obligations	1,094,649	6,986	1,016,974	6,381	1,135,006	6,773	1,104,403	6,773
Obligations under other USDA appropriations: 1/								
Agricultural Marketing Service	130	1	-	-	-	-	-	-
Agriculture & Food Research Initiative (AFRI)	3,512	12	1,963	8	1,963	8	1,963	8
Animal & Plant Health Inspection Service	15,085	53	15,868	64	15,868	64	15,868	64
Departmental Management	1,839	7	-	-	-	-	-	-
Economic Research Service	3,265	12	3,367	14	3,367	14	3,367	14
Food, Nutrition & Consumer Services	1,589	6	2,519	10	2,519	10	2,519	10
Food Safety & Inspection Service	2,915	10	3,128	13	3,128	13	3,128	13
Foreign Agricultural Service	4,082	14	691	3	691	3	691	3
Forest Service	1,333	5	1,328	5	1,328	5	1,328	5
Hazardous Waste	3,088	11	1,370	5	1,370	5	1,370	5
National Agricultural Statistics Service	4,351	15	4,280	17	4,280	17	4,280	17
National Institute of Food and Agriculture	22,531	82	26,093	106	26,093	106	26,093	106
Natural Resources Conservation Service	3,602	13	2,863	12	2,863	12	2,863	12
Office of the Chief Economist	-	-	127	1	127	1	127	1
Misc., Other USDA Funds	533	2	686	3	686	3	686	3
Total, Other USDA	67,855	243	64,283	261	64,283	261	64,283	261
Total, Agriculture Appropriations	1,162,504	7,229	1,081,257	6,642	1,199,289	7,034	1,168,686	7,034

Available Funds and Staff Years (SYs)
(Dollars in thousands)

Item	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Other Federal Funds: 1/								
Agency for International Development.	10,504	37	9,938	40	9,938	40	9,938	40
Department for International Development.....	415	1	-	-	-	-	-	-
Department of Defense.....	7,245	26	7,652	31	7,652	31	7,652	31
Department of Energy.....	1,416	5	1,257	5	1,257	5	1,257	5
Department of Health & Human Services.....	7,721	27	5,435	22	5,435	22	5,435	22
Department of Homeland Security.....	4,195	15	4,603	19	4,603	19	4,603	19
Department of State.....	1,165	4	678	3	678	3	678	3
Department of the Interior.....	2,062	7	1,544	6	1,544	6	1,544	6
Department of Treasury.....	-	-	125	1	125	1	125	1
Environmental Protection Agency.....	734	3	355	1	355	1	355	1
National Aeronautics & Space Administration.....	1,682	6	1,934	8	1,934	8	1,934	8
National Oceanic and Atmospheric Administration.....	133	1	-	-	-	-	-	-
Strategic Environmental Research Development Program (SERDP).....	649	2	463	2	463	2	463	2
Misc., Other Federal Funds.....	135	-	134	1	134	1	134	1
Total, Other Federal.....	38,056	134	34,118	139	34,118	139	34,118	139
Non-Federal Funds: 1/								
Arkansas, University of.....	251	1	349	1	349	1	349	1
Binational Agricultural Research & Development (BARD)....	324	1	432	2	432	2	432	2
Boyce Thompson Institute for Plant Research.....	-	-	110	1	110	1	110	1
California, State of.....	2,049	7	2,319	9	2,319	9	2,319	9
California, University of.....	2,077	7	1,969	8	1,969	8	1,969	8
Chicago, University of.....	-	-	134	1	134	1	134	1
Citrus Research and Development Foundation.....	1,949	7	2,789	11	2,789	11	2,789	11
Clemson University.....	-	-	124	1	124	1	124	1
Cornell University.....	506	2	694	3	694	3	694	3
Cotton Incorporated.....	782	3	1,214	5	1,214	5	1,214	5
Dade County Department of Environmental Resource Management.....	113	-	-	-	-	-	-	-
Danforth Plant Science Center.....	217	1	-	-	-	-	-	-
Delaware, University of.....	266	1	394	2	394	2	394	2

Available Funds and Staff Years (SYs)
(Dollars in thousands)

Item	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Non-Federal Funds: (continued)								
Florida Citrus Production Research Advisory Council	224	1	-	-	-	-	-	-
Florida, State of	779	3	826	4	826	4	826	4
Florida, University of	389	1	247	1	247	1	247	1
Georgia, University of	486	2	901	4	901	4	901	4
Hispanic Serving Institutions National Program	1,153	4	1,157	5	1,157	5	1,157	5
Idaho, University of	-	-	102	1	102	1	102	1
Illinois, University of	238	1	256	1	256	1	256	1
Indian River Citrus League	102	-	110	1	110	1	110	1
Iowa State University	1,084	4	1,122	5	1,122	5	1,122	5
Iowa, University of	-	-	468	3	468	3	468	3
Kansas State University	263	1	204	1	204	1	204	1
Kentucky, University of	312	1	325	1	325	1	325	1
Louisiana State University	231	1	185	1	185	1	185	1
Maryland, State of	-	-	153	1	153	1	153	1
Maryland, University of	134	-	413	3	413	3	413	3
Massachusetts General Hospital	-	-	117	1	117	1	117	1
Massachusetts, University of	284	1	236	1	236	1	236	1
Michigan State University	196	1	276	1	276	1	276	1
Minnesota, University of	391	1	563	3	563	3	563	3
Mississippi Soybean Association	119	-	107	1	107	1	107	1
Mississippi State University	-	-	119	1	119	1	119	1
National Cattlemen's Beef Association	109	-	-	-	-	-	-	-
Missouri, University of	-	-	109	1	109	1	109	1
National Pork Board	229	1	272	1	272	1	272	1
Nebraska, University of	116	-	234	1	234	1	234	1
North Carolina State University	360	1	665	4	665	4	665	4
North Dakota State University	212	1	120	1	120	1	120	1
Ohio State University	195	1	437	3	437	3	437	3
Oklahoma State University	-	-	528	3	528	3	528	3
Oregon State University	194	1	119	1	119	1	119	1
Pennsylvania State University	310	1	306	1	306	1	306	1
Perdue University	-	-	110	1	110	1	110	1
Quarters Deductions	119	-	-	-	-	-	-	-
Revocable Permits & Easements	568	2	1,906	-	1,906	-	1,906	-
Rutgers University	-	-	125	1	125	1	125	1
Sale of Animals & Personal Property (Proceeds)	1,519	5	2,284	-	2,284	-	2,284	-

Available Funds and Staff Years (SYs)
(Dollars in thousands)

Item	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Non-Federal Funds: (continued)								
South Dakota State University	565	2	282	1	282	1	282	1
South Florida Water Management District	459	2	300	1	300	1	300	1
South Illinois University	117	-	105	1	105	1	105	1
Tahoe Regional Planning Agency (TRAP)	117	-	-	-	-	-	-	-
Tennessee, University of	-	-	226	1	226	1	226	1
Texas Agrilife Research & Extension Center	380	1	408	3	408	3	408	3
Texas State Soil and Water Conservation Board	224	1	-	-	-	-	-	-
Texas Tech University	130	-	-	-	-	-	-	-
Texas Water Resources Institute	-	-	172	1	172	1	172	1
Travel and Miscellaneous Reimbursements	546	2	563	3	563	3	563	3
United Sorghum Checkoff Program	-	-	376	2	376	2	376	2
United Soybean Board	9,914	36	5,755	23	5,755	23	5,755	23
Virginia Polytechnic Institute	170	1	-	-	-	-	-	-
Washington State University	261	1	364	1	364	1	364	1
Washington Tree Fruit Research Commission	413	1	332	1	332	1	332	1
Wisconsin University	-	-	249	1	249	1	249	1
Misc., Non-Federal Funds	3,582	13	3,357	14	3,357	14	3,357	14
Total, Non-Federal Funds	35,728	125	38,119	155	38,119	155	38,119	155
Miscellaneous Contributed Funds:	24,466	108	31,977	122	31,977	122	31,977	122
Total, ARS	1,260,754	7,596	1,185,471	7,058	1,303,503	7,450	1,272,900	7,450

1/ All funding received is in support of agricultural research.

Permanent Positions by Grade and Staff Year Summary

Item	2012 Actual			2013 Actual			2014 Estimate			2015 Estimate		
	Head-quarters	Field	Total	Head-quarters	Field	Total	Head-quarters	Field	Total	Head-quarters	Field	Total
SES.....	14	25	39	14	24	38	14	24	38	14	24	38
GS/GM-15.....	51	619	670	49	657	706	53	701	754	53	701	754
GS/GM-14.....	57	613	670	65	586	651	70	625	695	70	625	695
GS/GM-13.....	128	487	615	126	462	588	136	493	629	136	493	629
GS-12.....	123	331	454	125	295	420	135	315	450	135	315	450
GS-11.....	58	539	597	61	541	602	66	577	643	66	577	643
GS-10.....	2	4	6	2	5	7	2	5	7	2	5	7
GS-9.....	61	943	1,004	54	928	982	58	990	1,048	58	990	1,048
GS-8.....	21	350	371	20	358	378	22	382	404	22	382	404
GS-7.....	57	641	698	52	615	667	56	656	712	56	656	712
GS-6.....	23	238	261	17	232	249	18	248	266	18	248	266
GS-5.....	12	144	156	10	131	141	11	140	151	11	140	151
GS-4.....	9	30	39	8	31	39	9	33	42	9	33	42
GS-3.....	1	10	11	1	11	12	1	12	13	1	12	13
GS-2.....	-	8	8	-	7	7	-	7	7	-	7	7
GS-1.....	-	1	1	-	1	1	-	1	1	-	1	1
Other Graded Positions.....	4	-	4	4	-	4	4	-	4	4	-	4
Ungraded Positions.....	-	477	477	-	457	457	-	457	457	-	457	457
Total Perm. Positions.....	621	5,460	6,081	608	5,341	5,949	655	5,666	6,321	655	5,666	6,321
Unfilled EOY..	128	106	234	102	89	191	110	61	171	110	61	171
Total Perm. Full-Time Employment, EOY.....	493	5,354	5,847	506	5,252	5,758	545	5,605	6,150	545	5,605	6,150
Staff Year Est..	490	7,106	7,596	527	6,531	7,058	566	6,884	7,450	566	6,884	7,450

Size, Composition and Cost of Motor Vehicle Fleet

The 2015 Budget Estimates propose the replacement of 2 passenger motor vehicles**.** These acquisitions will replace existing vehicles without increasing the number of passenger motor vehicles or fleet. Due to the timing of vehicle receipt and sales through the exchange/sale process, there may be an overlap in the vehicle receipt, replacement, and disposal inventory. However, ARS is not adding to the overall fleet.

Professional research and technical personnel primarily use the ARS motor vehicle fleet in conjunction with research studies and technical assistance. To conduct daily work, research personnel travel between agricultural research sites, State agricultural experiment stations, farms, ranches, commercial firms, and others. Most of these sites are in rural locations and require a high degree of mobility. Use of common carriers is not feasible. Studies of cost requirements between private and government vehicles show that it is more economical to use government vehicles than to reimburse employees for the use of private vehicles.

It is ARS policy to pool vehicle use to keep the number of vehicles to a minimum. ARS requires quarterly vehicle operational reports and makes periodic surveys to determine the extent of vehicle use. During the biennial physical inventory process, ARS works to ensure inactive vehicles are removed from the inventory according to Federal property management regulations. ARS program managers are responsible for managing budgets and program needs to fulfill the agency's research mission. Replacement is based on program management, vehicle mileage/age, and funding. By Federal regulation, minimum replacement standards for passenger vehicles are three years or 60,000 miles, and for light trucks are six years or 60,000 miles. All proposed replacement vehicles exceed minimum standards.

The composition of the ARS fleet is primarily light duty trucks. Multi-purpose vehicles enable research personnel to move equipment and transport personnel. Past practices have allowed ARS to decrease the number of passenger vehicles. However, it may be necessary to replace light duty vans with more fuel-efficient passenger vehicles to help reduce fuel costs. ARS will continue to review its fleet for opportunities to realign the fleet where it is necessary, without affecting the mission. The agency continues to review inventory information to accurately classify the fleet.

Fiscal Year	Number of Vehicles by Type *								Annual Operating Costs ($ in 000)
	Sedans and Station Wagons	Light Trucks, SUVs, and Vans		Medium Duty Vehicles	Ambulances	Buses**	Heavy Duty Vehicles	Total Number of Vehicles	
		4X2	4X4						
FY2012	243	1,331	856	905	0	1	55	3,391	$3,574
Change	-8	-18	47	-211	0	0	93	-97	-518
FY2013	235	1,313	903	694	0	1	148	3,294	3,056
Change	0	0	0	0	0	0	0	0	183
FY2014	235	1313	903	694	0	1	148	3,294	3,239
Change	0	0	0	0	0	0	0	0	194
FY2015	235	1,313	903	694	0	1	148	3,294	3,433

NOTES:

* These numbers include vehicles that are owned by the agency and leased from GSA.

** Bus was coded with the incorrect Standard Item Number (SIN) and appeared in FAST as a medium duty van. This will be corrected in the next FAST submission.

Proposed Language Changes

The estimates include appropriation language for this item as follows (new language underscored; deleted matter enclosed in brackets):

Salaries and Expenses:

For necessary expenses of the Agricultural Research Service and for acquisition of lands by donation, exchange, or purchase at a nominal cost not to exceed $100, and for land exchanges where the lands exchanged shall be of equal value or shall be equalized by a payment of money to the grantor which shall not exceed 25 percent of the total value of the land or interests transferred out of Federal ownership, **[**$1,122,482,000:**]**$1,104,403,000*: Provided*, That appropriations hereunder shall be available for the operation and maintenance of aircraft and the purchase of not to exceed one for replacement only: *Provided further*, That appropriations hereunder shall be available pursuant to 7 U.S.C. 2250 for the construction, alteration, and repair of buildings and improvements, but unless otherwise provided, the cost of constructing any one building shall not exceed $375,000, except for headhouses or greenhouses which shall each be limited to $1,200,000, and except for 10 buildings to be constructed or improved at a cost not to exceed $750,000 each, and the cost of altering any one building during the fiscal year shall not exceed 10 percent of the current replacement value of the building or $375,000, whichever is greater: *Provided further*, That the limitations on alterations contained in this Act shall not apply to modernization or replacement of existing facilities at Beltsville, Maryland: *Provided further*, That appropriations hereunder shall be available for granting easements at the Beltsville Agricultural Research Center: *Provided further*, That the foregoing limitations shall not apply to replacement of buildings needed to carry out the Act of April 24, 1948 (21 U.S.C. 113a): *Provided further*, That appropriations hereunder shall be available for granting easements at any Agricultural Research Service location for the construction of a research facility by a non-Federal entity for use by, and acceptable to, the Agricultural Research Service and a condition of the easements shall be that upon completion the facility shall be accepted by the Secretary, subject to the availability of funds herein, if the Secretary finds that acceptance of the facility is in the interest of the United States: **[***Provided further*, That section 732(b) of division A of Public Law 112–55 (125 Stat. 587) is amended by adding at the end the following new sentence: "The conveyance authority provided by this subsection expires September 30, 2015, and all conveyances under this subsection must be completed by that date.":**]** *Provided further*, That funds may be received from any State, other political subdivision, organization, or individual for the purpose of establishing or operating any research facility or research project of the Agricultural Research Service, as authorized by law.

The first change in language proposes deletion of the language included in the Consolidated Appropriations Act, 2014, extending the time period for conveyance authority. This is a non-recurring provision, and retention of the language in fiscal year 2015 is unnecessary.

Lead-Off Tabular Statement

Salaries and Expenses

Budget Estimate, 2015	$1,104,403,000
2014 Enacted	1,122,482,000
Change in Appropriation	-18,079,000

Summary of Increases and Decreases
(Dollars in thousands)

	2012 Actual	2013 Change	2014 Change	2015 Change	2015 Estimate
Discretionary Appropriations:					
Product Quality/Value Added	$100,541	-$7,439	+$5,654	-$9,032	$89,724
Livestock Production	76,054	-5,628	+16,258	-3,452	83,232
Crop Production	229,007	-18,228	+4,888	+2,162	217,829
Food Safety	106,210	-8,248	+13,739	-1,799	109,902
Livestock Protection	76,166	-5,636	+19,102	-2,561	87,071
Crop Protection	193,810	-14,341	+9,491	-9,281	179,679
Human Nutrition	85,438	-5,110	+6,000	+2,299	88,627
Environmental Stewardship	189,034	-13,987	+25,772	-1,193	199,626
National Agricultural Library	20,919	-228	+3,100	+108	23,899
Repair and Maintenance	17,468	+1,146	+1,530	-	20,144
Decentralized GSA and DHS Security Payments	-	-	-	+4,670	4,670
Total Discretionary Appropriations	1,094,647	-77,699	+105,534	-18,079	1,104,403

Project Statement
Appropriations Detail and Staff Years (SYs)
(Dollars in thousands)

Program	2012 Actual		2013 Actual		2014 Estimate		Inc. or Dec.		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Salaries and Expenses										
Discretionary Appropriations:										
Product Quality/Value Added	$100,541	759	$93,102	682	$98,756	734	-$9,032 (1)	-	$89,724	734
Livestock Production	76,054	416	70,426	376	86,684	404	-3,452 (2)	-	83,232	404
Crop Production	229,007	1,637	210,779	1,477	215,667	1,587	+2,162 (3)	-	217,829	1,587
Food Safety	106,210	783	97,962	783	111,701	783	-1,799 (4)	-	109,902	783
Livestock Protection	76,166	456	70,530	411	89,632	442	-2,561 (5)	-	87,071	442
Crop Protection	193,810	1,161	179,469	1,047	188,960	1,124	-9,281 (6)	-	179,679	1,124
Human Nutrition	85,438	279	80,328	279	86,328	279	+2,299 (7)	-	88,627	279
Environmental Stewardship	189,034	1,390	175,047	1,254	200,819	1,348	-1,193 (8)	-	199,626	1,348
National Agricultural Library	20,919	105	20,691	72	23,791	72	+108 (9)	-	23,899	72
Repair and Maintenance	17,468	-	18,614	-	20,144	-	-	-	20,144	-
Decentralized GSA and DHS Security Payments	-	-	-	-	-	-	+4,670 (10)	-	4,670	-
Subtotal	1,094,647	6,986	1,016,948	6,381	1,122,482	6,773	-18,079	-	1,104,403	6,773
Funds included for Homeland Security	[35,721]	-	[33,175]	-	[33,183]	-	-	-	[33,183]	-
Total Adjusted Approp	1,094,647	6,986	1,016,948	6,381	1,122,482	6,773	-18,079	-	1,104,403	6,773
Rescissions, Transfers, and Seq. (Net)	-	-	84,905	-	-	-	-	-	-	-
Total Appropriation	1,094,647	6,986	1,101,853	6,381	1,122,482	6,773	-18,079	-	1,104,403	6,773
Transfers In:										
Cong. Relations	111	-	102	-	-	-	-	-	-	-
Rescission	-	-	-29,838	-	-	-	-	-	-	-
Sequestration	-	-	-55,067	-	-	-	-	-	-	-
Bal. Available, SOY	6,845	-	8,970	-	9,632	-	-9,632	-	-	-
Recoveries, Other (Net)	2,380	-	696	-	-	-	-	-	-	-
Total Available	1,103,983	6,986	1,026,716	6,381	1,132,114	6,773	-27,711	-	1,104,403	6,773
Lapsing Balances	-5,218	-	-2,739	-	-	-	-	-	-	-
Bal. Available, EOY	-8,970	-	-9,632	-	-	-	-	-	-	-
Total Obligations	1,089,795	6,986	1,014,345	6,381	1,132,114	6,773	-27,711	-	1,104,403	6,773
Staff Years:										
Direct		6,986		6,381		6,773				6,773
Other		610		677		677				677
Total, Staff Year Estimate		7,596		7,058		7,450				7,450

Project Statement
Obligations Detail and Staff Years (SYs)
(Dollars in thousands)

Program	2012 Actual		2013 Actual		2014 Estimate		Inc. or Dec.			2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount		SYs	Amount	SYs
Salaries and Expenses											
Discretionary Obligations:											
Product Quality/Value Added	$100,021	759	$92,883	682	$98,756	734	-$9,032	(1)	-	$89,724	734
Livestock Production	75,660	416	70,261	376	86,684	404	-3,452	(2)	-	83,232	404
Crop Production	227,581	1,637	210,172	1,477	215,667	1,587	+2,162	(3)	-	217,829	1,587
Food Safety	106,210	783	97,962	783	111,701	783	-1,799	(4)	-	109,902	783
Livestock Protection	75,772	456	70,365	411	89,632	442	-2,561	(5)	-	87,071	442
Crop Protection	192,807	1,161	179,048	1,047	188,960	1,124	-9,281	(6)	-	179,679	1,124
Human Nutrition	85,438	279	80,328	279	86,328	279	+2,299	(7)	-	88,627	279
Environmental Stewardship	188,056	1,390	174,636	1,254	200,819	1,348	-1,193	(8)	-	199,626	1,348
National Agricultural Library	20,690	105	20,818	72	23,791	72	+108	(9)	-	23,899	72
Repair and Maintenance	17,319	-	17,762	-	20,144	-	-		-	20,144	-
Decentralized GSA and DHS Security Payments	-	-	-	-	-	-	+4,670	(10)	-	4,670	-
Subtotal	1,089,554	6,986	1,014,235	6,381	1,122,482	6,773	-18,079		-	1,104,403	6,773
Misc. Fees/Supplementals	241	-	110	-	9,632	-	-		-	-	-
Funds included for Homeland Security	[35,721]	-	[33,175]	-	[33,183]	-	-		-	[33,183]	-
Total Obligations	1,089,795	6,986	1,014,345	6,381	1,132,114	6,773	-27,711		-	1,104,403	6,773
Lapsing Balances	5,218	-	2,739	-	-	-	-		-	-	-
Bal. Available, EOY	8,970	-	9,632	-	-	-	-		-	-	-
Total Available	1,103,983	6,986	1,026,716	6,381	1,132,114	6,773	-27,711		-	1,104,403	6,773
Transfers In	-111	-	-102	-	-	-	-		-	-	-
Rescission	-	-	29,838	-	-	-	-		-	-	-
Sequestration	-	-	55,067	-	-	-	-		-	-	-
Bal. Available, SOY	-6,845	-	-8,970	-	-9,632	-	+9,632		-	-	-
Other Adjustments (Net)	-2,380	-	-696	-	-	-	-		-	-	-
Total Appropriation	1,094,647	6,986	1,101,853	6,381	1,122,482	6,773	-18,079		-	1,104,403	6,773
Staff Years:											
Direct		6,986		6,381		6,773					6,773
Other		610		677		677					677
Total, Staff Year Estimate		7,596		7,058		7,450					7,450

Proposed 2015 Program Increases and Decreases
(Dollars in thousands)

	New Prod. Prod. Quality	Livestock Production	Crop Production	Food Safety	Livestock Protection	Crop Protection	Human Nutrition	Environ. Stewardship	NAL	Repair and Maintenance	Decentralized GSA	Grand Total
2014 Base	$98,756	$86,684	$215,667	$111,701	$89,632	$188,960	$86,328	$200,819	$23,791	$20,144	$0	$1,122,482
Reductions:												
Project Terminations	-4,537	-4,907	-3,506	-5,698	-3,026	-7,991	-638	-3,566	-	-	-	-33,869
Project Redirections	-	-17,866	-18,982	-	-2,261	-2,259	-	-28,532	-	-	-	-69,900
Laboratory Consolidations	-5,268	-1,334	-	-	-2,019	-2,473	-	-3,403	-	-	-	-14,497
Subtotal	-9,805	-24,107	-22,488	-5,698	-7,306	-12,723	-638	-35,501	-	-	-	-118,266
Increases:												
Pay Cost	773	424	1,668	798	465	1,183	284	1,417	108	-	-	7,120
Decentralized GSA	-	-	-	-	-	-	-	-	-	-	4,670	4,670
Climate Resilient Land	-	8,800	2,148	-	2,261	2,259	-	28,532	-	-	-	44,000
Translational Breeding	-	9,066	16,834	-	-	-	-	-	-	-	-	25,900
Pollinator Health	-	-	4,000	-	-	-	-	-	-	-	-	4,000
Laboratory Consolidations	-	2,365	-	3,101	2,019	-	2,653	4,359	-	-	-	14,497
Subtotal	773	20,655	24,650	3,899	4,745	3,442	2,937	34,308	108	-	4,670	100,187
Total Changes	-9,032	-3,452	2,162	-1,799	-2,561	-9,281	2,299	-1,193	108	0	4,670	-18,079
Grand Total, 2015 Budget	89,724	83,232	217,829	109,902	87,071	179,679	88,627	199,626	23,899	20,144	4,670	1,104,403

Justification of Increases and Decreases

ARS is requesting $1,104,403,000 for fiscal year 2015, a decrease of $18,079,000 from the 2014 enacted budget. ARS' 2015 Budget request includes increases of: $73,900,000 for research programs, $7,120,000 for pay costs, and $4,670,000 for decentralized GSA rental and DHS security payments. Offsetting these increases are $103,769,000 in program reductions and redirections.

ARS' 2015 Budget proposes two new program initiatives: Climate Resilient Land, Crop, Grazing, and Livestock Production Systems, $44,000,000; and Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production, $25,900,000. These are crosscutting, multidisciplinary initiatives that integrate research conducted in multiple ARS program areas to achieve expected outcomes. The Climate Resilient Land, Crop, Grazing, and Livestock Production Systems will address critical needs for increased food production while improving the sustainability of production systems. The Translational Breeding initiative will facilitate and advance the development of genetic resources for enhanced agricultural food production. Both initiatives propose to strengthen existing research partnerships, and develop new partnerships and collaborations with government, university, and industry partners. Both initiatives will also respond to the challenge of developing research tools and infrastructure needed to handle the "big data" revolution and accelerate the pace of scientific discovery. More information on these crosscutting initiatives is included on pages 32 through 37. In addition, the agency is requesting $4,000,000 for pollinator health and additional research on Colony Collapse Disorder. The 2015 Budget also proposes the consolidation of resources from six of ARS' laboratories with other existing ARS laboratories and locations.

The President's 2015 Budget request includes a separate Opportunity, Growth, and Security (OGS) Initiative that will be offset with spending reductions and tax reforms. If enacted, the OGS Initiative would provide an additional $197,220,000 for ARS to fully fund the Biocontainment Laboratory and Consolidated Poultry Research Facility in Athens, Georgia, and provide increased funding for some of the agency's high priority research initiatives.

New Products/Product Quality/Value Added

1) A net decrease of $9.032,000 for New Products/Product Quality/Value Added research ($98,756,000 and 734 staff years available in 2014).

ARS' New Products/Product Quality/Value Added research program is directed toward: Improving the efficiency and reducing the cost for the conversion of agricultural products into biobased products and biofuels; developing new and improved products to help establish them in domestic and foreign markets; and providing higher quality, healthy foods that satisfy consumer needs in the United States and abroad.

Base funding supports ARS' program goals of increasing the economic viability and competitiveness of U.S. agriculture by maintaining and/or enhancing the quality of harvested agricultural commodities; and expanding domestic and global market opportunities through the development of value added food and nonfood technologies and products including energy and fuels.

ARS' New Products/Product Quality/Value Added research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's Strategic Goal: Assist Rural Communities to Create Prosperity So they Are Self-Sustaining, Repopulating, and Economically Thriving.

The funding change is requested for the following item:

a) An increase of $773,000 for pay costs ($181,000 for annualization of the 2014 pay increase and $592,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be

unable to maintain current positions and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) A decrease of $4,537,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

IL, Peoria – Bio-Based Lubricants from Farm-Based Raw Materials (-$580,000)
IL, Peoria – Genomics and Engineering of Stress Tolerant Microbes for Lower Cost Production of Ethanol from Lignocellulose (-$784,000)
IL, Peoria – Modification of Natural Polymers by Novel Processes (-$1,439,000)
PA, Wyndmoor – Environmentally Friendly Processes and New Applications for Animal Hides and Leather (-$1,734,000)

c) A decrease of $5,268,000 resulting from the consolidation of selected laboratories.

The proposed laboratory consolidations result in a net decrease in resources contributing to the New Products/ Product Quality/Value Added program area. New Products/Product Quality/Value Added resources from the Food Quality Research Laboratory in Beltsville, Maryland (-$3,240,000), are proposed for consolidation with the Human Nutrition Research Center; Hydrology and Remote Sensing Laboratory; and Crop Systems and Global Change Laboratory in Beltsville, Maryland, while resources from the Biobased and Other Animal Co-Products Research Laboratory in Wyndmoor, Pennsylvania (-$2,028,000), are proposed for consolidation with the Food Safety and Intervention Technologies Laboratory in Wyndmoor, Pennsylvania.

Livestock Production

2) A net decrease of $3,452,000 for Livestock Production research ($86,684,000 and 404 staff years available in 2014).

ARS' Livestock Production research program is directed toward: Safeguarding and utilizing animal genetic resources, associated genetic and genomic databases, and bioinformatic tools; developing a basic understanding of the physiology of livestock and poultry; and developing information, tools, and technologies that can be used to improve animal production systems. The research is heavily focused on the development and application of genomic technologies to increase the efficiency and product quality of beef, dairy, swine, poultry, aquaculture, and sheep systems. Areas of emphasis include increasing the efficiency of nutrient utilization; increasing animal well-being and reducing stress in production systems; increasing reproductive rates and breeding animal longevity; developing and evaluating non-traditional production systems (e.g., organic and natural); and evaluating and conserving animal genetic resources.

Base funding supports ARS' program goal of providing scientific information and biotechnologies which will ensure an abundant supply of competitively priced animal and aquaculture products. This includes: developing genome analysis tools; identifying economically important genetic traits; preserving agricultural animal genetic resources; improving the efficiency of nutrient utilization and conversion of feeds and forages to animal products; enhancing reproductive performance; and improving aquaculture production systems.

ARS' Livestock Production research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their

research supports USDA's Strategic Goals: Assist Rural Communities to Create Prosperity So they Are Self-Sustaining, Repopulating, and Economically Thriving; and Help America Promote Agricultural Production and Biotechnology Exports as America Works to Increase Food Security.

The funding change is requested for the following items:

a) An increase of $424,000 for pay costs ($98,000 for annualization of the 2014 pay increase and $326,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $8,800,000 for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems.

This is a crosscutting, multidisciplinary initiative which includes integrated research across many of ARS' major program areas, including Livestock Production, Crop Production, Livestock Protection, Crop Protection, and Environmental Stewardship. A full description of the initiative is presented on page 32.

c) An increase of $9,066,000 for Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production.

This initiative crosscuts two of ARS' major program areas, Livestock Production and Crop Production. Most of the proposed activities related to this initiative overlap both program areas. As such, the initiative is presented in its entirety on page 36.

d) An increase of $1,031,000 resulting from the consolidation of selected laboratories.

The proposed consolidation of the New England Plant, Soil, and Water Research Laboratory in Orono, Maine, with the National Coldwater Marine Aquaculture Center in Franklin, Maine (a worksite of Orono), results in a net increase of $1,031,000 in the Livestock Production program area.

e) A decrease of $4,907,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

AL, Auburn – Nutrition and Feed Development for Warm Water Aquaculture (-$460,000)
MD, Beltsville – Identification of Biomarkers for Pre- and Post-Weaning Growth in Swine (-$933,000)
MS, Stoneville – Biophotonics – The Application of Novel Imaging Methodologies to Livestock Production Research (-$518,000)
NE, Clay Center – Improved Nutrient Efficiency of Beef Cattle and Swine (-$856,000)
OR, Corvallis – Determine Genetic Diversity and Develop Tools for Genetic Improvement of Oyster Stocks for the Pacific Northwest (-$364,000)
WV, Leetown – Identifying Biochemical Pathways Using Genetically Modified Trout (-$321,000)

WI, Madison – Combating Viral Hemorrhagic Septicemia and Improving Yellow Perch Aquaculture for the Great Lakes Region (-$1,455,000)

f) A redirection of $17,866,000 from current, ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's two new program initiatives for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems; and Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production. Funding from the following research projects is proposed for redirection:

MD, Beltsville – Development of New Technologies and Methods to Enhance the Utilization and Long-Term Storage of Poultry, Swine, and Fish Gametes and Embryos (-$1,886,000)
MD, Beltsville – Enhancing Genetic Merit of Ruminants through Genome Selection and Analysis (-$2,130,000)
MD, Beltsville – Understanding Genetic and Physiological Factors Affecting Nutrient Use Efficiency of Dairy Cattle (-$1,395,000)
MT, Miles City – Alleviating Rate Limiting Factors that Compromise Beef Production Efficiency (-$1,679,000)
NE, Clay Center – Genetic Research to Enhance Efficient and Sustainable Production of Beef Cattle and Sheep (-$1,604,000)
NE, Clay Center – Genetic and Genomic Approaches to Improve Efficiency of Swine Production and Product Quality (-$1,421,000)
NE, Clay Center – Genomic and Metagenomic Approaches to Enhance Efficient and Sustainable Production in Beef Cattle (-$2,701,000)
OK, El Reno – Improving the Efficiency and Sustainability of Diversified Forage-Livestock Production Systems (-$1,073,000)
WV, Leetown – Utilizing Genetics and Physiology for Enhancing Cool and Cold Water Aquaculture Production (-$745,000)
WI, Madison – Determining Influence of Microbial, Feed, and Animal Factors on Efficiency of Nutrient Utilization and Performance in Lactating Dairy Cows (-$1,692,000)
WI, Madison – Forage Characteristics that Alter Feed Utilization, Manure Characteristics and Environmental Impacts of Dairy Production (-$1,540,000)

Crop Production

3) A net increase of $2,162,000 for Crop Production research ($215,667,000 and 1,587 staff years available in 2014).

ARS' Crop Production research program focuses on developing and improving ways to reduce crop losses while protecting and ensuring a safe and affordable food supply. The program concentrates on production strategies that are environmentally friendly, safe to consumers, and compatible with sustainable and profitable crop production systems. Research activities are directed at safeguarding and utilizing plant genetic resources and their associated genetic, genomic, and bioinformatic databases that facilitate selection of varieties and/or germplasm with significantly improved traits. Research activities attempt to minimize the impacts of crop pests while maintaining healthy crops and safe commodities that can be sold in markets throughout the world. The agency is conducting research to discover and apply naturally occurring and engineered genetic mechanisms for plant pest control, develop agronomic germplasm with durable defensive traits, and transfer genetic resources for commercial use. ARS provides taxonomic information on invasive species that strengthens prevention techniques, aids in detection/identification of invasive pests, and increases control through management tactics that restore habitats and biological diversity.

Base funding supports ARS' program goals of protecting, expanding, and enhancing the Nation's crop genetic resources; increasing scientific knowledge of crop genes, genomes, and biological systems; and delivering technologies that improve the production efficiency, quality, health, and value of the Nation's crops. This includes: developing and maintaining genome databases and informatics tools; managing plant and microbial genetic resources; assessing systematic relationships; enhancing and releasing improved genetic resources and varieties;

improving bee health; developing integrative strategies for managing pests, soil, water, nutrient and environmental factors for optimal yield; and determining the biological processes that improve crop productivity.

ARS' Crop Production research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. This research supports USDA's Strategic Goals: Assist Rural Communities to Create Prosperity So they Are Self-Sustaining, Repopulating, and Economically Thriving; and Help America Promote Agricultural Production and Biotechnology Exports as America Works to Increase Food Security.

The funding change is requested for the following items:

a) An increase of $1,668,000 for pay costs ($388,000 for annualization of the 2014 pay increase and $1,280,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $2,148,000 for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems.

This is a crosscutting, multidisciplinary initiative which includes integrated research across many of ARS' major program areas, including Crop Production, Livestock Production, Livestock Protection, Crop Protection, and Environmental Stewardship. A full description of the initiative is presented on page 32.

c) An increase of $16,834,000 for Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production.

This initiative crosscuts two of ARS' major program areas, Livestock Production and Crop Production. Most of the proposed activities related to this initiative overlap both program areas. As such, the initiative is presented in its entirety on page 36.

d) An increase of $4,000,000 for Pollinator Health and Colony Collapse Disorder.

Need for Change

In the United States, bees pollinate more than 90 crops, and are responsible for $15 billion (and close to $200 billion worldwide according to the United Nations Food and Agricultural Organization) in added crop value. "Pollinators" are vital to the agricultural industry for producing food for the world's population. However, the economic viability of the bee pollination industry is currently threatened by Colony Collapse Disorder (CCD).

CCD is the general term for the large scale deaths of honey bees in the United States and Europe. CCD was first reported in October 2006, when beekeepers began reporting significant unexpected losses. Annual losses in the U.S., from the winter 2006 though 2011, averaged about 33 percent with a third of those losses attributed to CCD. The causes of the CCD declines remain uncertain, though likely involve a combination of poor nutrition and loss of natural forage, parasites, stress from transportation, and pesticide exposure.

The significant die-offs of honey bees and other pollinators have brought scientific and public attention to the problem. The Fish and Wildlife Service, in fact, currently lists more than 90 species of pollinators as "threatened" or "endangered." There is an overarching concern about the impacts that the loss these pollinators will have on ecosystems across the country.

ARS' research encompasses bee health/improvement and pesticides, bee epidemiology, and genetics relating to diseases and pests of pollinators. NIFA's research is directed at determining methods to protect pollinators from

biotic and abiotic stresses. NASS is conducting surveys to provide baseline data to estimate the extent of CCD. The EPA and USDA have compiled a "Pollinator Road Map," which outlines past and planned activities to address CCD and other pollinator health issues. The U.S. Geological Service is evaluating how honey bee health is influenced by changing habitat conditions and the availability of resources.

USDA and EPA, in conjunction with other relevant Federal partners, are currently scaling up efforts to address the decline of honey bee health with a goal of ensuring the recovery of this critical subset of pollinators. As part of this effort, the 2015 Budget for ARS requests funding to address best management practices that can reduce colony mortalities and prevent CCD. This request supports implementation of the USDA-EPA *CCD National Action Plan* emphasizing the importance of coordinated action to identify the extent and causal factors in honey bee and pollinator declines, and the development and implementation of applied solutions.

Outcomes

The proposed increase will develop methods/practices which will reduce colony mortality to acceptable levels, and improve the nutrition of pollinators.

Means to Achieve Change

- Develop and test the efficacy of best management practices at Federal bee and pollinator research laboratories ($4,000,000). ARS will:
  - Engage domestically its research groups to complete current work on identifying "best management practices," (BMP) and plan and institute a longitudinal study to test the efficacy of various sets of BMPs to determine practices that can prevent CCD and reduce colony mortality to acceptable levels, and potentially isolate casual factors of CCD.
  - Continue internationally its partnerships with the European Food Safety Agency and COLOSS (a 35 nation consortium to prevent colony losses) to evaluate the impact of the European moratorium on certain neonicotinoid pesticide uses. These activities will be undertaken in coordination with other USDA and EPA components, the Planned Innovation Institute, and private sector partners.
  - Determine the best and most cost-efficient mix of seeds to use to improve pollinator nutrition.

e) A decrease of $3,506,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

Headquarters – Binational Agricultural Research and Development (-$484,000)
LA, Houma – Integrated Crop, Soil, and Water Management Systems for Sustainable Production of Sugarcane for Bioenergy Feedstock (-$327,000)
MS, Mississippi State – Development of Precision Agriculture Systems in Cotton Production (-$1,118,000)
OR, Corvallis – Production and Conservation Practices to Maintain Grass Seed Farm Profits (-$1,577,000)

f) A redirection of $18,982,000 from current, ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's two new program initiatives for Climate Resilient Land, Crop, Grazing, and Livestock Production

Systems; and Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production. Funding from the following research projects is proposed for redirection:

AR, Stuttgart – Development and Characterization of Genetic Resources for Agronomic and Quality Traits Using Genomic Tools (-$2,721,000)
FL, Miami – Development of an International Marker Assisted Selection Program for Cacao (-$1,376,000)
IL, Urbana – Identifying and Manipulating Determinants of Photosynthate Production and Partitioning (-$1,838,000)
IL, Urbana – Soybean Genetic Management and Utilization (-$1,030,000)
IA, Ames – Germplasm Enhancement of Maize Project (GEM) (-$1,000,000)
KS, Manhattan – Genetic Enhancement for Resistance to Biotic and Abiotic Stresses in Hard Winter Wheat (-$2,660,000)
MS, Mississippi State – Enhancing Corn with Resistance to Aflatoxin Contamination and Insect Damage (-$2,103,000)
MO, Columbia – Genetics and Genomics of Complex Traits in Grain Crops (-$1,564,000)
NC, Raleigh – Evaluation and Improvement of Cereal Germplasm for Disease Resistance and Winter-Hardiness (-$2,141,000)
NC, Raleigh – Germplasm Enhancement of Maize (GEM) (-$300,000)
ND, Fargo – Improvement of Hard Red Spring and Durum Wheat for Disease Resistance and Quality Using Genetics and Genomics (-$901,000)
NY, Ithaca – Dissecting Complex Traits in Maize and Biofuel Grasses By Applying Genomics, Bioinformatics, and Genetic Resources (-$500,000)
PR, Mayaguez – Characterization, Conversion, and Improvement of Common Bean Germplasm (-$313,000)
WA, Prosser – Develop Stress-Resistant Dry Bean Germplasm and Sustainable Pest Management Strategies for Edible Legumes (-$535,000)

Food Safety

4) A net decrease of $1,799,000 for Food Safety research ($111,701,000 and 783 staff years available in 2014).

ARS' Food Safety research is designed to yield science-based knowledge on the safe production, storage, processing, and handling of plant and animal products, and on the detection and control of pathogenic bacteria and fungi, parasites, chemical contaminants, and plant toxins. All of ARS' research activities involve a high degree of cooperation and collaboration with USDA's Research, Education, and Economics (REE) agencies, as well as with the Food Safety and Inspection Service (FSIS), Animal and Plant Health Inspection Service (APHIS), Food and Drug Administration (FDA), Centers for Disease Control and Prevention (CDC), Department of Homeland Security (DHS), and the Environmental Protection Agency (EPA). The agency also collaborates in international research programs to address and resolve global food safety issues. Specific research efforts are directed toward developing new technologies that assist ARS stakeholders and customers, including regulatory agencies, industry, and commodity and consumer organizations in detecting, identifying, and controlling foodborne diseases that affect human health.

Base funding supports ARS' program goal of protecting food from pathogens, toxins, and chemical contamination during production, processing, and preparation. This includes: developing and evaluating technologies for the detection and characterization of microbial contaminants; developing new intervention and control strategies for the reduction of foodborne pathogens; and developing and evaluating detection methods for the reduction and control of veterinary drugs, chemical residues, heavy metals, organic pollutants, and biological toxins derived from bacteria, fungi, and plants.

ARS' Food Safety research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's Strategic Goal: Ensure that All of America's Children Have Access to Safe, Nutritious, and Balanced Meals.

The funding change is requested for the following items:

a) An increase of $798,000 for pay costs ($186,000 for annualization of the 2014 pay increase and $612,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $3,101,000 resulting from the consolidation of selected laboratories.

The proposed consolidation of a portion of the resources from the Biological Control of Insects Research Laboratory in Columbia, Missouri with the National Animal Disease Center in Ames, Iowa, results in a net increase of $1,073,000 in the Food Safety program area, and the proposed consolidation of the Biobased and Other Animal Co-Products Research Laboratory in Wyndmoor, Pennsylvania, with the Food Safety and Intervention Technologies Laboratory in Wyndmoor, Pennsylvania results in an additional increase of $2,028,000 in this program area.

c) A decrease of $5,698,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

GA, Athens – Control of Toxic Endophytic Fungi with Bacterial Endophytes and Regulation of Bacterial Metabolites for Novel Uses in Food Safety (-$1,593,000)
IN, West Lafayette – Handling and Transport Stress Interactions with Pathogen Biology in Swine and Cattle (-$542,000)
MD, Beltsville – Zoonotic Parasites Affecting Food Safety and Public Health (-$1,082,000)
MS, Stoneville – Umbrella Project for Food Safety (-$753,000)
NE, Lincoln – Environmentally Sound Manure Management for Reduction of Gas Emissions, Nutrients, and Pathogens (-$488,000)
PA, Wyndmoor – Alternative Food Processing Technologies (-$1,240,000)

Livestock Protection

5) A net decrease of $2,561,000 for Livestock Protection research ($89,632,000 and 442 staff years available in 2014).

ARS' Livestock Protection research program is directed at protecting and ensuring the safety of the Nation's agriculture and food supply through improved disease detection, prevention, control, and treatment. Basic and applied research approaches are used to solve animal health problems of high national priority. Emphasis is given to methods and procedures to control animal diseases. The research program has the following strategic objectives: establish ARS' laboratories into a fluid, highly effective research network to maximize use of core competencies and resources; use specialized high containment facilities to study zoonotic and emerging diseases; develop an integrated animal and microbial genomics research program; establish centers of excellence in animal immunology; launch a biotherapeutic discovery program providing alternatives to animal drugs; build a technology driven vaccine and diagnostic discovery research program; develop core competencies in field epidemiology and predictive biology;

establish a best-in-class training center for our Nation's veterinarians and scientists; and develop a model technology transfer program to achieve the full impact of ARS research discoveries. ARS animal research program includes the following core components: biodefense research, animal genomics and immunology, zoonotic diseases, respiratory disease, reproductive and neonatal diseases, enteric diseases, parasitic diseases, and transmissible spongiform encephalopathies.

Base funding supports ARS' program goal of preventing and controlling pests and animal diseases that pose a threat to agriculture, public health, and the well-being of Americans. This includes: Identifying genes involved in animals with disease resistant phenotypes; improving our understanding of pathogenesis transmission, and immune responses to develop measures to prevent and control animal diseases; analyzing microbial genomes to better understand host-pathogen interactions; developing new vaccines to prevent disease in aquaculture species; developing new methods to minimize tick bites; identifying measures to restrict the cattle fever tick; developing methods to control stable flies, horn flies, and house flies and their impact on livestock; supporting the screwworm eradication program; and developing control methods for U.S. vectors of Rift Valley fever.

ARS' Livestock Protection research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's Strategic Goal: Ensure that All of America's Children Have Access to Safe, Nutritious, and Balanced Meals.

The funding change is requested for the following items:

a) An increase of $465,000 for pay costs ($108,000 for annualization of the 2014 pay increase and $357,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $2,261,000 for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems.

This is a crosscutting, multidisciplinary initiative which includes integrated research across many of ARS' major program areas, including Livestock Protection, Crop Protection, Livestock Production, Crop Production, and Environmental Stewardship. A full description of the initiative is presented on page 32.

c) A decrease of $3,026,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

Headquarters – Emerging Animal Diseases that Exist Offshore (-$98,000)
IA, Ames – Identification of Host Immune Factors and Intervention Strategies for Mastitis (-$1,312,000)
MD, Beltsville – Functional Genomic Approaches for Controlling Diseases of Swine (-$662,000)
MS, Mississippi State – Strategies to Control and Prevent Avian Mycoplasmosis (-$954,000)

d) A decrease redirecting $2,261,000 from current, ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's two new program initiatives for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems; and Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production. Funding from the following research projects is proposed for redirection:

TX, Kerrville – Biology and Control of Ticks of Veterinary and Human Importance (-$2,261,000)

e) Consolidation of selected laboratories.

Resources from the Avian Disease and Oncology Research Laboratory in East Lansing, Michigan, are proposed for consolidation with the Southeast Poultry Research Laboratory in Athens, Georgia. These resources contribute to the Livestock Protection as well as the Livestock Production program areas. The proposed consolidation of these laboratories would have no net impact on the overall funding level for either of these program areas.

Crop Protection

6) A net decrease of $9,281,000 for Crop Protection research ($188,960,000 and 1,124 staff years available in 2014).

ARS' Crop Protection research program is directed to protect crops from insect and disease loss through research to understand pest and disease transmission mechanisms, and to identify and apply new technologies that increase our understanding of virulence factors and host defense mechanisms. The program's research priorities include: identification of genes that convey virulence traits in pathogens and pests; factors that modulate infectivity, gene functions, and mechanisms; genetic profiles that provide specified levels of disease and insect resistance under field conditions; and mechanisms that reduce the spread of pests and infectious diseases. ARS is developing new knowledge and integrated pest management approaches to control pest and disease outbreaks as they occur. Its research will improve the knowledge and understanding of the ecology, physiology, epidemiology, and molecular biology of emerging diseases and pests. This knowledge will be incorporated into pest risk assessments and management strategies to minimize chemical inputs and increase production. Strategies and approaches will be available to producers to control emerging crop diseases and pest outbreaks and to address quarantine issues.

Base funding supports ARS' program goals of protecting our Nation's crops from arthropods, plant pathogens, nematodes, and weeds; and developing alternatives and new technologies to methyl bromide.

ARS' Crop Protection research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's Strategic Goal: Ensure that All of America's Children Have Access to Safe, Nutritious, and Balanced Meals.

The funding change is requested for the following items:

a) An increase of $1,183,000 for pay costs ($275,000 for annualization of the 2014 pay increase and $908,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill vacant critical positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $2,259,000 for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems.

This is a crosscutting, multidisciplinary initiative which includes integrated research across many of ARS' major program areas, including Crop Protection, Livestock Protection, Livestock Production, Crop Production, and Environmental Stewardship. A full description of the initiative is presented on page 32.

c) A decrease of $7,991,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

Headquarters – Area-wide Management of Agricultural Pests (-$5,246,000)
Headquarters – Floriculture and Nursery Research Initiative (-$745,000)
Headquarters – Minor Use Pesticides Umbrella Project (-$336,000)
Headquarters – Small Fruit and Nursery Research (-$664,000)
ND, Fargo – Sclerotinia Diseases (-$1,000,000)

d) A decrease redirecting of $2,259,000 from current, ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's two new program initiatives for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems; and Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production. Funding from the following research projects is proposed for redirection:

FL, Ft. Pierce – IPM Technologies for Insect Pests of Orchard Crops (-$2,259,000)

e) A decrease of $2,473,000 resulting from the consolidation of selected laboratories.

The proposed laboratory consolidations result in a net decrease in resources contributing to the Crop Protection program area. Crop Protection resources from the Food Quality Research Laboratory in Beltsville, Maryland (-$738,000), are proposed for consolidation with the Human Nutrition Research Center; Hydrology and Remote Sensing Laboratory; and Crop Systems and Global Change Laboratory in Beltsville, Maryland, while resources from the Biological Control of Insects Research Laboratory in Columbia, Missouri (-$1,735,000), are proposed for consolidation with the Crop Systems and Water Quality Laboratory in Columbia, Missouri, and the National Animal Disease Center in Ames, Iowa.

Human Nutrition

7) A net increase of $2,299,000 for Human Nutrition research ($86,328,000 and 279 staff years available in 2014).

Maintenance of health throughout the lifespan along with prevention of obesity and chronic diseases via food-based recommendations are the major emphases of ARS' Human Nutrition research program. These health-related goals are based on the knowledge that deficiency diseases are no longer primary public health concerns. Excessive consumption has become the primary nutrition problem in the American population. This is reflected by increased emphasis on prevention of obesity from basic science through intervention studies to assessments of large populations. The agency's research program also actively studies bioactive components of foods that have no

known requirement but have health promoting activities. Four specific areas of research are emphasized: nutrition monitoring and the food supply, e.g., a national diet survey and the food composition databank; dietary guidance on specific foods, nutrients, and dietary patterns that maintain health and prevent disease; prevention of obesity and related diseases, including research on the reasons for the limited use of the *Dietary Guidelines for Americans*; and life stage nutrition and metabolism, in order to better define the role of nutrition in pregnancy and growth of children, and for healthier aging.

Base funding supports ARS' program goal of enabling Americas to make health promoting, science-based dietary choices. This includes: determining food consumption and dietary patterns of Americans; updating U.S. food composition data; enhancing the health promoting quality of the food supply; developing and evaluating strategies to prevent obesity and related diseases; and understanding the mechanisms by which nutrition promotes healthy development.

ARS' Human Nutrition research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's Strategic Goal: Ensure that All of America's Children Have Access to Safe, Nutritious, and Balanced Meals.

The funding change is requested for the following item:

a) An increase of $284,000 for pay costs ($66,000 for annualization of the 2014 pay increase and $218,0000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $2,653,000 resulting from the consolidation of selected laboratories.

The proposed consolidation of a portion of the resources from the Food Quality Research Laboratory in Beltsville, Maryland, with the Human Nutrition Research Center in Beltsville, Maryland, results in a net increase of $2,653,000 in the Human Nutrition program area.

c) A decrease of $638,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

MD, Beltsville – Effects of Elevated Atmospheric CO2, Environmental Stress, and Edaphic Conditions on Bioactive Compounds in Brassica Crops (-$638,000)

Environmental Stewardship

8) A net decrease of $1,193,000 for Environmental Stewardship research ($200,819,000 and 1,348 staff years available in 2014).

ARS' Environmental Stewardship research program emphasis is in developing technologies and systems that support production and enhance the Nation's vast renewable natural resource base. The agency is currently developing the scientific knowledge and technologies needed to meet the challenges and opportunities facing U.S. agriculture in managing water resource quality and quantity under different climatic regimes, production systems, and environmental conditions. ARS' air resources research is developing measurement, prediction, and control technologies for emissions of greenhouse gases, particulate matter, ammonia, hydrogen sulfide, and volatile organic compounds affecting air quality and land-surface climate interactions. The agency is a leader in developing measurement and modeling techniques for characterizing gaseous and particulate matter emissions from agriculture. In addition, ARS is evaluating strategies for enhancing the health and productivity of soils, including developing predictive tools to assess the sustainability of alternative land management practices. Finding mechanisms to aid agriculture in adapting to changes in atmospheric composition and climatic variations is also an important component of this program. ARS' range and grazing land research objectives include the conservation and restoration of the Nation's range lands and pasture ecosystems and agroecosystems through improved management of fire, invasive weeds, grazing, global change, and other agents of ecological change. The agency is currently developing improved grass and forage legume germplasm for livestock, conservation, bioenergy, and bioproduct systems as well as grazing-based livestock systems that reduce risk and increase profitability. In addition, ARS is developing whole system management strategies to reduce production costs and risks.

Base funding supports ARS program goals of providing integrated, effective, and safe water resources; improving the quality of atmosphere and soil resources and understanding the effects of climate change; effectively and safely managing the use of manure and other industrial byproducts that maximize their potential benefits while protecting the environment and human and animal health; and developing and transferring economically viable and environmentally sustainable production and conservation practices, technologies, plant materials, and integrated management strategies that conserve and enhance the Nation's natural resources.

ARS' Environmental Stewardship research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's Strategic Goal: Ensure Our National Forests and Private Working Lands Are Conserved, Restored, and Made More Resilient to Climate Change, While Enhancing Our Water Resources.

The funding change is requested for the following items:

a) An increase of $1,417,000 for pay costs ($330,000 for annualization of the 2014 pay increase and $1,087,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

b) An increase of $28,532,000 for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems.

This is a crosscutting, multidisciplinary initiative which includes integrated research across many of ARS' major program areas, including Environmental Stewardship, Livestock Production, Crop Production, Livestock Protection, and Crop Protection. A full description of the initiative is presented on page 32.

c) An increase of $956,000 resulting from the consolidation of selected laboratories.

The proposed consolidation of the New England Plant, Soil, and Water Research Laboratory in Orono, Maine, with the National Coldwater Marine Aquaculture Center in Franklin, Maine (a worksite of Orono), results in a net decrease (-$1,031,000) for Environmental Stewardship. Consolidation of the Food Quality Research Laboratory in Beltsville, Maryland, with the Hydrology and Remote Sensing Laboratory and Crop Systems and Global Change Laboratory results in a net increase of $1,325,000, and the proposed consolidation of the Biological Control of Insects Laboratory in Columbia, Missouri, with the Crop Systems and Water Quality Laboratory in Columbia, Missouri, results in an additional increase of $662,000. In addition, resources from the Rangeland Resources Research Laboratory in Cheyenne, Wyoming, are proposed for consolidation with the Rangeland Resources Research Laboratory in Fort Collins, Colorado, but this proposed consolidation has no net impact on funding in the Environmental Stewardship program area.

d) A decrease of $3,566,000 from ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends selected high priority research initiatives which address the Administration's science and technology priorities and the Department's Strategic Goals. To finance these initiatives, within limited resources, some existing projects are proposed for reduction or termination given that they are: 1) mature where the research objectives have been mainly accomplished; 2) duplicative or can be accomplished more effectively elsewhere in ARS; 3) marginal or below threshold funding for program viability or sustainability; 4) conducted in substandard or inadequate infrastructure and future costs are prohibitive; 5) lacking a critical mass of scientists/support personnel for an effective program; or 6) are carried out by other research institutions. The savings achieved from these reductions/terminations will be redirected to finance the higher priority agricultural research initiatives identified in the 2015 Budget, and will improve program and operational efficiencies.

LA, Houma – Integrated Crop, Soil, and Water Management Systems for Sustainable Production of Sugarcane for Bioenergy Feedstock (-$763,000)
MD, Beltsville – Controls on Microbial Community Structure and Function in Soil and Rhizosphere (-$664,000)
MS, Oxford – Acoustic and Geophysical Technology Development for Improving Assessment and Monitoring of Erosion and Sediment Transport in Watersheds (-$660,000)
MS, Oxford – Improving Computational Modeling in Support of Better Erosion and Sediment Movement Control in Agricultural Watersheds (-$724,000)
NE, Lincoln – Environmentally Sound Manure Management for Reduction of Gas Emissions, Nutrients, and Pathogens (-$489,000)
TX, College Station – Improved Forage and Alternative Use Grasses for the Southern U.S. (-$266,000)

e) A redirection of $28,532,000 from current, ongoing research projects to support higher priority research initiatives.

The 2015 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's two new program initiatives for Climate Resilient Land, Crop, Grazing, and Livestock Production Systems; and Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production. Funding from the following research projects is proposed for redirection:

AZ, Maricopa – Reuse of Treated Municipal Waste Water for Irrigation as a Means to Increase Alternative Water Supplies (-$756,000)
AZ, Tucson – Soil Erosion, Sediment Yield, and Decision Support Systems for Improved Land Management on Semiarid Rangeland Watersheds (-$1,328,000)
CA, Parlier – Developing Sustainable Cropping Systems to Improve Water Productivity and Protect Water and Soil Quality in Irrigated Agriculture (-$2,424,000)
CA, Riverside – Crop Genetic Improvement and Crop Management in Irrigated Areas Affected by Salinity and Toxic Ions (-$1,136,000)
CO, Akron – Sustainable Dryland Cropping System for the Central Great Plains (-$2,101,000)
CO, Ft. Collins – Enhanced System Models and Decision Support Tools to Optimize Water Limited Agriculture (-$926,000)

CO, Ft. Collins – Management Strategies to Sustain Irrigated Agriculture with Limited Water Supplies (-$1,865,000)
CO, Ft. Collins – Spatial Modeling of Agricultural Watersheds: Water and Nutrient Management and Targeted Conservation Effects at Field to Watershed Scales (-$1,260,000)
ID, Kimberly – Soil and Water Conservation for Northwestern Irrigated Agriculture (-$1,692,000)
IN, West Lafayette – Biogeochemical Processes and Soil Management Impacts on Soil Erosion, Soil/Air/Water Quality, and Greenhouse Gas Emissions (-$1,436,000)
IA, Ames – Animal and Manure Management for Sustainable Production and Reduced Environmental Impact (-$1,389,000)
MD, Beltsville – Developing Analytical and Management Strategies to Improve Crop Utilization of and Reduce Losses to the Environment (-$1,646,000)
MD, Beltsville – Biological Treatment of Manure and Organic Residuals to Capture Nutrients and Transform Contaminants (-$1,119,000)
MD, Beltsville – Regulation of Gene Expression in Alfalfa Development and Stress Tolerance (-$351,000)
MS, Oxford – Preserving Water Quality and Availability for Agriculture in the Lower Mississippi River Basin (-$583,000)
MS, Stoneville – Agrochemical and Weed Seed Fate and Transport in Mid-South Crop Production Systems (-$664,000)
MS, Stoneville – Development of Sustainable Production Systems and Water Management Technology for the Mid-South (-$506,000)
NE, Lincoln – Management Strategies for Meeting Agronomic, Environmental, and Societal Crop Production Demands (-$1,463,000)
ND, Mandan – New Technologies to Enhance Sustainability of Northern Great Plains Grasslands (-$218,000)
OK, Woodward – Sustaining Southern Plains Landscapes through Plant Genetics and Sound Forage-Livestock Production Systems (-$2,465,000)
OR, Pendleton – Improved Soil Management Practices for Tilled Summer Fallow in the Pacific Northwest (-$1,002,000)
PA, Wyndmoor – Function of Arbuscular Mycorrhizal Fungi in Organic and Conventional Agriculture (-$772,000)
TX, Lubbock – Improving Air Quality of Agricultural Operations and Processes (-$284,000)
TX, Lubbock – Sustainable Agro-Ecosystems that Control Soil Erosion and Enhance the Environment (-$1,146,000)

Library and Information Services

9) A net increase of $108,000 for Library and Information Services ($23,791,000 and 72 staff years available in 2014).

The National Agricultural Library (NAL) provides services directly to the staff of USDA and to the public, primarily via its web site, http://www.nal.usda.gov. NAL was created with the USDA in 1862 and was named in 1962 as one of four national libraries by Congress, as the primary agricultural information resource of the United States. NAL is the primary agricultural information resource of the U.S., and is responsible for collecting, managing, and disseminating agricultural knowledge. The Library is the repository of our Nation's agricultural heritage, the provider of world class information, and the wellspring for generating new fundamental knowledge and advancing scientific discovery. It is a priceless national resource that, through it services, programs, information products, and web-based tools and technologies, serves anyone who needs agricultural information.

Base funding supports ARS' goal of ensuring the provision and access of agricultural information for USDA, the Nation, and the global agricultural community. This includes: delivering unified, easy to use, convenient 24/7 digital services; improving information delivery; extending AGRICultural OnLine Access (AGRICOLA); conserving rare and at-risk items; extending partnerships with USDA and other Federal agencies to develop targeted information services; and marketing NAL services to specific audiences.

The funding change is requested for the following item:

a) An increase of $108,000 for pay costs ($25,000 for annualization of the 2014 pay increase and $83,000 for the 2015 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Absorption of these costs reduces the number of scientists and support personnel essential for conducting the agency's research programs. If pay costs are not fully funded, ARS will be unable to maintain current and fill critical vacant positions, and will have to reduce spending for much needed laboratory equipment, supplies, and other materials.

10) *Proposed Laboratory Consolidations*

The proposed 2015 Budget includes a proposal to consolidate the resources from six of ARS' laboratories with other existing ARS laboratories and locations.

Proposed Laboratory Consolidation	Laboratory/Location Where Funding Will Be Redirected	Research To Be Conducted With Redirected Funds
Rangeland Resources Research, Cheyenne, Wyoming (Conservation-production systems for semi-arid rangelands and global climate change research)	Rangeland Resources Research, Fort Collins, Colorado	Conservation-production systems for semi-arid rangelands and global climate change research.
Plant, Soil, and Water Research, Orono, Maine (Crop management systems research)	National Coldwater Marine Aquaculture Center; Orono, Maine/Franklin, Maine	Aquaculture research
Food Quality Research Laboratory Beltsville, Maryland (research on biology/technology of fruits/vegetables to reduce postharvest losses)	Human Nutrition Research Center; Hydrology and Remote Sensing Laboratory; and Crop Systems and Global Change Laboratory, Beltsville, Maryland	Enhance nutrition monitoring and surveillance capability/water quantity and quality research/adapt agriculture systems to climate variability
Avian Disease and Oncology Research, East Lansing, Michigan (Avian disease research)	Southeast Poultry Research Laboratory, Athens, Georgia	Countermeasures to prevent and control viral diseases of poultry
Biological Control of Insects Research, Columbia, Missouri (Biological insect control research)	Crop Systems and Water Quality Laboratory, Columbia, Missouri; and National Animal Disease Center, Ames, Iowa	Water quantity and quality research/alternatives to antibiotic resistance
Biobased and Other Animal Co-Products, Wyndmoor, Pennsylvania (Biobased and animal co-products research)	Food Safety and Intervention Technologies Laboratory, Wyndmoor, Pennsylvania	Identify and evaluate specific intervention strategies through the food production chain

Other

11) An increase of $4,670,000 for Decentralized GSA Rental and DHS Security Payments.

USDA proposes the decentralization of GSA rental and DHS security payments in the 2015 Budget. The amount shown is the equivalent share of the current GSA rent and DHS central appropriations based upon current space occupancy across the continental United States. The appropriations request for the central GSA rent account and the DHS payment account has been reduced accordingly.

12) OGS Initiative ($197,220,000)

The President's 2015 Budget request includes a separate Opportunity, Growth, and Security (OGS) Initiative that will be offset with spending reductions and tax reforms. Enactment of the OGS Initiative would provide ARS additional funding for:

- Replacement/Modernization of the Biocontainment Laboratory and Consolidated Poultry Research Facility, Athens, Georgia ($155,000,000). The laboratory is USDA's major facility for conducting research on exotic and emerging poultry diseases, supporting APHIS, FSIS, FDA, and the CDC. Inadequate and badly outdated, the laboratory was identified in a review of ARS' laboratories as the highest priority facility recommended for modernization.
- Integrated Research for Land, Crop, Grazing, and Livestock Production Systems ($11,000,000).
- Advanced Crop and Livestock Genetic Improvements and Translational Breeding for Enhanced Food Production ($11,100,000).
- Expansion of Research Capacity in Earth Sciences ($2,500,000). Additional research is needed on the condition of the natural resource base to improve agricultural production. For example, remote sensing technologies and tools need to be developed to detect droughts and agroecosystem changes.
- Food Safety Alternatives to Antibiotics ($2,620,000). More research is needed on the role of alternatives to antibiotics, and the role of management practices and the environment on the prevalence of antimicrobial resistance and emerging pathogens in food animals.
- Other high priority research ($15,000,000).

CLIMATE RESILIENT LAND, CROP, GRAZING, AND LIVESTOCK PRODUCTION SYSTEMS

ARS is requesting an increase of $44,000,000 for this crosscutting, multidisciplinary initiative that will integrate research conducted in multiple ARS program areas to achieve the expected outcomes. Funding increases for this initiative are located under the Livestock Production, Crop Production, Livestock Protection, Crop Protection, and Environmental Stewardship sections of this document.

Need for Change

Global climate change represents one of the greatest challenges facing human civilization. The ramifications of potential changes are forecasted to have major political, social, and economic impacts throughout the world, affecting millions of people. The ability to effectively prepare for and respond to climate change is critical to the American economy including our agricultural natural resources, crop and livestock production and protection, pests and diseases, food safety, and water availability and quality, as well as sustainable agriculture and world hunger.

One of ARS' key program goals is to better understand the effects of climate change and its impacts on crops, range lands, pasture systems, endemic pests, weeds, and plant and animal diseases, and develop adaptive strategies and technologies.

Gradual increases of temperature and atmospheric carbon dioxide coupled with the expected increases in the frequency, duration, and intensity of weather events driven by changing climate present novel and unprecedented challenges to the sustainability of U.S. agriculture. Climate is becoming a more significant factor in decision making by producers and other land managers, scientists and technical advisors, agribusiness, and policymakers. Production systems have become so complex that finding the best balance among production, environmental, and economic goals can be challenging. Decision support systems built on a firm foundation of new and/or additional knowledge, and climate resilient management technologies and strategies will provide producers and policymakers with a tool to compare the consequences of alternative management scenarios prior to implementation.

Agricultural production integrates crop cultivars and/or livestock lines/breeds with soil, climate, and management practices. Stable production over years is dependent upon the producer's ability to understand these interactions. For the purposes of research and decision making, it is useful to separate environmental influences from management practices, as management can be controlled. Linking management practices with genotype, the interaction of Genetics, Environment, and Management (GxExM), provides a new strategy for developing and implementing agricultural production systems. Thus, there is a need to develop decision support tools for risk management that enable producers, land managers, and policymakers to manage agricultural system vulnerability to the effects of climate change.

As climate change impacts the quality and quantity of water (i.e., too much too fast or not enough), competition for the use of available water increases. Fresh water demands from urban and industrial sources continue to increase while key groundwater reserves (e.g., the Ogallala Aquifer) and water quality (e.g., in the Mississippi River Basin/Gulf of Mexico) continue to decline.

Total meat consumption worldwide is expected to increase 1.73 times by the year 2050 and is projected to double in developing countries. To meet this global demand under the projected stresses of changing climate conditions, production must be enhanced on existing crop, pasture, and range lands, underscoring the critical need for increased animal production, improved animal production efficiencies, and improved environmentally sustainable food animal production systems. Ruminant animal production best utilizes feeds, forages, and feedstocks unsuitable for human consumption which will be vital contributors to domestic and international food security.

Pasture and range lands cover over 40 percent of the world's inhabited land mass (over 52 million square kilometers), and represent an ecological and economically sustainable form of agriculture worldwide. In the U.S., pasture and range lands exceed 770 million acres of private, State, and Federally owned lands. These grazing lands are a major source of watershed filtration, ground water recharge, and carbon sequestration and provide the key forage resources for ruminant food animal production systems. Research is needed to better integrate forage and food animal production systems for improved production efficiencies; improve forage production and value for food

animals; and provide essential ecosystem services that will ensure the continued productivity and environmental sustainability of pastures and range lands.

Means to Achieve Change/Outcomes

ARS will develop technologies and practices for agricultural adaptation to the effects of climate change, including strategies to minimize its detrimental impacts on the Nation's soil, water, and air resources.

The agency will take a three pronged approach to develop risk management tools that enable producers, land managers, and policymakers to identify more resilient production systems: 1) a decision support and data management tool that enables users to compare production systems under various climate change scenarios, 2) new knowledge on the exposure and sensitivities of agroecosystems to climate change, and 3) management technologies and strategies to enhance sustainability. The outcomes will be climate resilient agriculture production systems. Specifically, ARS will:

- Develop decision support systems that integrate genetics/genomics knowledge, environmental interactions, and management strategies.
  - Partner with the climate science community for use of climate change forecasting models to generate likely weather scenarios for key agriculture production regions.
  - Build decision support capacity for projecting climate effects on production by expanding the Agricultural Modeling Intercomparison and Improvement Project (AgMIP) to include climate driven effects on weeds, pathogens, and insects, as well as better predictive capabilities for short- and long-term fluctuations of seasonal and annual water availability to better align crop choices with climate driven water availabilities.
  - Develop the software infrastructure that integrates the available information, models, and management strategies, and projects sustainability of the production options (i.e., plant cultivar, animal breed, water, nutrient, and pest management).
  - Develop a data management system for users to identify candidate varieties with climate resilience as well as other potential gene combinations to be considered; optimize management strategies (i.e., water, nutrient, light, pests, pathogens, pollinators, beneficial organisms, etc.) for resilient production systems; and characterize environmental consequences of specified climate conditions and specified crop/animal production systems.

- Develop knowledge to populate the above data management systems.
  - Develop foundational knowledge on the sensitivities of natural resources to the effects of climate change.
  - Develop foundational knowledge on the sensitivities of specific crop and animal germplasm to the effects of climate change using genomics tools.
  - Develop foundational knowledge on the sensitivities of beneficial and deleterious insects and microbes to the effects of climate change including range expansion, seasonal expansion, changes in vector behavior, and establishment of new invasive species.
  - Develop foundational knowledge on greenhouse gas emissions in animal and crop systems related to production systems, nutritional efficiency, environmental adaptation/resiliency, and climate change.
  - Develop foundational knowledge on animal and plant health implications for vector and non-vector borne diseases and parasite infestations related to animal and crop production, resiliency, and adaptability to climate change.

- Develop management technologies for adaptation of production systems for climate change.
  - Expand genebank capacity to safeguard plant and animal genetic diversity, and meet the increasing demand for genetic resources with more tolerance of abiotic stressors that are expected to increase with climate change.
  - Develop and introduce plant varieties and animal lines/breeds that are less vulnerable to the negative impacts of climate change and extreme weather events that can potentially take advantage of new environmental conditions.
  - Develop more sophisticated management technologies to precisely deliver inputs (i.e., water, nutrient, and pest control) for maximized production efficiency and minimized environmental degradation.

- Develop integrated animal and/or crop production systems to enhance adaptation to heat stress, water stress, disease, and/or parasites while optimizing the efficient production of high quality animal and crop products in varying environments and minimizing greenhouse gas emissions.
- Expand the Long Term Agroecosystem Research (LTAR) network to accommodate GxExM research that can be used to develop and validate the sustainability of climate resilient agroecosystems, including evaluation of management practices that maintain or enhance productivity while reducing fertilizer inputs and nutrient losses to runoff, groundwater, and air emissions; and provide an improved understanding of the biogeochemical cycling of key fertilizer nutrients and agrichemicals.
- Leverage the resources of the LTAR network and related resources as an outdoor laboratory system for standardized data collection and long term sustainability assessments. Specifically, incorporate anticipated effects of climate change on landscapes and animals in risk management; leverage large collaborative program data such as the Conservation Assessment Program (CEAP) for crops and range lands to better direct and assess environmental sustainability and ecosystem service research and programming; and incorporate data management and data stewardship into research programming and related activities.

- Strengthen the USDA Climate Regional Hubs to accelerate research on region specific climate effects, and adaptation and technology transfer/outreach.

- Develop new technologies and tools to improve precision food production systems that meet current and future food production needs while ensuring economic and environmental sustainability and animal well-being.
  - Match animal and plant genotypic capacity (phenotype) to the environment for greater efficiency and production.
  - Develop animal, plant, and landscape indicators useful for management decisions.
  - Develop improved and adapted plant and animal genetic lines and products to increase market access and competitiveness in domestic and foreign markets.

- Big Data Initiative: Develop high performance cyber infrastructure that supports the integration of big data for GxExM. Categories of big data that contain germplasm information include genotype, phenotype, and genetic information; germplasm data sources include GRIN-Global, MaizeGDB, SoyBase, GrainGenes, Gramene, Legume Information System, AgMIP, iPlant (NSF), KBase (DOE), Phytozome (DOE), and Ensemble Genomes (EBI). Categories of environmentally relevant data include weather, soil, water, and nutrition conditions; data sources for environmental data include the National Oceanic and Atmospheric Administration (NOAA), National Center for Atmospheric Research (NCAR), National Ecological Observatory Network (NEON), and the National Science Foundation (NSF). Categories of agricultural management data include irrigation, nutrition, weed, disease, and pest control.
  - Develop and deploy common standards for data formats and common vocabulary/ontologies for data curation, and advanced analytical tools that support GxExM data integration, thus enabling the generation of computational models for plant and animal production that integrate genotype, environmental, and production factors into the adaptation of agriculture to climate change.
  - Develop and apply database mining and data integration methods to combine high volumes of ecogeographical and agroclimatic information from Geographic Information Systems (GIS) databases with trait and genotypic data in the global Germplasm Resources Information Network (GRIN). This will accelerate the prediction, identification, and delivery to crop improvement programs of germplasm with specific adaptations/tolerances to abiotic stresses, such as drought and heat.
  - Implement open access, shared information technology needed for development of interdisciplinary and cross organizational GxExM derived science solutions.
  - Develop technologies for the delivery of farmer preferred applications, products, and services via personal computers and mobile devices.
  - Expand and integrate research teams of breeders, bioinformaticists, geneticists, genebank curators, and modelers to support the breeding climate resilient crops and livestock.

Partners/Collaborators

Current interactions and opportunities to increase cooperation and leveraging of resources will be expanded with agencies and institutions listed below, particularly those focused on common priorities of food animal production and efficiency, environmental stewardship, and sustainability.

NIFA:	Program focus and prioritization; coordination of research priorities, funding, and implementation.
NRCS:	Program focus and prioritization, and research collaboration and implementation focused on natural resource stewardship; enhancing ecosystem services and landscape resiliency; and revitalization of rural communities.
APHIS:	Research data and results to inform Federal programs and policies for protection of natural resources, and production of a healthy and wholesome food supply.
RMA:	Research data and results to inform Federal programs and policies to improve risk management strategies for food animal producers and industry stakeholders.
FS:	Program focus and prioritization, and research collaboration and implementation focused on landscape resiliency and guidance for conventional and emerging land use issues.
NASS:	Research data and results to inform Federal programs and policies, and statistical analyses of production factors for agricultural industries.
ERS:	Research data and results to inform Federal programs and policies, and statistical analyses of production factors for agricultural industries.
FAS:	Research data and results to inform Federal programs and policies, and expand opportunities for exports of U.S. agricultural products.
FSA:	Research data and results to inform Federal programs and policies focused on natural resource stewardship; develop sustainable, resilient landscapes; and assist with risk management, recovery, and preparation for extreme weather events.
USGS/BLM:	Program focus and prioritization, and research collaboration and implementation to provide expert guidance for land management decision making.
NASA:	Research collaboration, funding, and implementation to incorporate new monitoring methods and technologies for landscape analyses.
NSF:	Research collaboration, funding, and implementation in food animal and ecosystem biology.
USAID:	Research collaboration, funding, and implementation focused on research products with relevance to developing countries, particularly in Africa.

Also, collaborations with NOAA, NASA, NCAR, and university researchers will investigate and deliver climate information useful to agriculture. Collaborations with the Joint Genome Initiative (JGI); NSF; Bioversity International and the Global Crop Diversity Trust (for genebanks and GRIN); and irrigation, fertilizer, and plant and animal protection industries will be strengthened to ensure that climate ready crops, livestock, and technologies can be developed using the foundational research conducted by ARS.

Specifically, collaborations with APHIS, RMA, FS, NASS, ERS, and FSA will ensure that research outcomes will include multiple use landscape perspectives including ecosystem services, economic viability for producers and rural communities, expanded markets, food safety and security, conservation of natural resources, and policy relevant information and tools that enable policy based on sound science. Research partnerships with the university research community (funded via NIFA, NSF, and other sources) will be essential to leverage complementary expertise, and contribute to future generations of agricultural scientists. Stakeholder dialogue with State, local and tribal governments and organizations will ensure delivery of practical knowledge and technologies.

Technology transfer will be accomplished through the USDA Climate Regional Hubs via partnerships with NRCS, State Extension Services, NGOs, and other educational media organizations. Collaboration with FAS and USAID will ensure that climate change adaptation technologies relevant to the needs of the international community are made available.

ADVANCED CROP AND LIVESTOCK GENETIC IMPROVEMENTS AND TRANSLATIONAL BREEDING FOR ENHANCED FOOD PRODUCTION

ARS is requesting an increase of $25,900,000 for this crosscutting, multidisciplinary initiative that will integrate research conducted in multiple ARS program areas to achieve the expected outcomes. Funding increases for this initiative are located under the Livestock Production and Crop Production sections of this document.

Need for Change

ARS will establish the Translational Breeding Initiative (TBI) to support the recommendations of the President's Council of Advisors on Science and Technology (PCAST) on Agricultural Preparedness, the draft goals of the Interagency Working Group on Plant Genomics Strategic Plan, and the National Plant Genome Initiative, 2013-2018. This initiative incorporates input received from customers and stakeholders across the U.S. Government.

The TBI is needed to:

- Incorporate a renewed commitment in the area of translational breeding to research, innovation, and technology development; support, training, and workforce development; and provide infrastructure to support collaborative, multidisciplinary research alliances between Federal, university, and industry scientists. This will accelerate performance gains through development of new breeds, lines, and strains with better climate adaptation, drought tolerance, disease resistance, nutritional value, enhanced production efficiencies, and reduced environmental impact.
- Ensure that U.S. agricultural resources contribute to greater global food security through enhanced breeding methods and sustainable intensification of production.
- Enhance America's ability to develop and trade agricultural products derived from new and emerging technologies.
- Promote new advances in breeding to accelerate trait improvement.
- Integrate genetic and genomic information systems with high performance cyber infrastructure systems thereby enhancing use of data and knowledge for crop and animal improvement.
- Expand genotype and phenotype analysis of national germplasm collections and genetic stocks under diverse environments.
- Attract, train, and inspire a new generation of breeders and scientists to apply new technologies to enhance food security in a changing climate, and provide safe nutritious foods and renewable energy production.

The TBI encompasses the activities listed below under the "Means to Achieve Change/Outcomes."

Means to Achieve Change/Outcomes

ARS will increase agricultural productivity and resiliency, and enhance America's capability to develop and trade agricultural products. This will be achieved by developing and using genetic resources and tools along the entire continuum of preservation, characterization, and high throughput genotyping and phenotyping, and developing advanced molecular techniques for crop and animal genetic improvement. Specifically, ARS will:

- Advance translational breeding including classical and genomics enabled breeding.
  - Support the development and translation of new research in classical breeding, trait analyses, quantitative genetics, and epigenetics to accelerate trait improvement. Develop models for breeding that integrate genetic variation, variation in the environment, and management practices. Targets will be to accelerate gains in animal and plant performance, develop and implement new strategies for increasing resilience to weather extremes, and enhance resistance to diseases and pests.
  - Develop high throughput field-based phenotyping platforms. The agency will strengthen USDA, university, and industry partnerships for innovative phenotyping. Performance testing across a range of environments and management systems will be critical for producer profitability.
  - Expand access to high throughput genotyping resources. Genotype information is central for sustaining improvement in target traits. Research will focus on applications of genotype data analyses to support breeding programs, germplasm analysis, complex trait analysis, and the development of new genetic resources for breeding.

- Expand access to genetic resources, knowledge, and tools for crop and animal breeders.
  - Enhance the value and utility of genetic resources. Expand the capacity for NPGS genebanks to acquire, conserve, multiply, and distribute germplasm and associated information.
  - Expand genotype analysis of national germplasm collections and genetic stocks.
  - Expand phenotype analysis of national germplasm collections and genetic stocks under diverse environments.
  - Enhance the capacity of GRIN-Global to provide access to information and data on genetic resources, e.g., genotype, phenotype, genetic, and associated metadata.

- Big Data Initiative: Develop high performance cyber infrastructure and bioinformatic tools that support the integration of big data for accelerated translational breeding, big data for genetic resources analysis, and big data for the genetic analysis of traits.

- Strengthen ARS databases (e.g., GRIN-Global, MaizeGDB, SoyBase, Gramene, GrainGenes, and Legume Information System, AgMIP, Animal GRIN, AgBase, Bovine Genome DB, Swine Genome Sequencing Consortium, Barbel, and NCBI) to accelerate the integration of genetic and genomic information with high performance cyber infrastructure systems (iPlant, iAnimal, KBase, XSEDE, and ELIXIR) thereby enhancing public access to utilization of data and knowledge for crop and animal improvement. This includes expansion of capacity to serve more types of crops including fruits and vegetables.

- Provide bioinformatic tools and advanced data processing software and training for genotype and phenotype data analysis and modeling for translational breeding. Leverage existing information systems (iPlant, iAnimal, KBase, and XSEDE) and databases (GRIN-Global, MaizeGDB, SoyBase, Bovine Genome DB, AgBase, et al.) to advance the application of the genetic understanding of complex traits, and diversity for breeders.

Partners/Collaborators

Partners and collaborators for translational breeding include the ARS, NIFA, NSF, DOE, USAID, National Association of Plant Breeders, National Sclerotinia Initiative, Floral and Nursery Research Initiative, U.S. Wheat and Barley Scab Initiative, U.S. Rosaceae Genetics, National Grape and Wine Initiative, Wheat Genomics and Breeding Executive Committee, National Wheat Improvement Committee, Corn Breeding Research Group, Consortium of International Agricultural Research Centers (CGIAR), National Association of Animal Breeders, Poultry Breeders Roundtable, National Institute for Animal Agriculture, American Society of Animal Sciences, American Dairy Science Association, American Poultry Science Association, National Swine Improvement Federation, Beef Improvement Federation, World Aquaculture Society, and Catfish Farmers of America.

Geographic Breakdown of Obligations and Staff Years (SY)
(Dollars in thousands)

	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
ALABAMA, Auburn	$5,957	46	$5,506	43	$5,542	46	$5,128	46
ALASKA, Fairbanks	628	6	--	--	--	--	--	--
ARIZONA								
Maricopa	9,810	74	8,684	67	9,825	74	9,825	74
Tucson	5,144	47	5,492	49	6,320	54	6,320	54
Total	14,954	121	14,176	116	16,145	128	16,145	128
ARKANSAS								
Booneville	1,570	19	1,855	14	3,929	19	3,929	19
Fayetteville	1,689	12	1,553	11	1,772	12	1,772	12
Little Rock	7,681	5	6,929	2	7,759	5	7,759	5
Stuttgart	7,553	57	6,899	58	7,888	59	7,888	59
Total	18,493	93	17,236	85	21,348	95	21,348	95
CALIFORNIA								
Albany	35,540	240	33,203	218	36,408	230	36,408	230
Davis	11,588	93	11,402	90	11,523	93	12,873	93
Parlier	12,229	108	10,809	105	11,319	107	11,319	107
Riverside	5,277	36	4,969	36	5,144	36	5,144	36
Salinas	4,953	47	4,997	45	5,069	47	5,069	47
Shafter	267	8	--	--	--	--	--	--
Total	69,854	532	65,380	494	69,464	513	70,814	513
COLORADO								
Akron	1,973	20	1,827	20	1,891	20	1,891	20
Fort Collins	12,515	134	13,108	117	13,782	119	15,916	143
Total	14,488	154	14,935	137	15,673	139	17,807	163
DELAWARE								
Newark	2,088	16	1,981	15	2,000	16	2,000	16
DISTRICT OF COLUMBIA								
National Arboretum	11,853	78	9,695	74	11,412	76	11,412	76
Headquarters Federal Administration	91,135	490	90,369	527	90,774	568	90,774	568
Total	102,988	568	100,064	601	102,186	644	102,186	644
FLORIDA								
Brooksville	357	4	--	--	--	--	--	--
Canal Point	2,922	35	2,649	35	2,936	35	2,936	35
Fort Lauderdale	2,551	25	2,287	26	2,446	26	2,446	26
Fort Pierce	15,331	143	13,613	147	13,373	147	13,373	147
Gainesville	12,712	118	11,069	112	11,955	114	12,180	114
Miami	4,677	41	4,417	34	4,218	34	4,218	34
Total	38,550	366	34,035	354	34,927	356	35,152	356
GEORGIA								
Athens	22,850	195	22,187	159	23,894	165	25,478	186
Byron	3,796	31	3,218	33	3,559	33	3,559	33
Dawson	3,654	32	3,555	31	3,760	32	3,760	32
Griffin	2,436	20	2,248	20	2,410	20	2,410	20
Tifton	10,184	89	9,283	86	10,267	91	10,267	91
Total	42,920	367	40,491	329	43,889	341	45,473	362
HAWAII, Hilo	9,177	63	9,606	59	9,142	59	9,142	59

Geographic Breakdown of Obligations and Staff Years (SY)
(Dollars in thousands)

	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
IDAHO								
Aberdeen	5,827	49	6,110	47	6,044	47	6,044	47
Boise	2,191	19	2,052	18	1,978	18	1,978	18
Dubois	2,401	20	2,140	19	1,984	17	1,984	17
Kimberly	3,610	35	3,384	34	4,269	38	4,269	38
Total	14,029	123	13,686	118	14,274	120	14,275	120
ILLINOIS								
Peoria	32,085	217	30,789	206	31,938	210	29,116	210
Urbana	5,949	39	5,293	36	5,562	37	5,562	37
Total	38,034	256	36,082	242	37,501	247	34,678	247
INDIANA, W. Lafayette	7,799	61	7,054	62	7,515	63	7,027	63
IOWA, Ames	50,769	418	47,196	395	52,955	420	53,307	431
KANSAS, Manhattan	13,803	110	12,779	103	13,721	110	13,721	110
KENTUCKY								
Bowling Green	2,660	16	2,455	15	2,475	15	2,475	15
Lexington	2,617	14	2,368	14	2,567	14	2,567	14
Total	5,277	30	4,823	29	5,042	29	5,042	29
LOUISIANA								
Baton Rouge	2,779	23	2,923	24	2,897	24	3,122	24
Houma	3,995	48	4,105	49	4,025	49	3,044	49
New Orleans	22,617	169	20,473	151	20,660	152	20,660	152
Total	29,391	240	27,501	224	27,582	225	26,826	225
MAINE, Orono	2,452	14	2,255	15	2,606	15	2,606	15
MARYLAND								
Beltsville	112,540	766	107,806	690	116,890	750	113,985	750
National Ag Library	21,533	105	20,818	72	23,197	72	23,197	72
Frederick	5,694	41	5,797	38	6,096	43	6,096	43
Total	139,767	912	134,421	800	146,183	865	143,278	865
MASSACHUSETTS, Boston	15,166	10	15,126	9	14,983	9	14,983	9
MICHIGAN, East Lansing	4,331	35	4,291	34	5,007	41	1,990	20
MINNESOTA								
Morris	2,763	25	2,537	26	2,440	26	2,440	26
St. Paul	6,922	66	6,473	58	6,636	60	6,636	60
Total	9,685	91	9,010	84	9,075	86	9,075	86
MISSISSIPPI								
Mississippi State	8,776	71	8,534	69	9,181	74	7,728	74
Oxford	14,113	91	12,777	86	14,757	91	13,511	91
Poplarville	5,300	35	5,111	35	4,951	35	4,951	35
Stoneville	35,646	281	34,361	266	36,824	279	35,681	279
Total	63,835	478	60,783	456	65,712	479	61,871	479
MISSOURI, Columbia	8,771	75	8,307	70	9,393	75	7,860	64
MONTANA								
Miles City	4,691	26	3,193	24	3,755	26	3,755	26
Sidney	5,082	45	4,641	40	4,821	43	4,821	43
Total	9,773	71	7,834	64	8,576	69	8,576	69
NEBRASKA								
Clay Center	19,504	116	19,377	116	22,752	132	21,981	132
Lincoln	5,862	69	5,597	64	5,612	67	4,493	67
Total	25,366	185	24,974	180	28,363	199	26,473	199

Geographic Breakdown of Obligations and Staff Years (SY)
(Dollars in thousands)

	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
NEVADA								
Reno	2,232	20	2,178	16	2,184	16	2,184	16
NEW MEXICO								
Las Cruces	6,143	48	5,672	46	6,895	55	6,895	55
NEW YORK								
Geneva	3,977	32	3,697	31	3,894	32	3,894	32
Greenport	4,078	31	3,541	29	4,130	31	4,130	31
Ithaca	10,850	59	10,269	56	11,398	63	11,398	63
Total	18,905	122	17,507	116	19,422	126	19,422	126
NORTH CAROLINA								
Raleigh	9,570	78	8,985	77	9,352	78	9,352	78
NORTH DAKOTA								
Fargo	14,798	116	13,932	113	15,104	121	15,313	121
Grand Forks	9,007	47	8,710	45	9,273	49	9,273	49
Mandan	3,505	34	3,344	33	4,166	39	4,166	39
Total	27,310	197	25,986	191	28,543	209	28,752	209
OHIO								
Columbus	1,396	15	1,323	14	1,364	14	1,364	14
Coshocton	329	5	--	--	--	--	--	--
Wooster	5,906	47	5,652	45	4,805	45	4,805	45
Total	7,631	67	6,975	59	6,169	59	6,169	59
OKLAHOMA								
El Reno	5,408	40	5,204	40	6,726	51	6,726	51
Lane	530	9	--	--	--	--	--	--
Stillwater	3,631	29	3,301	28	3,649	29	3,649	29
Woodward	1,663	15	2,343	15	2,219	15	2,219	15
Total	11,232	93	10,848	83	12,593	95	12,593	95
OREGON								
Burns	3,394	30	2,456	23	2,517	23	2,517	23
Corvallis	13,631	116	12,081	103	11,622	103	10,099	103
Pendleton	1,974	17	1,844	19	1,810	19	1,810	19
Total	18,999	163	16,381	145	15,949	145	14,425	145
PENNSYLVANIA								
University Park	4,297	37	4,017	38	5,511	44	5,511	44
Wyndmoor	32,534	198	30,268	188	32,881	197	30,204	197
Total	36,831	235	34,285	226	38,393	241	35,716	241
SOUTH CAROLINA								
Charleston	4,651	42	4,434	39	4,589	42	4,589	42
Clemson	665	11	--	--	--	--	--	--
Florence	4,213	32	3,868	31	3,829	31	3,829	31
Total	9,529	85	8,302	70	8,418	73	8,418	73
SOUTH DAKOTA								
Brookings	3,042	32	2,853	30	2,825	30	2,825	30
TEXAS								
Bushland	6,507	44	5,974	43	6,424	43	6,424	43
College Station	14,487	125	13,854	110	14,330	115	14,091	115
Houston	13,967	7	13,813	7	13,524	7	13,524	7
Kerrville	5,937	53	5,529	51	6,218	58	6,218	58
Lubbock	8,908	96	8,721	93	8,432	93	8,432	93
Temple	3,386	29	3,202	30	3,310	30	3,310	30
Weslaco	3,975	59	825	--	--	--	--	--
Total	57,167	413	51,918	334	52,236	346	51,997	346

Geographic Breakdown of Obligations and Staff Years (SY)
(Dollars in thousands)

	2012 Actual		2013 Actual		2014 Estimate		2015 Estimate	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
UTAH, Logan	9,302	81	8,444	76	9,168	81	9,618	81
WASHINGTON								
Prosser	3,657	30	3,760	28	3,110	28	3,110	28
Pullman	16,257	124	15,461	112	17,537	124	17,537	124
Wapato	4,553	49	4,436	49	4,589	49	4,589	49
Wenatchee	2,030	24	2,055	21	2,035	21	2,035	21
Total	26,497	227	25,712	210	27,270	222	27,270	222
WEST VIRGINIA								
Beaver	1,310	24	- -	- -	- -	- -	- -	- -
Kearneysville	7,114	61	7,048	61	7,082	61	7,082	61
Leetown	6,828	33	6,786	33	7,281	38	6,992	38
Total	15,252	118	13,834	94	14,363	99	14,074	99
WISCONSIN, Madison	15,808	118	14,711	110	17,661	123	16,352	123
WYOMING, Cheyenne	2,089	21	1,918	22	2,134	24	- -	- -
PUERTO RICO								
Mayaguez	2,953	35	2,895	33	3,159	37	3,159	37
OTHER COUNTRIES								
Argentina, Buenos Aires	1,177	- -	-	- -	- -	- -	- -	- -
France, Montpellier	3,055	2	3,174	2	3,201	2	3,201	2
Total	4,232	2	3,174	2	3,201	2	3,201	2
Extramural and Funds Administered from Headquarters-Held Funds	29,406	- -	14,472	- -	63,229	- -	55,053	- -
Repair & Maintenance of Facilities	17,319	- -	17,762	- -	20,144	- -	20,144	- -
Obligations	1,089,795	7,596	1,014,345	7,058	1,132,114	7,450	1,104,403	7,450
Lapsing Balances	5,218	- -	2,739	- -	- -	- -	- -	- -
Bal. Available, EOY	8,970	- -	9,632	- -	- -	- -	- -	- -
Total Available	1,103,983	7,596	1,026,716	7,058	1,132,114	7,450	1,104,403	7,450

Salaries and Expenses

Classification by Objects
(Dollars in thousands)

		2012 Actual	2013 Actual	2014 Estimate	2015 Estimate
Personnel Compensation:					
Washington D.C.		$46,162	$42,430	$46,718	$47,175
Field		480,155	457,625	503,875	508,807
11	Total personnel compensation	526,317	500,055	550,593	555,982
12	Personal benefits	165,418	160,743	179,020	180,772
13.0	Benefits for former personnel	9,633	1,845	-	-
	Total, personnel comp. and benefits	701,368	662,643	729,613	736,754
Other Objects:					
21.0	Travel and transportation of persons	11,765	8,092	10,388	10,092
22.0	Transportation of things	793	309	345	323
23.1	Rental payments to GSA	19	39	43	4,557
23.2	Rental payments to others	751	430	480	449
23.3	Communications, utilities, and misc. charges	41,303	42,666	47,660	44,600
24.0	Printing and reproduction	668	494	494	463
25.1	Advisory and assistance services	925	989	1,105	1,034
25.2	Other services from non-Federal sources	6,132	7,654	10,508	8,001
25.3	Other purchases of goods and services from Federal sources	-	40	45	42
25.4	Operation and maintenance of facilities	33,200	30,986	34,613	32,391
25.5	Research and development contracts	147,481	141,641	157,378	141,968
25.6	Medical care	325	290	324	303
25.7	Operation and maintenance of equipment	14,813	12,851	21,483	13,433
25.8	Subsistence and support of persons	39	175	196	183
26.0	Supplies and materials	81,883	70,628	78,974	73,831
31.0	Equipment	35,713	19,996	22,355	20,903
32.0	Land and structures	3,042	5,033	5,622	5,261
41.0	Grants	9,575	9,389	10,488	9,815
	Total, Other Objects	388,427	351,702	402,501	367,649
99.9	Total, new obligations	1,089,795	1,014,345	1,132,114	1,104,403
Position Data:					
Average Salary (dollars), ES Position		$138,302	$144,753	$147,648	$149,124
Average Salary (dollars), GS Position		$68,088	$69,096	$72,116	$72,821
Average Grade, GS Position		10.6	10.6	10.6	10.6

Salaries and Expenses

Shared Funding Projects
(Dollars in thousands)

	2012 Actual	2013 Actual	2014 Estimate	2015 Estimate
Working Capital Fund:				
Administration:				
Beltsville Service Center	$346	$164	$168	$172
Mail and Reproduction Management	2,028	2,122	1,850	2,016
Integrated Procurement System	1,023	1,180	1,161	1,211
Procurement Operations	-	5	5	5
Subtotal	3,397	3,471	3,184	3,404
Communications:				
Creative Media & Broadcast Center	41	135	162	203
Finance and Management:				
NFC/USDA	1,541	1,970	2,300	2,318
Controller Operations	3,159	3,084	2,429	2,424
Financial Systems	2,022	2,111	2,001	2,039
Internal Control Support Services	112	162	136	147
Subtotal	6,834	7,327	6,866	6,928
Information Technology:				
NITC/USDA	1,515	988	864	881
International Technology Services	-	275	36	37
Telecommunications Services	1,733	1,383	1,598	1,535
Subtotal	3,248	2,646	2,498	2,453
Correspondence Management	101	112	98	117
Total, Working Capital Fund	13,621	13,691	12,808	13,105
Department-Wide Reimbursable Programs:				
1890's USDA Initiatives	238	217	211	211
Advisory Committee Liaison Services	23	17	21	21
Continuity of Operations Planning	135	153	151	151
E-GOV Initiatives HSPD-12	489	490	485	485
Emergency Operations Center	185	172	167	167
Facility and Infrastructure Review and Assessment	30	31	32	32
Faith-Based Initiatives	32	29	28	28
Federal Biobased Products Preferred Procurement Program	28	26	25	25
Hispanic-Serving Institutions National Program	157	146	143	143
Honor Awards	5	3	5	5
Human Resources Transformation (inc. Diversity Council)	130	119	117	117
Intertribal Technical Assistance Network	154	-	-	-
Medical Services	47	16	19	19
Personnel and Document Security	41	79	81	81
Pre-authorizing Funding	271	252	268	268
Retirement Processor/Web Application	42	42	41	41
Sign Language Interpreter Services	139	61	66	66
TARGET Center	69	67	66	66
USDA 1994 Program	63	57	56	56
Virtual University	165	153	148	148

Salaries and Expenses

Shared Funding Projects
(Dollars in thousands)

	2012 Actual	2013 Actual	2014 Estimate	2015 Estimate
Visitor Information Center	62	64	70	70
Total, Department-Wide Reimbursable Programs	2,505	2,194	2,200	2,200
E-Gov:				
Budget Formulation and Execution Line of Business	7	7	7	7
Enterprise Human Resources Integration	226	185	161	161
E-Rulemaking	-	-	74	74
E-Training	221	189	200	200
Financial Management Line of Business	6	13	13	13
Grants.gov	47	52	45	45
Human Resources Line of Business	19	21	20	20
Integrated Acquisition Environment - Loans and Grants	94	101	136	136
Integrated Acquisition Environment	45	51	48	48
Total, E-Gov	665	619	704	704
Agency Total	16,791	16,504	15,712	16,009

Status of Programs

The Agricultural Research Service's (ARS) major research programs -- New Products/Product Quality/Value Added; Livestock/Crop Production; Food Safety; Livestock/Crop Protection; Human Nutrition; and Environmental Stewardship -- address the Department's goals and priorities. A brief summary of the agency's selected accomplishments for 2013 and current research activities, including the National Agricultural Library, are detailed below.

Program Evaluations: In 2013, ARS conducted retrospective reviews of the New Products/Product Quality/Value Added, Livestock Production, and Livestock Protection programs. Overall, the programs were found to have had high impact (i.e., significant benefit or influence.) The programs were evaluated by a panel of experts who represented government, private industry, and customer/stakeholder groups and the nonprofit arena. Performance was evaluated based on the quality of the research leading to actual impact, or progress toward anticipated benefits to end users, scientific communities, and the broader society. The panel of experts provided recommendations that ARS managers can use in making future management decisions.

New Products/Product Quality/Value Added

Current Activities:

ARS has active research programs directed toward: (1) improving the efficiency and reducing the cost for the conversion of agricultural products into biobased products and biofuels, (2) developing new and improved products to help establish them in domestic and foreign markets, and (3) providing higher quality healthy foods that satisfy consumer needs in the United States and abroad.

Selected Examples of Recent Progress:

Microgreens: the new food rich in human nutrients. ARS scientists in Beltsville, Maryland, were the first to study the nutrient content of microgreens -- leafy vegetables older than sprouts, but much younger than baby greens. The scientists tested 25 commercially available microgreen varieties and discovered they possess two to four times higher nutrient content in Vitamin C, carotenoids, and Vitamins K and V than the same plants' mature leaves. This nutritional data will serve as a reference for health agency recommendations and consumers of fresh microgreens. In addition, the scientists optimized growing and harvesting conditions, and improved storage life to 14 days from the previous three to five days. This significant shelf life extension will enable microgreen growers to ship their product by ground rather than air, providing considerable cost reduction.

Cranberry sugars prevent bacteria from adhering to urinary cells. Urinary tract infections result in millions of doctor visits annually, and some people suffer from recurrent bacterial infections. Cranberry juice phenolic compounds associated with its red color were previously thought to be solely responsible for preventing *E. coli*. ARS scientists in Wyndmoor, Pennsylvania, described the composition of sugars derived from and unique to cranberry pulp that prevented the adherence of *E. coli* to urinary tract cells. A joint patent application was filed under a collaborative research and development agreement with a major cranberry producer. These newly recognized cranberry sugars may have the potential to provide the consumer with another bioactive food ingredient which improves health.

Extending the life of frying oils with antioxidants. During frying, oils that are high in healthy polyunsaturated fatty acids, such as soybean oil, quickly react with oxygen and polymerize which causes darkening, foaming, and a reduction in nutritional value. Synthetic antioxidants are used to protect oils during frying, but many synthetic antioxidants have come under scrutiny because of potential negative health effects. Food companies are very interested in replacing synthetic antioxidants with natural antioxidants. ARS scientists in Peoria, Illinois, discovered that phytosteryl ferulates, natural antioxidants found in corn, rice, wheat, and rye, formulated with Vitamin E, another important antioxidant found in oils, protect each other and work together to protect the oil during frying. With this combination, soybean and other healthy oils can be used for a longer time for frying, a cost savings for food processors and restaurants owners. As part of the research the scientists discovered that a low resolution nuclear magnetic resonance instrument, commonly used by oil companies and in quality assurance environments, may be substituted for traditional methods of measuring oil degradation. During deep fat frying, it is necessary to

monitor oil quality so food processors and restaurants know when to replace the oil. Although several instruments are available for quick measurements, they are not very accurate. The advantages of the new, hand-held method are that, once calibrated, it correlates with standard methods, requires no solvents and minimal sample preparation, and is easy and fast to use so that anyone could be trained to measure frying oil degradation.

Low cost process for producing marketable pyrolysis oil. Pyrolysis converts biomass into bio-oil, a petroleum-like liquid that has the potential to be refined into renewable, drop-in replacements for petroleum-based fuels. However, bio-oil cannot be used by existing petroleum refiners because it contains too much oxygen. Although oxygen can be removed from bio-oil by catalytic hydrotreating (reacting with hydrogen), that process is expensive and reduces product yield. ARS researchers in Wyndmoor, Pennsylvania, developed and are patenting a relatively simple, non-catalytic process utilizing tail gas from the pyrolysis reactor to reduce the oxygen content of the bio-oil from 35 to 12 percent. The new process doubles the yield of distillate product and results in a more narrow range of products (five to ten compounds) versus traditional pyrolysis (hundreds of compounds).

Controlling bacterial contaminations without antibiotics. Lactic acid bacteria frequently contaminate commercial fuel ethanol fermentations, reducing yields and decreasing biorefining profitability. The current practice to control these bacterial contaminations involves antibiotics, but there is concern about the fate of these antibiotics in waste water and ethanol co-products used in livestock feed. ARS researchers in Peoria, Illinois, and Beltsville, Maryland, discovered antibacterial enzymes, called phage endolysins, that inhibit lactobacilli. The scientists have expressed the genes for endolysins in ethanol producing yeast. ARS has applied for a patent for this technology which ethanol biorefineries can use to prevent bacterial contaminations and avoid large scale antibiotic use.

Removing cellulase inhibitors from pretreated biomass. The most expensive step in converting biomass to fuels involves the use of cellulase enzymes to hydrolyze cellulosic biomass to fermentable sugars. One of the reasons for this high cost is that byproducts produced by pretreating cellulosic biomass significantly inhibit cellulase enzymes. ARS scientists in Peoria, Illinois, in collaboration with researchers at Purdue University, developed a low waste fermentation process to remove these enzyme inhibitors, and showed that this biological conditioning or "bioabatement" process increases conversion of cellulose to fermentable sugars by 20 to 50 percent.

Enzymes for preprocessing biomass. Breaking the chemical crosslinks between lignin and carbohydrate fibers would greatly improve the value of biomass for biorefining or in livestock feed. Using genomic techniques, ARS scientists in Albany, California, discovered a new feruloyl esterase enzyme that eliminates these crosslinks. The scientists expressed the enzyme in *E. coli*, a bacteria used industrially to produce enzymes, and confirmed the enzyme's effectiveness when applied to rice bran, wheat bran, corn fiber, switchgrass, and corn bran. A patent application was filed; an industrial partner is considering using the technology to produce livestock feed.

Livestock Production

Current Activities:

ARS' livestock production program is directed toward: (1) safeguarding and utilizing animal genetic resources, associated genetic and genomic databases, and bioinformatic tools; (2) developing a basic understanding of the physiology of livestock and poultry; and (3) developing information, tools, and technologies that can be used to improve animal production systems. The research is heavily focused on the development and application of genomics technology to increase the efficiency and product quality of beef, dairy, swine, poultry, aquaculture, and sheep systems. Current areas of emphasis include increasing efficiency of nutrient utilization, increasing animal well being and reducing stress in production systems, increasing reproductive rates and breeding animal longevity, developing and evaluating non-traditional production systems (e.g., organic, natural), and evaluating and conserving animal genetic resources.

Selected Examples of Recent Progress:

Development of international genomic evaluations for young dairy bulls. Genomic evaluations have rapidly replaced traditional evaluation systems used for dairy cattle selection and have had a significant impact in increasing genetic progress. However, accurate, unbiased comparison of genomic evaluations from different countries has not been possible because of differences in national methodologies and the data included in evaluations. ARS scientists in Beltsville, Maryland, collaborated with the Canadian Dairy Network (Guelph, Ontario), and the Interbull Centre (Uppsala, Sweden), to develop a genomic multi-trait, cross country evaluation (GMACE) system by modifying techniques used in traditional international evaluations. Initial implementation of GMACE for young Holstein bulls was completed in August 2013 by the Interbull Centre. The availability of accurate international genomic evaluations for young bulls will enable breeders to select globally from the best animals, thereby providing access to a much larger genetic pool and increasing the rate of genetic progress for dairy production worldwide.

Identification of engineered antimicrobial proteins that eradicate Staphylococcal Mastitis pathogens. The U.S. dairy industry's loss due to mastitis (infections of mammary glands) exceeds $2 billion annually. Mastitis is also responsible for the greatest use of antibiotics on the dairy farm despite an international effort to reduce antibiotic use in agriculture. The bacterial pathogen *Staphylococcus aureus* can evade most conventional antibiotics by invading and residing inside the cells (intracellularly) of the cow mammary gland, leading to chronic infection and increased culling of infected animals. Conventional antibiotics do not kill intracellular pathogens; thus, novel antimicrobials effective at killing intracellular bacteria would benefit the dairy industry for the treatment of mastitis and help to replace antibiotics that are facing high levels of resistant strain development. ARS scientists in Beltsville, Maryland, demonstrated that an engineered antimicrobial protein facilitates transport across the mammary cell walls into intracellular spaces. The scientists then fused the protein to a previously engineered antimicrobial protein with three distinct enzyme activities. The top candidate engineered antimicrobial protein for the eradication of intracellular *S. aureus* in cultured cell assays showed the ability to reduce the *S. aureus* infection 1,000-fold in a mouse mastitis model. This technology presents a novel alternative mastitis treatment to effectively treat and potentially eliminate bovine mastitis and significantly reduce the need for conventional antibiotic use on the dairy farm.

New semen extender supplement improved fertility of turkey semen. The turkey industry relies exclusively on artificial insemination, a time- and labor-intensive process, to reproduce birds in commercial operations. When producers use freshly collected semen for artificial insemination, fertility rates are typically 94 to 98 percent; however, if semen is held longer than six hours prior to insemination, fertility rates drop to 40 percent. ARS scientists in Beltsville, Maryland, evaluated the biological basis for this drop in fertility and have shown that the sugar residues on the surface of the sperm membrane change when semen is held longer than six hours. To address this issue, the scientists conducted an intensive evaluation of the concentration of different sugars, as well as the effect of time and temperature on these sugars. Results indicate that providing extra sialic acid (sugar) in the semen extender can boost the fertility rates of semen held at a cool temperature (4 C) for 24 hours from 40 to 85 percent. This represents a significant advance in poultry semen storage technology that will save producers time and money when reproducing flocks.

Finding markers to predict reproduction efficiency in beef cattle. Reproductive efficiency is arguably the most economically important trait in commercial beef cattle production, as failure to achieve pregnancy reduces the number of calves marketed per cow exposed to breeding. Identification of variation in the genome with predictive merit for reproductive success would facilitate accurate prediction of daughter pregnancy rate in sires, enabling effective selection of bulls whose daughters have improved fertility. ARS scientists in Clay Center, Nebraska, applied a Genome Wide Association Study (GWAS) approach using a procedure based on genotyping multi-animal pools of DNA to increase the number of animals that could be genotyped with available resources. The study identified regions of the genome associated with reproductive efficiency which are being targeted for further analysis to develop robust marker systems. The scientists also demonstrated that DNA pooling can be used to substantially reduce the cost of GWAS studies in cattle. A specific deletion of DNA along chromosome 5 in *Bos indicus* crossbred cattle was identified that is strongly correlated with reproductive failure, providing a potentially useful marker for breeders in sub-tropical areas that make use of these types of cattle. The results demonstrate the ability to leverage the bovine genome sequence to improve reproductive efficiency in beef cattle while significantly reducing technology costs for research communities.

Introduction of free genetic tests for inherited defects of dairy cattle. A method to identify exact locations of loss-of-function mutations and DNA sequences associated with lethal or undesirable conditions of dairy cattle was developed by ARS scientists at Beltsville, Maryland, and automated over the past two years. However, results from that method could not be made available to the dairy industry because the respective DNA sequences were associated with patented genes. Genetic tests were available for some of the lethal mutations, but most females were not tested because individual gene tests were expensive and not included on genotyping chips until very recently. The June 2013 U.S. Supreme Court's unanimous decision that biotechnology companies cannot patent genes that occur naturally has made possible the release of information from genetic tests for bovine leukocyte adhesion deficiency, deficiency of uridine monophosphate synthase, and mulefoot in Holsteins as well as Weaver Syndrome, spinal dysmyelination, and spinal muscular atrophy in Brown Swiss. For Holsteins, the method also can be applied to identify DNA markers associated with complex vertebral malformation and brachyspina as well as for desired traits such as red coat color and polledness (no horns). In addition, four new deleterious DNA sequences have been identified for dairy cattle fertility, and those sequences have been incorporated into new genotyping chips. The first release of genomic status information for the inherited defects occurred in August 2013 and is expected to provide the tools for dairy producers to reduce or eliminate costs for genetic testing, decrease the frequency of undesired traits, and increase the rate of genetic progress for desired traits through significant improvements in reproductive efficiency, health, and animal well-being.

Increasing production of healthy omega-3 fatty acids in rainbow trout. The increase in the price of fish oil is making it very expensive to include it at desired levels in aquaculture feeds to improve the nutritional value of farmed fish. ARS scientists in Aberdeen, Idaho, have determined that genetic variation exists between families of rainbow trout in their ability to produce and deposit fish oils in their flesh. During 2013, scientists measured the genetic variation among rainbow trout families and validated methods for measuring fatty acid levels in live fish. This methodology will improve fish oil content in filets through breeding and ultimately produce fish with greater health benefits to humans.

Kaolinitic clay protects fish from Columnaris disease. Columnaris disease, caused by the bacterium *Flavobacterium columnare*, is a costly disease of many commercially grown fish species including channel catfish. Few preventative methods or therapies exist for this disease. ARS scientists in Stuttgart, Arkansas, evaluated a type of clay, called kaolin, for the prevention of Columnaris disease. Kaolin works by binding to the bacteria, thereby preventing it from attaching to the fish. ARS scientists demonstrated that addition of kaolin to the water significantly improved the survival of channel catfish that were experimentally challenged with the disease. Kaolin was shown to be a novel, non-antibiotic treatment to increase survival rates in catfish hatcheries.

High survival of Bacterial Cold Water Disease (BCWD) resistant rainbow trout line in farm trials. BCWD is a frequent cause of farmed trout loss. ARS researchers at Leetown, West Virginia, developed a BCWD resistant rainbow trout line through multiple generations of genetic selection for improved disease resistance. Three consecutive years of performance testing of these fish were carried out under farm conditions. In five completed trials to date in which non-select fish were diagnosed with BCWD, survival of the select line was 95 percent from initial feeding through the early rearing phase. In addition to greater survival, the select line had a smaller percentage of fish that tested positive for the pathogen that causes BCWD. These findings support the release of the germplasm to stakeholders, and the continued evaluation of the select genetic line in large scale production trials.

Development of an improved aerator for the catfish industry. Supplemental aeration is used by all catfish producers. It is critical to maintain dissolved oxygen (DO) at levels that support high densities of catfish grown in production ponds, especially when oxygen levels drop on warm summer nights. Paddlewheel aerators have been used for aeration in aquaculture for over 30 years, and while they transfer oxygen to the water efficiently, they also move a huge volume of water so the oxygen concentration increases slowly. Thus, a great deal of equipment and a large amount of power is required to prevent low DO conditions in commercial ponds. ARS researchers at Stoneville, Mississippi, have developed a new aerator, the Power Tube Airlift (PTA), which can concentrate DO into a small zone of water in a pond using less energy than traditional methods. A patent application for this invention is currently pending. Two commercial scale PTAs were installed in an eight acre catfish production pond and gave promising results. This new equipment will both lower energy costs and enable higher production densities.

Crop Production

Current Activities:

ARS' crop production program focuses on developing and improving ways to reduce crop losses while protecting and ensuring a safe and affordable food supply. The research program concentrates on effective production strategies that are environmentally friendly, safe to consumers, and compatible with sustainable and profitable crop production systems. Research activities are directed at safeguarding and utilizing plant genetic resources and their associated genetic, genomic, and bioinformatic databases that facilitate selection of varieties and/or germplasm with significantly improved traits.

Current research activities attempt to minimize the impacts of crop pests while maintaining healthy crops and safe commodities that can be sold in markets throughout the world. ARS is conducting research to discover and exploit naturally occurring and engineered genetic mechanisms for plant pest control, develop agronomic germplasm with durable defensive traits, and transfer genetic resources for commercial use. ARS provides taxonomic information on invasive species that strengthens prevention techniques, aids in detection/identification of invasive pests, and increases control through management tactics that restore habitats and biological diversity.

Selected Examples of Recent Progress:

"Sunpreme" raisins dry themselves. Eliminating the processing step of tray drying in the field would help maintain the quality of raisins and reduce the need for costly additional post-harvest processing. ARS researchers in Parlier, California, have developed "Sunpreme," a new raisin grape that dries naturally on the vine without the grapes requiring cutting and drying in trays. "Sunpreme," is particularly well suited for mechanical harvesting, thereby significantly reducing production costs. Unlike Thompson Seedless, the major grape variety used for tray dried raisin production, "Sunpreme," can be spur-pruned, further reducing grower costs.

New citrus cryopreservation method developed. The current and future productivity and profitability of the multi-billion dollar U.S. citrus industry is threatened by virulent pests and diseases, such as citrus greening and citrus canker. These pests and diseases also threaten ARS' citrus breeding stock and genebank collections maintained in field and screen house plantings. Until now, preserving vegetatively propagated citrus germplasm under ultra-cold (cryopreservation) genebank conditions has not been feasible. ARS researchers in Ft. Collins, Colorado, and Riverside, California, developed a novel micrografting technique that results in high survival rates of citrus germplasm maintained by cryopreservation. Furthermore, the new cryopreservation technique eliminates several graft transmissible viruses and viroids. This new cryopreservation technique not only provides an effective means for safeguarding invaluable citrus germplasm, but it can also serve as a new pathogen elimination method for producing disease free citrus propagating material.

Discovery of genes for drought tolerance in the common bean. Drought strongly reduces the yields of dry beans in the Northern Plains (North Dakota and Minnesota), Great Lakes (Michigan), and other regions which rely primarily on rainfall for crop growth. Consequently, dry beans with tolerance to drought are critical for those regions, and for adapting this globally important crop to climate change. ARS researchers in Prosser, Washington, and their university colleagues identified two major genes (also known as quantitative trait loci or QTL) that strongly govern drought tolerance in dry beans. The two genes showed positive effects when the dry beans were cultivated in multiple drought stress environments. This research will enhance our capacity for marker assisted breeding to accelerate development of drought tolerant beans by seed companies and public sector breeders in the United States and worldwide.

Rich native U. S. sources of plant genetic diversity identified for crop improvement and research. The wild relatives of domesticated crops contain rich sources of genetic diversity which new genomics assisted breeding techniques can now exploit more effectively for crop improvement. It has long been assumed that U.S. flora contains relatively few crop wild relatives. ARS scientists in Prosser, Washington, and Beltsville, Maryland, with international research collaborators, completed an inventory of U.S. flora that contains a rich trove (more than 4,600 different types) of crop wild relatives and wild species that could be exploited directly for food, forage, medicinal,

ornamental, and industrial applications. This research has furnished a blueprint for urgent action to conserve the most endangered U.S. crop wild relatives.

Novel multi-seeded mutants identified that might substantially increase sorghum grain yield. ARS researchers in Lubbock, Texas, have identified novel sorghum mutants that might significantly increase sorghum grain yield. The multi-seeded mutants have more and larger primary and secondary flower branches bearing more types of floral organs that develop into seeds. Compared to current sorghum cultivars, these mutants have triple the number of seeds and double the seed weight. The mutants are being evaluated in the field for their ability to substantially increase sorghum grain yield.

Reducing environmental impacts of wine grape production. Better identification of the environmental impacts of wine grape production could help growers facilitate targeted improvement in production system sustainability. ARS scientists in Davis, California, have developed a tool that helps growers and policymakers understand the full environmental impacts of an agricultural production system and identify ways to improve overall efficiency. The Life Cycle Assessment (LCA) tool has been used to assess environmental impacts of wine grape production across a range of vineyard management regimes in two important growing regions of California. The tool evaluates resource extraction; manufacturing of raw materials into products used in wine grape production (e.g., herbicide and fertilizer) and their subsequent transport to the vineyard; activities and energy required to grow the wine grapes (e.g., irrigation and harvest); and final transport of wine grapes to the winery. The tool helped scientists discover a number of alternative management practices, including but not limited to compost, reduced irrigation, and various cover cropping systems that will assist growers seeking to improve the energy use and air emissions of their vineyards.

Attractants for Brown Marmorated Stink Bug**.** The Brown Marmorated Stink Bug is an invasive insect pest that causes severe damage to fruits, vegetables, and field crops that has spread to 40 States, as well as to Canada, Switzerland, Germany, and France. A means of monitoring the numbers of stink bugs is necessary for determining when to apply treatments. ARS scientists in Beltsville, Maryland, have confirmed that the bug is attracted to methyl decatrienoate (MDT), a pheromone of a different Asian stink bug species. The researchers have developed and commercialized a new synthesis of this compound for use in monitoring traps. In addition, ARS scientists in Kearneysville, West Virginia, and Beltsville, discovered the true male produced aggregation pheromone of the stink bug and confirmed in field trials that it is attractive to male and female adults and immature bugs. The pheromone was developed into a commercial version that has been transferred to the private sector. ARS scientists in Beltsville also discovered that the performance of the bug's pheromone could be enhanced (synergized) by MDT, providing a superior lure for season long monitoring. A patent application has been filed on discovery of the Brown Marmorated Stink Bug attractants. It is expected that the commercialization of this pheromone technology will lead to effective management of the pest and new trap-and-kill techniques to reduce pesticide usage.

Varroa Mite migration represents a new control challenge. Varroa Mites are a major cause of colony losses in honey bees because they parasitize bees and spread viruses in the colony. ARS researchers in Tucson, Arizona, devised a treatment schedule to control Varroa based on colony and Varroa population dynamics. The researchers found that Varroa populations could be kept at low levels throughout most of the summer with this treatment schedule. However, by fall, mite populations were much larger than predicted or than could be accounted for by mite reproduction alone. The researchers determined that mites appear to be migratory and move between colonies with far greater frequency than previously thought. This finding led to changes in recommendations on Varroa control that include a late fall treatment so mite populations remain low over the winter to prevent the loss of honey bee colonies in the spring.

Use of biochar as a component in greenhouse substrates. Fertilizers are becoming increasingly expensive due to the energy required to manufacture them or the cost of mining the raw materials. Phosphorus and potassium are two of the primary nutrients used in fertilizers. ARS scientists in Wooster, Ohio, determined that gasified rice hull biochar, a commercially abundant byproduct from the processing of rice, contains a high concentration of phosphorus and potassium, and has potential as an alternative source for use in commercial potting substrates for greenhouse and nursery crops. The scientists determined that the optimal rate for amendment with gasified rice hull biochar into a typical greenhouse potting substrate is 10 percent by volume. At this rate, sufficient phosphorus and potassium are provided for a variety of crop species without additional nutrients being provided. This data provides the industry

with baseline information on rates of application that can be used when this product becomes available to the horticultural industry.

Food Safety

Current Activities:

Assuring that the United States has the highest levels of affordable safe food requires that the food system be protected at each stage from production through processing and consumption from pathogens, toxins, and chemical contaminants that cause diseases in humans. The U.S. food supply is very diverse, extensive, easily accessible, and thus vulnerable to the introduction of biological and chemical contaminants through natural processes, intentional means, or by global commerce.

ARS' current food safety research is designed to yield science-based knowledge on the safe production, storage, processing, and handling of plant and animal products, and on the detection and control of toxin producing and/or pathogenic bacteria and fungi, parasites, chemical contaminants, and plant toxins. All of ARS' research activities involve a high degree of cooperation and collaboration with USDA's other Research, Education, and Economics agencies, as well as with the Food Safety and Inspection Service (FSIS), Animal and Plant Health Inspection Service (APHIS), Food and Drug Administration (FDA), Centers for Disease Control and Prevention (CDC), Department of Homeland Security (DHS), and the Environmental Protection Agency (EPA). ARS also collaborates in international research programs to address and resolve global food safety issues.

Specific research efforts are directed toward developing new technologies that assist ARS stakeholders and customers, that is, regulatory agencies, industry, and commodity and consumer organizations, in detecting, identifying, and controlling foodborne diseases that affect human health.

Selected Examples of Recent Progress:

Shell eggs pasteurized using an innovative process. Pasteurization of all shell eggs in the United States would reduce *Salmonella* illnesses by approximately 110,000 annually, yet only about 1 percent of eggs are currently pasteurized because the process is costly and damages the egg white appearance. ARS researchers in Wyndmoor, Pennsylvania, developed a radio frequency (RF) energy process that eliminates 99.999 percent of *Salmonella* that may be present in eggs. The RF process is significantly (more than 50 percent) faster than the current pasteurization process. ARS filed for patent protection and several companies have expressed interest in licensing the technology. RF pasteurization substantially reduces the threat of illness from uncooked and undercooked shell eggs.

Screening method for fluoroquinolone residues. Fluoroquinolone antibiotics are used to treat humans and often serve as the last defense against antibiotic resistant microorganisms. However, they are also used in veterinary medicine. Worldwide, this has been a particular concern in regulatory monitoring programs. Current screening tests using microbial inhibition for antibiotics do not respond well to fluoroquinolones. A new screening method is needed for these drugs. ARS researchers in Wyndmoor, Pennsylvania, developed a novel approach which met U.S. tolerance detection levels. Adoption of this new screening process for these important drugs will ensure proper veterinary practices, and reduce the chances of transferring antibiotic microbial resistance.

Antibiotic treatment of cattle in feedlots does not increase prevalence of antibiotic resistant *E. coli*. Some classes of antibiotics are critically important to human medicine and are prescribed for the treatment of serious *E. coli* and *Salmonella* infections. Concerns have been raised that therapeutic treatment of feedlot cattle with antibiotics in the same classes as those used for humans increases the prevalence of resistant *E. coli*. ARS scientists in Clay Center, Nebraska, assessed fecal samples before, during, and after antibiotic treatment for disease in a feedlot herd over a ten month period. A baseline, a low level of antibiotic resistant *E. coli*, was detected in cattle upon arrival at the feedlot, and antibiotic resistance temporarily increased after antibiotic treatment. Resistance levels returned to baseline levels after several weeks. Genetic analysis of 312 resistant *E. coli* isolates obtained from this study demonstrated that the baseline level of resistant *E. coli* in the herd was more likely due to the persistence of a few feedlot adapted resistant *E. coli* strains rather than the transfer of the genes conferring resistance between *E. coli*

strains. These results indicate that antibiotic treatment of disease in cattle feedlots does not increase the prevalence of antibiotic resistant *E. coli* in those cattle when they are harvested.

Irrigation management strongly affects arsenic and cadmium accumulation in rice grain. Changing concepts of dietary arsenic (As) risk to humans threatens the safety of U.S. rice, the only grain that accumulates substantial levels of As. Flooding rice soils causes arsenite to be generated from soil arsenate; soil arsenite can be accumulated by rice, as can dimethylarsinic acid, a less toxic organic form of As generated by soil microbes. ARS scientists from Beltsville, Maryland, in collaboration with those the University of Arizona, measured levels of As and cadmium (Cd) in grains with six different irrigation schemes. Rice grown with traditional flooding, which lowers soil aeration, contained the highest As and the lowest Cd levels. Any soil oxidation promoted Cd accumulation, whereas making the soil nearly fully aerobic was required to reach minimal As concentrations in grain. Three tested cultivars varied in As accumulation but showed similar changes with irrigation management. The research concluded that growing rice aerobically rather than via traditional flood culture can substantially lower grain As and yield, and increases grain Cd. The results provide growers and the FDA with information that may be needed to meet market As limits in areas with naturally high soil levels of the element.

Portable method for identifying harmful bacteria from food. Rapid detection of harmful bacteria in food is necessary to prevent foodborne illness and safeguard public health. The Bacterial Rapid Detection using Optical Scattering Technology, know as BARDOT sensor technology developed by ARS funded researchers at Purdue University's Center for Food Safety Engineering (CFSE) in West Lafayette, Indiana, is easy to use and allows rapid identification of bacteria. A new portable BARDOT instrument was developed by CFSE scientists and was evaluated by ARS scientists in Wyndmoor, Pennsylvania. The system is able to identify known pathogenic bacteria, including pathogenic *E. coli*, *Salmonella*, and *Listeria monocytogenes*. The pathogen identification capabilities coupled with the portability of this new BARDOT instrument has tremendous potential for improving the response to foodborne illness outbreaks because the method can travel to the source, thereby reducing the time to detection. The utility of the BARDOT system was demonstrated by its ability to detect *Salmonella* in peanut butter within 24 hours with an accuracy of 98 percent. This is comparable to the current USDA-FSIS method, which requires about 72 hours. The patented BARDOT system is licensed and available for use worldwide.

Point scan Raman imaging-based detection of food contaminants. Incidents in recent years of profit driven adulteration of milk and wheat ingredients used to make dairy products and pet foods have highlighted the need for nondestructive methods to screen food ingredients for contaminants that can pose significant food safety hazards. A Raman chemical imaging system and method were developed by ARS scientists in Beltsville, Maryland, for detecting multiple adulterants in dry skim milk powder. Spectral image processing methods were developed to remove interference from background fluorescence, and to create Raman chemical images visualizing the distribution of the different adulterants in the milk powder using unique Raman peaks of the adulterants. A correlation was found between adulterant concentration and the number of adulterant pixels identified in the images, demonstrating the utility of this method for regulatory and industry use in the quantitative analysis of adulterants in milk powder. A U.S. patent ("System and Methods for Detecting Contaminants in a Sample") was granted in May 2013.

USDA Integrated Pathogen Modeling Program (IPMP 2013). Predictive microbiology entails applying mathematical models to predict the growth and survival of foodborne pathogens undergoing complex environmental changes. Predictive models are the building blocks for microbial food safety risk assessments. ARS researchers in Wyndmoor, Pennsylvania, developed an easy-to-use integrated data analysis and model development tool that can be used by students and scientists. The program can also be used in colleges and universities to train students to carry out predictive microbiology research. This software package is offered as a free tool to scientists and risk modelers around the world and can be downloaded from http://www.ars.usda.gov/Main/docs.htm?docid=23355.

Livestock Protection

Current Activities:

ARS' animal health program is directed at protecting and ensuring the safety of the Nation's agriculture and food supply through improved disease detection, prevention, control, and treatment. Basic and applied research approaches are used to solve animal health problems of high national priority. Emphasis is given to methods and procedures to control animal diseases.

The research program has the following strategic objectives: develop ARS' laboratories into a fluid, highly effective research network to maximize use of core competencies and resources; use specialized high containment facilities to study zoonotic and emerging diseases; develop an integrated animal and microbial genomics research program; establish centers of excellence in animal immunology; launch a biotherapeutic discovery program providing alternatives to animal drugs; build a technology driven vaccine and diagnostic discovery research program; develop core competencies in field epidemiology and predictive biology; establish a best-in-class training center for our Nation's veterinarians and scientists; and develop a model technology transfer program to achieve the full impact of ARS' research discoveries.

ARS' current animal research program includes eight core components: (1) biodefense research, (2) animal genomics and immunology, (3) zoonotic diseases, (4) respiratory disease, (5) reproductive and neonatal diseases, (6) enteric diseases, (7) parasitic diseases, and (8) transmissible spongiform encephalopathies.

Selected Examples of Recent Progress:

H7N9 outbreak in China: Animal investigations and U.S. animal health preparedness activities. On March 29, 2013, the Chinese Center for Disease Control and Prevention (CDC) completed laboratory confirmation of three human infections with an Avian Influenza A (H7N9) virus not previously reported in humans. By April 26, reports from the China Ministry of Agriculture indicated that the H7N9 virus had been confirmed in chickens, ducks, pigeons (feral and captive), and environmental samples in four of the eight provinces and in Shanghai municipality, confirming that the source of human infections was poultry markets. USDA set up a Situational Awareness Coordination Unit with a core team of subject matter experts and other USDA representatives, including the ARS, APHIS, FSIS, and the Foreign Agricultural Service. USDA and the Chinese CDC worked collaboratively to understand the epidemiology of H7N9 infections among humans and animals in China. To date, there is no evidence of this strain of Avian Influenza A (H7N9) virus has entered the United States. ARS scientists at the Southeast Poultry Research Laboratory, Athens, Georgia, and the National Animal Disease Center, Ames, Iowa, rapidly conducted animal studies to characterize the virus pathogenicity and transmission properties of the virus in avian and swine species. Results from studies performed on poultry and pigs indicated that chickens and quail showed no signs of illness, but they were shedding Avian Influenza A (H7N9) virus. Pigs infected with the H7N9 virus on the other hand, did not amplify or shed the virus. This information was considered critical to prepare first responders in case this new and emerging virus reached the United States. ARS scientists also rapidly developed new diagnostic tests to ensure the virus could be quickly detected, and completed antigenic mapping studies to help identify virus isolates that could be used to develop a vaccine for poultry if needed.

A safe, "leaderless" Foot-and-Mouth Disease (FMD) vaccine platform with two negative markers for differentiating infected from vaccinated animals. ARS scientists at the Plum Island Animal Disease Center identified that if the lead sequence in the FMD virus is removed, it is rendered harmless to animals while still leaving it capable of growing in cell culture. This information has contributed to the understanding of how the FMD virus amplifies, interacts with an animal host, evades the host defense mechanism, and how various parts of the virus genome function. Importantly, ARS scientists used this information to produce a new "leaderless" FMD vaccine virus. The vaccine is safer than current FMD vaccine technologies that use naturally occurring (wild type) virus, because the "leaderless" attenuated FMD vaccine virus does not cause disease in animals. This is a major milestone in vaccine technologies because it will enable the safe production of FMD vaccines, and likely eliminate concerns that FMD vaccine viruses might escape from a manufacturing plant and cause a FMD disease outbreak. This will be especially beneficial for FMD-free countries such as the United States, providing the capability to rapidly manufacture millions of FMD vaccine doses without fear of vaccine virus escapes. In addition, the "leaderless" FMD vaccine has been

genetically modified to include two negative markers to differentiate it from wild type virus found in animals during a disease outbreak. A patent has been filed for this new technology which is being developed in partnership with a multinational pharmaceutical company.

Elimination of persistent infection and transmission risk following the re-emergence of *Theileria equi* in the United States. *Theileria equi* is a tick-borne disease of horses that can cause severe acute disease characterized by fever, anemia, hemoglobinuria and, in some cases, death. Infected horses that recover from the acute disease become persistently infected for life. Disease caused by *T. equi*, called piroplasmosis, has been eradicated from the United States, although in 2009, an outbreak of the disease occurred in Texas. Until recently, horses diagnosed with piroplasmosis were either euthanized or quarantined for life due to the persistence of infection. ARS scientists in Pullman, Washington, developed a treatment regimen using imidocarb dipropionate to eliminate *T. equi* from naturally infected horses, and removed the risk of transmission of the pathogen to other horses. This allowed the horses to resume their previous lives and has facilitated international movement of horses between infected and noninfected countries.

Development of a *Brucella suis* vaccine for feral swine. USDA continues to work to control brucellosis since an eradication program was initiated in the 1950s. However, the persistence of brucellosis in wildlife reservoirs (bison, elk, and feral swine) poses a risk for reintroduction to domestic livestock. New vaccines and diagnostics that can be applied to wildlife are needed. Brucellosis is not currently a problem in domestic swine. However, it is common in the millions of feral pigs present in the United States. Surveillance has shown that up to 35 percent of some herds of feral pigs may test positive for *Brucella*. In addition, transmission from infected feral pigs, which shed the organism in their urine to cattle, has resulted in dairy herds in the southeastern United States becoming positive for *Brucella*. Recently, ARS scientists at the National Animal Disease Center, Ames, Iowa developed an experimental vaccine that has been shown to be protective against brucellosis in feral swine when administered orally or parentally. More research needs to occur to determine the optimal dose and efficacy data. However, the vaccine shows promise in reducing the risk of *Brucella* transmission from feral swine to humans and domestic livestock.

Complete genome sequences of new emerging Newcastle disease virus strains isolated from China. Five virulent Newcastle Disease Virus (NDV) strains were isolated from geese in China during 2010 and 2011. The complete sequences of two NDV strains, and the sequences of the envelop glyprotein genes (F and HN) of three other strains were determined. Phylogenetic analysis classified them into a new genotype, designated as genotype XII, which is genetically distinct from genotype VII, the predominant genotype responsible for most outbreaks of Newcastle disease in China in recent years. This is the first report of complete genome sequences of new emerging genotype XII NDV strains isolated from geese in China. This basic scientific information is critical to ensuring current molecular diagnostic tests can detect emerging viruses that may migrate from China and pose a threat to the United States.

DEET mosquito repellent works by taste and smell. Current mosquito repellents are effective if used correctly, but dosages applied to the skin are very high. Prevention of disease transmission using repellents is a problem because people are reluctant to use unpleasant products until they have already been bitten. ARS scientists in Beltsville, Maryland, have been working to understand the physiological mode of action of repellents. They found that DEET not only affects odor receptors on mosquito antennae, but also taste receptors on the mouthparts. This new understanding that taste and odor are involved in the function of the repellent opens the door to more precisely targeted exploration for repellent active ingredients that work at much lower concentrations. This discovery will change the way that active ingredients in new repellents are evaluated and may ultimately lead to highly effective products that have a greater chance of preventing mosquito bites than current repellents.

Gene silencing technology leads toward safe mosquito control. Only a very limited number of public health pesticides are available for controlling medically important vectors such as mosquitoes and sand flies. This novel approach is based on the technology that allows the specific silencing of genes critical to the survival of the target vector species. This technology uses double stranded RNA (dsRNA) and the process of RNA interference (RNAi) to prevent the synthesis of specific proteins in cells. By choosing the right target, it is possible to debilitate mosquito vectors of disease. ARS researchers in Gainesville, Florida, have demonstrated that a dsRNA construct targeting a gut expressed gene effectively shuts down production of that protein when fed to the adult yellow fever

mosquito. The dsRNA was fed to the mosquitoes in a sugar meal and that protein production was stopped in 12 or 24 hours. Oral delivery of dsRNA to mosquitoes could be a practical way to deliver this new technology. The specificity of the dsRNA would prevent any danger to other insects, including pollinators. Also, only tiny quantities of dsRNA would be required which would reduce costs. This research will lead to products that have no nontarget effects and that are safe for humans and the environment.

How house fly maggots live in bacteria rich media. House flies breed in places such as garbage and manure that host numerous species of bacteria. Many of those bacteria are human or animal pathogens. Remarkably, house fly maggots are seldom harmed by the soup of bacteria in which they live. The interaction of the maggot's own immune system and the bacteria in its medium is important in determining whether or not the adult flies emerging from the maggots will carry pathogenic bacteria. In collaboration with Clemson University, ARS scientists in Manhattan, Kansas, sequenced genes that were activated in immune stimulated house flies, and identified several sequences coded for molecules that protect the maggots from bacteria. Production of these substances creates a component of the maggots' immune system, thus allowing the maggot to live in contaminated environments and helps determine which pathogens survive in the adult fly. An understanding of the intricacies of the relationship between larval flies and bacteria will lead to better ways of protecting food and livestock from pathogens.

Development of a new, selective insecticide. One of the objections to the use of pesticides is their toxicity to other organisms, including humans, that are not intended as their targets. Although residue limits to protect people on the basis of toxicological data exist, compliance with those limits can be a problem. From an environmental perspective, toxic effects on any vertebrate species would be considered undesirable. ARS scientists in Kerrville, Texas, collaborated with researchers at the University of Florida and Virginia Tech University, to evaluate a synthetic carbamate insecticide, designated PRC-408, for the control of horn, stable, and sand flies. PRC-408 was as toxic to these insects as carbaryl, an efficacious, commercially available compound. An in vitro assay was used to demonstrate that PRC-408 exhibited approximately 300-fold higher specificity for its arthropod target compared with mammalian (i.e., bovine and human) targets, and may offer improved safety compared with other chemicals in its class. This research will result in new insecticides that are very safe to use but flexible in their application.

Crop Protection

Current Activities:

ARS research on crop protection is directed toward epidemiological investigations to understand pest and disease transmission mechanisms, and to identify and apply new technologies that increase our understanding of virulence factors and host defense mechanisms. Currently, ARS research priorities include: (1) identification of genes that convey virulence traits in pathogens and pests; (2) factors that modulate infectivity, gene functions, and mechanisms; (3) genetic profiles that provide specified levels of disease and insect resistance under field conditions; and (4) mechanisms that facilitate the spread of pests and infectious diseases.

ARS is developing new knowledge and integrated pest management approaches to control pest and disease outbreaks as they occur. Its research will improve the knowledge and understanding of the ecology, physiology, epidemiology, and molecular biology of emerging diseases and pests. This knowledge will be incorporated into pest risk assessments and management strategies to minimize chemical inputs and increase production. Strategies and approaches will be available to producers to control emerging crop diseases and pest outbreaks.

Selected Examples of Recent Progress:

Molecular diagnostic assay for Wheat Stem Rust Ug99 strains. Strains of the Wheat Stem Rust pathogen in the group Ug99 are threats to wheat production worldwide, and while these strains are not yet in the United States, U.S. wheat varieties are vulnerable to Ug99. Until now, the only way to distinguish Ug99 strains from other forms of Wheat Stem Rust was to put the fungus spores on wheat plants and wait for disease to develop. ARS scientists in St. Paul, Minnesota, have developed a two stage assay based on fungal DNA to distinguish among rust strains. The first stage determines if the sample belongs to the Ug99 strain group, while the second stage predicts the specific strain. This assay is currently being used to track the movement of the Ug99 in Africa where the disease is endemic.

Deployment of this assay in the United States would greatly enhance growers' ability to detect and identify any Ug99 introductions and to provide information for responding to potential outbreaks.

Natural plant molecules disrupt nematode development. Safe strategies for managing plant parasitic nematodes should effectively control these target pests while having minimal impact upon the environment and nontarget species. Using the most economically important plant nematodes in the United States, the soybean cyst nematode and the root knot nematode, ARS scientists in Beltsville, Maryland, found that plant chemicals called catechins inhibit nematode hatching and also significantly inhibit nematode enzymes called proteases. The catechins affect three specific proteases that are part of a complex structure central to nematode survival. Without proper protease function, nematodes fail to develop and will die. This discovery is important because it demonstrates a molecular basis for how this plant chemical can suppress plant parasitic nematode development and reproduction at low doses. In addition, it also demonstrates that catechins can be used as nematode control agents. This information will help scientists develop precision treatment strategies for controlling plant parasitic nematodes and help growers seeking to decrease synthetic chemical use in crop protection.

Flat mite identification tool on the Web. Flat mites, such as false spider mites, red palm mites, citrus mites, and peacock mites, are devastating pests on citrus, tea plants, bananas, coconuts, date palms, olive crops, eucalyptus trees, and ornamental palms. In addition to directly causing damage, these mites also vector plant diseases, including citrus leprosis virus. Accurate identification of these mites is the first step in controlling them. ARS researchers in Beltsville, Maryland, in collaboration with APHIS developed an interactive online identification key with descriptors and numerous images using light microscopy and low temperature scanning electron microscopy. Since its launch one year ago, more than 123,800 visitors from 180 countries have acccessed the Web site. This tool has enabled correct identification by farmers, extension agents, State and university researchers, government agencies, and APHIS quarantine specialists in controlling mites and plant diseases vectored by mites.

Discovery, field release, and establishment of new natural enemies of Giant Reed in Texas. Giant Reed (*Arundo donax*) is a highly invasive weedy grass from the Mediterranean region that displaces native riparian vegetation in the United States and clogs waterways along the Southern border. Its dense thickets also hinder effective border patrol activities and provide habitat for the tick that carries cattle fever. Giant Reed became a problem in the United States because it lacks effective natural enemies. Scientists at ARS' European Biological Control Laboratory in Montpellier, France, have now identified four candidate natural enemies after making more than 250 field collections in Spain, France, Italy, and Greece. The candidates were shipped to U.S. quarantine facilities in Mission, Texas, where ARS scientists evaluated them for safety and efficacy against the weed. Two of the agents, a gall forming wasp *(Tetramesa romana)* and a scale insect *(Rhizaspidiotus donacis)*, have received APHIS permits and have been released into the field. A third agent, a leaf mining fly (*Lasioptera donacis*), is currently being evaluated in quarantine. During the past year, ARS scientists in Kerrville, Texas, and in Montpellier, France, have also made significant advances in understanding the biological association of the defoliating leafminer fly and associated endophytic pathogens. The fly has previously undiscovered specialized organs on its ovipositor in which it stores the spores of a single species of fungus. The fungus appears to be necessary for complete development of the fly and is probably responsible for much of the damage to the *Arundo* plant. As these natural controls spread they will help to suppress the grass and restore original riparian habitats.

Insect control for export of table grapes and sweet cherries. Spotted Wing Drosophila (*Drosophila suzukii*) is an invasive pest in the western United States that threatens the ability of growers to export California-grown table grapes and sweet cherries, which have an annual export value estimated at $200 million to Australia and New Zealand. ARS scientists in Parlier, California, developed a combination of sulfur dioxide fumigation and cold treatment as a postharvest alternative to methyl bromide fumigation for controlling this pest in California-grown table grapes. The scientists further enhanced producer's ability to export grapes by developing a method to remove fungicide residues using ozone fumigation. Following requests of the western U.S. cherry industry, the scientists also completed the validation of a quarantine treatment utilizing methyl bromide fumigation. This research has enabled the retention and expansion of market access to Australia, estimated at $55 million annually.

Human Nutrition

Current Activities:

Maintenance of health throughout the lifespan along with prevention of obesity and chronic diseases via food-based recommendations are the major emphases of ARS' human nutrition research program. These health-related goals are based on the knowledge that deficiency diseases are no longer important public health concerns. Excessive consumption has become the primary nutrition problem in the American population. This is reflected by increased emphasis on prevention of obesity from basic science through intervention studies to assessments of large populations. ARS' research program also actively studies bioactive components of foods that have no known requirement but have health promoting activities.

Four specific areas of research are currently emphasized: (1) nutrition monitoring and the food supply, e.g., a national diet survey and the food composition databank; (2) dietary guidance on specific foods, nutrients, and dietary patterns that maintain health and prevent disease; (3) prevention of obesity and related diseases, including research on the reasons for the limited use of the *Dietary Guidelines for Americans*; and (4) life stage nutrition and metabolism, in order to better define the role of nutrition in pregnancy and growth of children, and for healthier aging.

Selected Examples of Recent Progress:

Early development of heart rate regulation and bone growth differ between breast-fed and formula-fed infants. It is not known whether differences in an infant's diet are associated with differences in the development of heart rate control. A longitudinal investigation at the Arkansas Children's Nutrition Center in Little Rock, Arkansas, is studying the development of breast-fed, soy formula-fed, and cow's milk formula-fed infants. Findings in 465 infants on the basis of measures of resting heart rate across the first two years of life revealed that vagal tone, a parameter of the autonomic nervous system that regulates cardiac function by slowing heart rate, was within the normal range across groups but was lower after six months in breast-fed than formula-fed infants. Variations in vagal tone have been related to mental development and emotional behavior in infants, children, and adults. These findings provide new information regarding the influence of early infant diet on neurodevelopment and suggest that variations in early diet may contribute to the development of individual differences in autonomic heart rate control, which is important in the regulation of attention, emotion, mental abilities, and behavior. In a study of more than 200 of these infants over their first nine months of age, the breast-fed children were significantly fatter than soy or milk formula-fed infants. Those fed soy formula were leaner than the other groups and accumulated bone and body length faster. These results should help reduce concerns regarding the use of soy formula. Although the long term consequences of these observations are unknown, these children will be followed to ascertain the health effects of the early growth differences.

Fatty acid ratios in food affects human immune response. Although hundreds of studies have been conducted, there is no scientific consensus on how different dietary fatty acids influence the human immune system. Diets containing five different soybean oils that varied in their content of polyunsaturated fatty acid (PUFA) were fed to volunteers for 35 days by scientists at the Human Nutrition Research Center on Aging at Tufts University in Boston, Massachusetts. Standard tests of the immune system were performed at the end of each test period. Two PUFAs, designated omega-6 and omega-3, had the strongest effect on proliferation of immune cells. Soybean growers are changing most strains grown to reduce specific fatty acids. It is critical to know how these changes might affect the health of consumers.

Scientists have a pivotal role in analysis of the pig genome and proteome. ARS human nutrition scientists in Beltsville, Maryland, contributed to a multinational consortium that mapped the entire pig genome, and led a related analysis of porcine genes that control the immune system. Full knowledge of the pig genome will contribute to more efficient production of healthier animals and better meat for human consumption, and will serve as a better experimental model for human diseases. Many of the pig's organ systems and its genes are closer to that of humans than those of standard laboratory animals such as mice or rats. In addition, a large scale analysis of the proteins in biological fluids from multiple sites in a strain of pigs susceptible to metabolic syndrome was performed and

reflected metabolic responses in various organs that will enable scientists to study development of diabetes in real time as it influences different systems in the body.

Vitamin K may protect against coronary calcification. Vitamin K is a well known factor involved in blood clotting, but emerging evidence suggests that it has other functions. Coronary calcium progression, which is a characteristic of severe heart disease, has not been well studied in humans with respect to Vitamin K. To address this gap in knowledge, ARS funded researchers at Tufts University in Boston, Massachusetts, in collaboration with scientists from Wake Forest Medical Center, measured the Vitamin K concentrations in blood samples from men and women participating in a multi-ethnic study of atherosclerosis, and determined their association with coronary calcium progression. The overall findings suggest those with low Vitamin K concentrations were more likely to have coronary calcium progression. Among participants who were taking blood pressure medication, those with low Vitamin K were even more likely to have coronary calcium progression. These data support the need to review Vitamin K dietary requirements in the context of health outcomes beyond that of Vitamin K's established role in blood clotting.

Moderately high folic acid negatively affects fetal development. Pregnant women are encouraged to consume prenatal vitamins with extra folic acid. Whereas adequate folate helps prevent many neural tube defects, there is concern about high doses having an adverse effect. Because a study cannot ethically be conducted in humans, scientists supported by ARS in Boston, Massachusetts, fed mice folate at 10 times the recommended amount, which is similar to the level recommended for pregnant women. The mice exhibited increased fetal loss, embryonic delays, and a higher incidence of heart defects in offspring. This indicates that moderately high supplementation of folic acid adversely affects fetal mouse development. It will be critical to follow up this research to determine whether there is concern in pregnant women.

Environmental Stewardship -- Water Quality; Air/Soil Quality; Global Climate Change; Range/Grazing Lands; Agricultural Systems Integration

Current Activities:

ARS' research program emphasis is in developing technologies and systems that support profitable production and enhance the Nation's vast renewable natural resource base.

The agency is currently developing the scientific knowledge and technologies needed to meet the challenges and opportunities facing U.S. agriculture in managing water resource quality and quantity under different climatic regimes, production systems, and environmental conditions. ARS' air resources research is developing measurement, prediction, and control technologies for emissions of greenhouse gases, particulate matter, ammonia, hydrogen sulfide, and volatile organic compounds affecting air quality and land surface climate interactions. The agency is a leader in developing measurement and modeling techniques for characterizing gaseous and particulate matter emissions from agriculture. In addition, ARS is evaluating strategies for enhancing the health and productivity of soils including developing predictive tools to assess the sustainability of alternative land management practices. Finding mechanisms to aid agriculture in adapting to changes in atmospheric composition and climatic variations is also an important component of ARS' research program.

ARS' range and grazing lands research includes the conservation and restoration of the Nation's range lands and pasture ecosystems and agroecosystems through improved management of fire, invasive weeds, grazing, global change, and other agents of ecological change. The agency is currently developing improved grass and forage legume germplasm for livestock, conservation, bioenergy, and bioproduct systems as well as grazing-based livestock systems that reduce risk and increase profitability. In addition, ARS is developing whole system management strategies to reduce production costs and risks.

Selected Examples of Recent Progress:

Early warning index for flash drought. The flash droughts of 2012 and 2013 in the Nation's corn belt were rapid onset events fueled by below normal precipitation levels and a lingering heat wave that essentially "baked" moisture reserves from the soil profile. ARS scientists in Beltsville, Maryland, developed a satellite-based drought product

called the Evaporative Stress Index (ESI) that provided early warning of the deteriorating crop and moisture conditions in 2012, preceding signals of increasing drought severity recorded by the U.S. Drought Monitor and many other standard drought indicators by several weeks. The ESI depicts areas of anomalously low water use and availability, derived from measurements of evapotranspiration (ET) generated with thermal infrared satellite imaging systems. Robust early warning of impending drought provides growers additional time to adjust cropping and marketing strategies during the growing season. ARS scientists are also working with researchers at the National Agricultural Statistics Service to establish the utility of using ESI records of seasonal crop stress to improve estimates of at-harvest yield. With minimal reliance on ground-based observations, the ESI shows good potential for monitoring food and water security at the global scale.

Long-term data from an ARS experimental watershed validates NASA satellite-based rainfall estimates. Water is a critical resource in rapidly developing arid and semiarid regions. Accurate rainfall estimates are essential to effective management of agricultural production and critical water resources, but in many parts of the world, rugged terrain limits the deployment of rain gauges, while simultaneously blocking ground-based radar estimates of rainfall. Working with colleagues from the National Aeronautics and Space Administration (NASA), ARS researchers in Tucson, Arizona, compared rain gauge observations from the densely instrumented ARS Walnut Gulch Experimental Watershed, with rainfall intensity estimates from the Tropical Rainfall Measurement Mission (TRMM) satellite from 1999 to 2010. Results showed a very good agreement between the two sets of rainfall rate estimates, an important finding because rainfall is not well measured over large parts of the globe. The satellite design is also the basis for NASA's new Global Precipitation Mission. In addition to underscoring the importance of ARS' long-term research sites and the data sets they enable, the validation presages success for the new NASA mission. Among other benefits, the significance of quantifying precipitation worldwide has important implications for improving the world's capacity for food production in light of expected population growth and climatic uncertainty.

Assessing feasibility and sustainability of bioenergy crop production. In collaboration with their university partners, ARS scientists in Temple, Texas, assessed the feasibility and sustainability of biofuel production in the eastern and central United States, in the face of growing energy production demands and climate change. Switchgrass productivity, estimated under both current and future climate change scenarios, showed substantial variation both within regions and over time. In particular, the southern U.S. has the highest current biomass potential, but is predicted to have the largest future decrease in productivity, because the temperature is predicted to increase (and precipitation decrease) in this region. These results help develop a better understanding of the possibility for large scale biofuel production from perennial grasses in the eastern and central U.S.

New soil nitrogen test helps to reduce fertilizer applications. Current soil nutrient tests do not account for all sources of plant available nitrogen. Fertilizer recommendations based on these tests frequently overestimate application amounts, leading to an financial loss for the farmer and an increased environmental impact from the excess amounts. Cooperation between ARS scientists in Temple, Texas, and industry has led to the development and commercialization of a method to rapidly and inexpensively determine the total plant available nitrogen in soils. Since its introduction in September 2010, the new testing method, known as the "Haney Soil Health Test," has been adopted by 40 university and commercial soil testing laboratories. The estimated nitrogen fertilizer savings realized from reduced application recommendations based on analysis of 3,000 soil samples was $2.5 million.

ARS' greenhouse gas and biofuel sustainability Web-based database now accessible. Data management systems are needed to expand the availability of vast amounts of data generated by field studies. ARS researchers in Fort Collins, Colorado, and other ARS laboratories nationwide created and revised a general data entry template designed to accommodate comprehensive data from various cropping, biofuel, and grazing studies within the ARS Geenhouse Gas Reductions through Agricultural Carbon Enhancement Network (GRACEnet) and Renewable Energy Assessment (REAP) projects. Currently, data from 35 ARS units have been populated in the template, quality controlled, and uploaded to a relational database. A subset of this data is now publically available. Making the greenhouse gas (GHG) flux, soil, vegetation, and other data accessible and easily available is important for enabling a wider variety of researchers to perform meta-analyses, test existing GHG flux and crop growth models, and develop new models.

Revegetation of barren superfund site using compost and gypsum. Wind and water erosion at a 300 acre abandoned asbestos mining Superfund site in Vermont represents a continuing risk to nearby populations. Without vegetation, the site will continue to erode and be a health threat. ARS scientists in Beltsville, Maryland, conducted a three year study to evaluate applications of manure compost plus a gypsum byproduct and fertilizers to obtain an effective vegetative cover of the soil. Results showed the surface applied amendments produced extensive vegetative cover of clover and grasses, while the control plots receiving simple fertilization remain barren. The EPA has estimated that revegetation using two feet of topsoil on the site would cost $220 million, while revitalizing the soil using these soil amendments and leveling would cost only $25 million, resulting in a significant savings to the public.

Ammonia recovery from poultry litter with gas permeable membranes. Recovery of gaseous ammonia from poultry litter benefits bird health and productivity while reducing environmental emissions from poultry production. ARS scientists in Florence, South Carolina, investigated the potential use of gas permeable membranes as components of a new process to capture and recover ammonia in poultry houses. Prototype systems consistently reduced headspace ammonia gas concentrations from 70 to 97 percent and allowed recovery of 88 to 100 percent of the ammonium volatilized from poultry litter. The potential industry benefits of this technology include cleaner air inside poultry houses, reduced ventilation costs, a concentrated liquid ammonium salt that can be utilized as fertilizer, and a significant reduction in ammonia volatilization, which will reduce the environmental impact of the poultry industry. A patent application has been submitted for the process.

Effects of grain processing on the carbon footprint of beef cattle. Most cattle in the southern Great Plains are fed diets based on steam-flaked corn. Steam-flaking corn uses additional natural gas not required when cattle are fed diets based on dry rolled corn. Using data from multiple trials, ARS researchers in Bushland, Texas, calculated the effects of steam flaking on the carbon footprint of cattle fed high concentrate finishing diets. Despite the additional fossil fuel used in steam flaking compared to dry rolling corn, cattle fed steam flaked, corn-based diets produced less methane, excreted less organic matter (which decreased manure methane production), and improved feed efficiency, thus decreasing the quantity of corn required for finishing. Overall, steam flaking decreased the carbon footprint of cattle feeding by 8 to 18 percent compared to their being fed dry rolled corn. These results can be important in developing accurate life cycle analysis of cattle feeding and in improving sustainability of cattle production.

Improved genetic selection technology for complex grass genomes. Genetic selection programs to improve economically valuable traits for forage grasses with complex genomes (polyploids) has been hindered by a lack of technologies to effectively target specific genetic markers and associated gametes. In response to this critical limitation, ARS researchers in El Reno, Oklahoma, have developed a gamete selection approach for tall fescue and rye grass that now provides forage breeders with breeding technologies similar to those used to effectively increase the yield and adaptability of corn and other commodity crops. This technology has the capacity to revolutionize grass breeding by increasing the rate of genetic progress several fold over conventional breeding strategies by identifying truly elite germplasm for use in subsequent generations through the development of dihaploid selection lines.

Rapid DNA-based paternity testing assay for alfalfa. Alfalfa is the fourth most widely grown crop in the United States, following corn, soybeans, and wheat, with 17.8 million acres harvested in 2013. In alfalfa variety development programs, the pollen donors of plants being evaluated are most often unknown. This lack of paternal identity leads to slower genetic improvement from alfalfa breeding programs. ARS researchers in Madison, Wisconsin, conducted research in collaboration with an industry stakeholder to develop a low cost, rapid, DNA-based paternity testing laboratory assay for alfalfa, including necessary computational software. This new technology doubles the amount of genetic information available to alfalfa breeders, enabling them to target and select specific genetic lines that will significantly increase the yield and adaptability of existing and developing alfalfa varieties.

Improved bioenergy type switchgrass cultivar with high biomass yield tested. Switchgrass cultivars for the northern half of the United States have been limited to upland ecotype cultivars because traditional lowland cultivars have poor winter survival in the region. Lowland switchgrass cultivars, however, have the potential to produce greater biomass yields if they had better winter survival rates. A new lowland type switchgrass cultivar, “Liberty,” was released in 2013 by ARS researchers at Lincoln, Nebraska, after crossing northern upland and southern lowland plants followed by three generations of breeding selection for improved winter survival, high biomass yield, and low

stem lignin concentration. Over a three year period in trials in Illinois, Nebraska, and Wisconsin, "Liberty" had excellent winter survival. In eastern Nebraska and northern Illinois, it had biomass yields that were two tons per acre greater than the best available upland cultivars. The experimental strain is in the ARS cultivar release process and has been planted in a foundation seed increase field. It will be the first bioenergy type cultivar for the Midwest and the northern Great Plains and will likely be adapted to the northeastern States as well.

Carbon dioxide emissions from grasslands are affected by weather but not cattle stocking rates. Grasslands represent the largest land resource in the world, yet little is known about how their management affects the carbon cycle. To help address this knowledge gap, ARS scientists in Mandan, North Dakota, measured carbon dioxide flux from native vegetation and crested wheatgrass pastures over three years. More carbon dioxide was emitted from soil of the crested wheatgrass pasture compared with a native vegetation pasture under heavy grazing; however, there was no difference in carbon dioxide emission between heavy and light grazing for native vegetation. Soil temperature and moisture status were strongly associated with carbon dioxide emissions, though associations were seasonally dependent with temperature most relevant during spring and fall, and moisture status most important in summer. Summer months were characterized by the greatest carbon dioxide emissions which corresponded to periods of warm but generally stable soil temperatures. Accordingly, weather conditions have a strong influence on grassland carbon dioxide emissions, and as a result long term monitoring is necessary to confidently discern management effects on the carbon cycle.

Biological means of controlling aphids in lettuce. Research is needed to identify efficient strategies for intercropping lettuce with plants, such as alyssum, that provide food for beneficial insects that are the natural enemies of aphids on lettuce. ARS researchers in Salinas, California, assessed the growing of alyssum with organic romaine lettuce and identified a novel intercropping pattern that allowed farmers to grow lettuce and alyssum without displacing any lettuce. This research provides the organic sector of the lettuce industry, which accounts for $182 million annually in production, with information to fight the most economically detrimental insect pest to lettuce. This information is also applicable to conventional lettuce production valued at more than $1.3 billion.

Significant reduction of *E. coli* and *Salmonella* in high value produce cropping soils. Contamination of spinach and raw vegetables by *E. coli* and *Salmonella* has resulted in numerous cases of gastroenteritis, kidney failure, and even fatalities throughout the United States. Preventing contamination of fresh produce is an important strategy for protecting crops from contamination. This research revealed that covering soil with a clear plastic film (solarization) and using biofumigation techniques significantly reduced *E. coli* survival in a two week period compared with nonfumigated soil covered with black plastic. These results show that soil solarization combined with natural product biofumigants provide a quick and effective strategy to reduce *E. coli* contamination in high value produce cropping soils. These results will be of interest to organic and conventional leafy greens producers, processors, and marketers.

Reducing nitrate losses in drainage water using cover crops. Nitrate in freshwater streams in the Mississippi River basin contributes to hypoxia in the Gulf of Mexico and requires removal by municipal water treatment plants. Much of the nitrate in the Mississippi River comes from land used to produce corn and soybean, especially if it has been drained with subsurface drainage systems. Oat and rye cover crops grown in the off season after corn and soybeans can significantly reduce nitrate losses in drainage water. ARS scientists in Ames, Iowa, showed that a cereal rye winter cover crop reduced the concentration of nitrate in drainage water by 48 percent. An oat fall cover crop reduced nitrate concentrations by 26 percent. The knowledge that both oat and rye cover crops are viable management options for reducing nitrate losses from corn and soybean production enable growers to contribute to reducing nitrate levels in the Mississippi River basin.

Library and Information Services

Current Activities:

The National Agricultural Library (NAL) is the largest and most accessible agricultural research library in the world. NAL provides services directly to the staff of USDA and to the public, primarily via the NAL website, http://www.nal.usda.gov. NAL was created with USDA in 1862 and was named in 1962 a national library by Congress, as "the primary agricultural information resource of the United States." NAL is the premier library for

collecting, managing, and disseminating agricultural knowledge. The Library is the repository of the Nation's agricultural heritage, the provider of world class information, and the wellspring for generating new fundamental knowledge and advancing scientific discovery. It is a priceless national resource that, through its services, programs, information products, and Web-based tools and technologies, serves anyone who needs agricultural information. The Library's vision is "advancing access to global information for agriculture."

Selected Examples of Recent Progress:

Automated indexing. NAL developed and deployed—in full-scale production—automated indexing/text analytics software to generate the AGRICultural OnLine Access (AGRICOLA) Index of agricultural literature. This application combines semantic analysis, machine learning, and human rules to automatically assign subject terms to journal articles. This metadata facilitates effective literature classification, management, search, and retrieval. The system successfully indexed 107,000 articles and reduced indexing costs from $9.80 to $3.05 per article. This amounted to more than $600,000 in staff time savings in FY 2013.

LCA Digital Commons. Supporting interoperability for life cycle assessment data and systems was a major thrust for the program in FY 2013, continuing into FY 2014. Crosswalks were developed to link the USDA crop production data in the LCA Digital Commons to related upstream Ecoinvent (international data) and data in the U.S.LCI Database (Department of Energy, National Renewable Energy Laboratory). More than 1,000 crosswalk unit processes will be released in early FY 2014. Longer term and more sustainable linking solutions are in development using semantic technologies. This work is underway in collaboration with the EPA.

Digitization of NAL collections. NAL launched its first large scale digitization project to digitize agricultural literature and provide online access to the general public. Important and unique items were selected from the NAL collection, with initial focus on USDA scientific reports and bulletins. In FY 2013, NAL successfully digitized and provided descriptive metadata for 19,500 USDA publications (1,023,382 pages), 3,099 nursery catalogs, and 53 World War I and World War II posters. Publications are accessible at https://archive.org/details/usdanationalagriculturallibrary.

NAL Digital Collections. NAL launched a digital repository of full text content in 2007. In 2011, NAL migrated the content to a more robust platform in preparation for the newly launched digitization effort. As of the end of FY 2013, this system includes nine collections of full text content including nearly 50,000 peer reviewed journal articles authored by USDA researchers.

DigiTop. In FY 2013, NAL obtained contributions from across USDA to purchase nearly $4.5 million in licensed full text and databases to support research and scientific discovery. Just over two years ago, NAL launched a new component of DigiTop called Navigator which allows cross searching of multiple bibliographic databases. This system includes AGRICOLA; AGRIS; BIOSIS; CAB Abstracts; Fish, Fisheries & Aquatic Biodiversity Worldwide; Food Science and Technology Abstracts; GEOBASE; GeoRef; MEDLINE; Wildlife & Ecology Studies Worldwide; Scopus; and Zoological Record. The Navigator service allows researchers to access nearly 75 million records at once and is updated weekly.

Start2Farm Information Clearinghouse. With funding from the NIFA Beginning Farming and Ranching Development Program (BFRDP) and in partnership with the American Farm Bureau Federation, NAL's Alternative Farming and Rural Information Centers created Start2Farm.gov, a web-based educational clearinghouse (http://start2farm.gov/). The website is designed to assist people new to or with less than 10 years of experience in farming or ranching. Tutorials, training materials and curricula, links to BFRDP projects, and an events calendar on the Start2Farm website aim to help new farmers grow successful and sustainable farming operations.

In 2013, the Beginning Farmer and Rancher Development Program Curriculum and Training Clearinghouse added a new search function to the Start2Farm.gov website to help new farmers and ranchers find education and service opportunities and support services. The Start2Farm team at NAL answered reference queries, added content to the online database, and provided information to prospective farmers and ranchers. With the Start2Farm partner, the American Farm Bureau, the Start2Farm team convened a meeting in North Carolina for beginning farmer trainers and service providers to share knowledge and resources. In addition, the Start2Farm team managed communications with NIFA and program grantees which included a monthly email newsletter. The team also provided NIFA with outcome information for the BFRDP annual report.

Lead-Off Tabular Statement

Buildings and Facilities

Budget Estimate, 2015……	-
2014 Enacted……	-
Change in Appropriation……	-

Project Statement
Appropriations Detail and Staff Years (SYs)
(Dollars in thousands)

Program	2012 Actual		2013 Actual		2014 Estimate		Inc. or Dec.		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Discretionary Appropriations:										
Buildings and Facilities...	-	-	-	-	-	-	-	-	-	-
Subtotal.....	-	-	-	-	-	-	-	-	-	-
Rescissions, Transfers, and Seq. (Net).....	-	-	-	-	-	-	-	-	-	-
Total Appropriation.....	-	-	-	-	-	-	-	-	-	-
Bal. Available, SOY.....	$10,098	-	$5,247	-	$2,892	-	-$2,892	-	-	-
Recoveries, Other (Net).....	3	-	274	-	-	-	-	-	-	-
Total Available.....	10,101	-	5,521	-	2,892	-	-2,892	-	-	-
Lapsing Balances.....	-	-	-	-	-	-	-	-	-	-
Bal. Available, EOY.....	-5,247	-	-2,892	-	-	-	-	-	-	-
Total Obligations.....	4,854	-	2,629	-	2,892	-	-2,892	-	-	-

Project Statement
Obligations Detail and Staff Years (SYs)
(Dollars in thousands)

Program	2012 Actual		2013 Actual		2014 Estimate		Inc. or Dec		2015 Estimate	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Discretionary Obligations:										
Buildings and Facilities...	$4,854	-	$2,629	-	$2,892	-	-$2,892	-	-	-
Total Obligations.....	4,854	-	2,629	-	2,892	-	-2,892	-	-	-
Bal. Available, EOY.....	5,247	-	2,892	-	-	-	-	-	-	-
Total Available.....	10,101	-	5,521	-	2,892	-	-2,892	-	-	-
Rescission.....	-	-	-	-	-	-	-	-	-	-
Bal. Available, SOY.....	-10,098	-	-5,247	-	-2,892	-	+2,892	-	-	-
Other Adjustments (Net).....	-3	-	-274	-	-	-	-	-	-	-
Total Appropriation.....	-	-	-	-	-	-	-	-	-	-

Buildings and Facilities

Classification by Objects
(Dollars in thousands)

		2012 Actual	2013 Actual	2014 Estimate	2015 Estimate
Other Objects:					
25.2	Other services from non-Federal sources	-	$418	$2,892	-
25.4	Operation and maintenance of facilities	$4,854	2,106	-	-
32.0	Land and Structure	-	105	-	-
	Total, Other Objects	4,854	2,629	2,892	-
99.9	Total, new obligations	4,854	2,629	2,892	-

Status of Construction Projects as of December 2013

Status of research facilities authorized or funded in prior years and reported as uncompleted in the 2014 Explanatory Notes, are as follows:

NOTE: POR: A study/document that defines the research program, associated space and equipment needs and associated design criteria. DESIGN: The design is either a conceptual design - designated as 35% - or a complete design designated as 100%.

Location and Purpose	Year	Amount of Funds Provided	Description
California, Albany	2000 Planning and Design	$2,600,000	Construction of Phases 1-3a of the Research and Development Facility is complete. The re-design of the remaining work (Phases 3b, 4, 5, and 6) completed 1st Quarter 2010. Construction contract award for the final phases 3 thru 6 awarded 3rd Quarter 2010 with ARRA funding and will be completed 4th Quarter 2014.
Western Regional	2001 Construction	4,889,220	
Research Center	2002 Construction	3,800,000	
(R&D Facility)	2009 ARRA	15,624,460	
	Total	26,913,680	
California, Davis	2004 Planning and Design	$2,684,070	POR completed 2nd Quarter 2007. Lease agreement with University is in progress.
Center for Advanced	2005 Construction	2,976,000	
Viticulture and Tree Crop Research	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,000,000	
	2011 Rescission	($16,062,114)	
	Total	248,525	
California, Salinas	2004 Planning and Design	$4,473,450	Design (100%) completed 2nd Quarter 2007.
Agricultural Research Station	2005 Planning and Design	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($14,937,644)	
	Total	3,816,375	
Connecticut, Storrs	2008 Planning and Design	$1,869,819	POR completed 4th Quarter 2010. Lease agreement with the University has been put on hold due to funding.
Center of Excellence for Vaccine Research	2009 Design & Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($7,221,296)	
	Total	494,523	
District of Columbia	2000 Planning and Design	$500,000	Design (100%) of Bladensburg Road Entrance completed 1st Quarter 2006. The Administrative Building Modernization design completed 1st Quarter 2006. The construction of Phase 2, greenhouse and mechanical support space, completed 1st Quarter 2009. ARRA funds were used to award a construction contract for Administrative Building Modernization 4th Quarter of 2010. Construction completed 2nd Quarter 2013.
U.S. National Arboretum	2001 Design & Construction	3,322,674	
	2002 Design & Construction	4,600,000	
	2003 Design & Construction	1,688,950	
	2008 Construction	695,100	
	2009 ARRA	8,041,842	
	2011 Rescission	($2,066,637)	
	Total	16,781,929	

Location and Purpose	Year	Amount of Funds Provided	Description
Florida, Canal Point	2008 Planning and Design	$521,325	POR completed 2nd Quarter 2011. Land purchases complete. Historic preservation consultation
Agricultural Research Service Lab	2009 Planning and Design	1,096,000	needs to be completed before building demolition can occur.
	2010 Construction	3,422,000	
	2011 Rescission	($4,106,211)	
	Total	933,114	
Georgia, Athens	1992 Planning	$400,000	
Southeast Poultry Research	1993 Construction	677,000	Draft POR completed 1st Quarter 2007.
Laboratory	2008 Planning and Design	2,780,400	
	2009 Planning and Design	2,427,000	
	2011 Rescission	($5,832,898)	
	Total	451,502	
Hawaii, Hilo	1999 Planning and Design	$4,500,000	Design of Phases 1 and 2 is complete. Construction of Phase 1 completed 3rd Quarter 2007.
U.S. Pacific Basin	2000 Construction	4,500,000	Construction contract for Phase 2 awarded 4th Quarter 2010 and completed 1st Quarter 2012.
Agricultural Research	2001 Construction	4,989,000	
Center	2002 Construction	3,000,000	
	2003 Design & Construction	2,980,500	
	2004 Construction	4,831,326	
	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,737,750	
	2009 Construction	1,565,000	
	2010 Construction	5,000,000	
	2011 Rescission	($7,730,452)	
	Total	31,937,874	
Idaho, Hagerman	2005 Planning and Design	$992,000	Lease agreement is in place. POR completed 3rd Quarter 2007.
Aquaculture Facility	2006 Construction	990,000	
	2008 Construction	695,100	
	2009 Construction	544,000	
	2011 Rescission	($2,907,600)	
	Total	313,500	
Illinois, Peoria	2000 Construction Design	$1,800,000	The modernization of the Chemical Wing was completed in 3 segments. The construction of
National Center for	2002 Construction	6,500,000	phases 1 and 2 is complete. Construction for all remaining phases of the Central Wing awarded
Agricultural	2004 Construction	2,684,070	2nd Quarter 2010 using ARRA funding and completed 3rd Quarter 2012.
Utilization Research	2005 Construction	2,976,000	
(Central Wing)	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2009 ARRA	16,237,165	
	Total	37,847,804	

Location and Purpose	Year	Amount of Funds Provided	Description
Iowa, Ames	2001 Design & Construction	$8,980,200	The accelerated plan for the completion of the modernization of ARS/APHIS animal facilities is in progress. All major components of the modernization are complete.
National Centers for	2002 Design & Construction	40,000,000	
Animal Health	2002 Construction	50,000,000	
	2002 APHIS Transfers	15,753,000	-Phase 1 Lab/Office (APHIS) completed in 2004.
	(Supplemental)	(14,081,000)	-Large Animal BSL-3Ag facilities construction completed 2nd Quarter 2007.
	(Other Transfers)	(1,672,000)	
	2002 Construction	25,000,000	-Central Utility Plant & Infrastructure, Phase 1 and 2 construction is complete. Phase 3 construction completed 1st Quarter 2009.
	2003 Construction	32,785,500	
	2003 Construction	110,000,000	-Construction of the Consolidated Laboratory Facility completed 2nd Quarter 2009.
	2005 Construction	121,024,000	
	2006 Construction	58,212,000	-Low Containment Large Animal Facility construction completed 1st Quarter of 2009. Demolition of existing facilities on 1st and 2nd St complete 3rd Quarter 2012. Bldgs. 1 & 2 demo will be complete 1st Quarter 2015.
	Total	461,754,700	
Kentucky, Bowling Green	2005 Planning and Design	$2,281,600	POR is complete for total project. Design (100%) for the Headhouse/Greenhouse only was completed 3rd Quarter 2008. Lease agreement is in place. Construction of the GH/HH was awarded 4th Quarter 2010 and was completed 2nd Quarter 2012.
Animal Waste Management	2006 Construction	2,970,000	
Research Laboratory	2008 Construction	1,390,200	
	2009 Construction	1,088,000	
	2010 Construction	2,000,000	
	2011 Rescission	($5,880,338)	
	Total	3,849,462	
Kentucky, Lexington	2005 Planning and Design	$2,976,000	
Forage Animal	2006 Construction	3,960,000	POR is complete. Lease agreement is in progress. Design (100%) was completed 2nd Quarter 2011.
Research Laboratory	2008 Construction	2,085,300	
	2009 Construction	1,632,000	
	2010 Construction	2,000,000	
	2011 Rescission	($9,678,689)	
	Total	2,974,611	
Louisiana, Houma	2004 Planning and Design	$1,342,035	Design (100%) completed 4th Quarter 2007. Repackaging of design to allow for construction of some elements within the available funding was completed 2nd Quarter 2008. Phase 1A construction was completed 4th Quarter 2010. Phase 1b construction awarded 2nd Quarter 2011 and completed in the 3rd Quarter 2013.
Sugarcane Research	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,505,000	
	2010 Construction	3,654,000	
	Total	15,935,604	
Louisiana, New Orleans	1998 Planning and Design	$1,100,000	The 2006 Supplemental funding was appropriated for the design and construction of the Long-Term Restoration (LTR) of facilities damaged by Hurricane Katrina. Design (100%) for the LTR of facilities was completed 4th Quarter 2008. Construction of the LTR was awarded 3rd Quarter 2009 and completed 3rd Quarter 2011.
Southern Regional	1999 Modernization	6,000,000	
Research Center	2000 Modernization	5,500,000	
(Industrial Wing)	2006 Supplemental (design)	4,900,000	
	2006 Supplemental (construction)	20,000,000	
	Total	37,500,000	

Location and Purpose	Year	Amount of Funds Provided	Description
Maine, Orono/Franklin	2001 Planning and Design	$2,494,500	Construction of all facilities at Franklin (Pump House, Storage Tanks, Lab/Office/Tank Bldg.) is complete. Program for the laboratory facility located at the University Campus in Orono, ME needs to be developed.
National Cold Water Marine	2002 Construction	3,000,000	
Aquaculture Center	2003 Construction	9,090,525	
	2004 Design & Construction	2,684,070	
	2005 Design & Construction	2,976,000	
	2006 Design & Construction	2,475,000	
	2011 Rescission	($2,012,504)	
	Total	20,707,591	
Maryland, Beltsville	1988 Design & Construction	$5,750,000	Study to evaluate boiler plants, steam lines, and electrical distribution was completed 4th Quarter 2009. Construction contract for repairs to boiler plants and portions of the steam distribution system was awarded 4th Quarter 2010 with ARRA funding and were completed 2nd Quarter 2012. Design-Build contract for major renovations to Building 306 was awarded 4th Quarter 2010 with ARRA funding and was completed 4th Quarter 2012.
Beltsville Agricultural Research	1989 Design & Construction	6,100,000	
Center, (BARC)	1990 Design & Construction	9,860,000	
	1991 Design & Construction	15,999,792	
	1992 Design & Construction	16,000,000	
	1993 Design & Construction	13,547,000	
	1994 Design & Construction	19,700,000 **	
	1995 Design & Construction	3,960,000	
	1996 Design & Construction	8,000,000	
	1997 Design & Construction	4,500,000	
	1998 Design & Construction	3,200,000	
	1999 Design & Construction	2,500,000	
	2000 Design & Construction	13,000,000	
	2001 Design & Construction	13,270,740	
	2002 Design & Construction	3,000,000	
	2003 Design & Construction	4,152,830	
	2004 Design & Construction	2,684,070	
	2005 Design & Construction	2,976,000	
	2006 Design & Construction	3,588,750	
	2009 Design & Construction	2,192,000	
	2009 ARRA	21,513,046	
	2010 Construction	3,000,000	
	2011 Rescission	($9,831,954)	
	Total	168,662,274	
Maryland, Beltsville	1998 Design & Construction	$2,500,000	Renovation of the NAL building continues. Completed projects include: replacement of the computer room HVAC and fire suppression systems; completion of chiller replacement and brick repairs of three building elevations; and 14th floor window replacements. Construction for the deteriorated building envelope, repair of brick facade, and replacement of the plumbing system was awarded 1st Quarter 2010 using ARRA funding and was completed 3rd Quarter 2012.
National Agricultural	1999 Design & Construction	1,200,000	
Library	2001 Design & Construction	1,766,106	
	2002 Construction	1,800,000	
	2003 Design & Construction	1,490,250	
	2004 Design & Construction	894,690	
	2009 ARRA	6,357,422	
	2011 Rescission	($115,175)	
	Total	15,893,293	

**Appropriated under USDA Rental Payments Account

Location and Purpose	Year	Amount of Funds Provided	Description
Michigan, East Lansing	1992 Planning	$250,000	Design (100%) for this multi-phased facility modernization is complete.
Avian Disease and	1993 Planning	212,000	
Oncology Laboratory	1998 Planning and Design	1,800,000	
	2011 Rescission	($63,193)	
	Total	2,198,807	
Mississippi, Lorman	2006 Planning and Design	$1,980,000	A lease agreement with Alcorn State University for the new facility was completed 4th Quarter
Biotechnology Laboratory	2008 Planning and Design	1,390,200	2009. POR was completed 3rd Quarter 2008.
Alcorn State University	2009 Construction	1,176,000	
	2010 Construction	1,500,000	
	2011 Rescission	($5,798,055)	
	Total	248,145	
Mississippi, Poplarville	2002 Design	$800,000	Construction of the Headhouse/Greenhouse was awarded 4th Quarter 2007 and completed 1st
Thad Cochran Southern	2003 Construction	9,140,200	Quarter 2008.
Horticultural Laboratory	2006 Supplemental	4,300,000	
	2011 Rescission	($9,178)	
	Total	14,231,022	
Mississippi, Starkville	2005 Planning and Design	$2,976,000	Lease agreement is in place. Design (100%) was completed 1st Quarter 2008.
Poultry Science	2006 Construction	4,950,000	
Research Facility	2008 Construction	1,390,200	
	2009 Construction	3,177,000	
	2011 Rescission	($10,345,645)	
	Total	2,147,555	
Mississippi, Stoneville	2004 Construction	$4,831,326	Design (100%) is complete. Construction of Phase 1 is complete. Construction of mechanical,
Jamie Whitten Delta	2005 Construction	2,976,000	electrical, and plumbing systems for phases 2 thru 5 (of 5 total) and repair of deteriorated building
States Research Center	2008 Construction	2,780,400	envelope was awarded 3rd Quarter 2010. Phase 2 and 3 were completed 1st Quarter 2013, Phase 4
	2009 ARRA	36,347,783	will be completed in the 4th quarter of 2014, and Phase 5 will be completed in the 4th Quarter
	2010 Construction	4,000,000	2015.
	2011 Rescission	($6,047,327)	
	Total	44,888,182	
Missouri, Columbia	2004 Planning and Design	$2,415,663	Design (100%) was completed 4th Quarter 2008.
National Plant and Genetics	2005 Construction	4,960,000	
Security Center	2006 Construction	3,687,750	
	2008 Construction	2,085,300	
	2009 Construction	1,633,000	
	2010 Construction	3,500,000	
	2011 Rescission	($15,590,075)	
	Total	2,691,638	

Location and Purpose	Year	Amount of Funds Provided	Description
Montana, Bozeman	2005 Planning and Design	$1,984,000	Lease agreement is in place. Conceptual Design (35%) was completed 3rd Quarter 2008.
Animal Bioscience Facility	2006 Construction	3,960,000	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($12,720,879)	
	Total	938,940	
Montana, Sidney	1998 Planning and Design	$606,000	Construction of Phase 1 (Lab/Office Building) was completed in 2003 and Phase 2 (Quarantine Lab) was completed 4th Quarter 2008.
Northern Plains Agricultural	1999 Construction	7,300,000	
Research Laboratory	2004 Design and Construction	2,505,132	
	2011 Rescission	($29,505)	
	Total	10,381,627	
Nebraska, Lincoln	2008 Planning and Design	$1,390,200	POR was completed 3rd Quarter 2011.
Systems Biology Research Facility	2009 Planning and Design	1,088,000	
	2010 Construction	3,760,000	
	2011 Rescission	($5,782,528)	
	Total	455,672	
New York, Geneva	2004 Planning and Design	$2,415,663	Design (100%) was completed 4th Quarter 2007.
Grape Genetics	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($14,806,870)	
	Total	1,889,362	
New York, Ithaca	2004 Planning and Design	$3,847,167	Design (100%) was completed 2nd Quarter 2008.
Crop-based Health Genomics	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2011 Rescission	($7,314,491)	
	Total	3,097,426	
Ohio, Toledo	2005 Planning and Design	$1,984,000	Design (100%) completed 1st Quarter 2010. Lease agreement is in place.
University of Toledo	2006 Construction	1,584,000	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($9,356,845)	
	Total	1,926,974	

Location and Purpose	Year	Amount of Funds Provided	Description
Oklahoma, Woodward	2002 Planning and Design	$1,500,000	Phases 1 and 2 of the three-phased construction project are complete.
Southern Plains Range	2003 Construction	7,948,000	
Research Station	2005 Construction	2,976,000	
	2011 Rescission	($152,556)	
	Total	12,271,444	
Pennsylvania, Wyndmoor	1997 Construction	$4,000,000	Modernization of the Center is being accomplished in nine phases, with construction of Phases 1
Eastern Regional Research Center	1998 Construction	5,000,000	through 7 completed. Construction award for Phases 8 and 9 was made 4th Quarter 2010 with
	1999 Construction	3,300,000	ARRA funding and was completed 2nd Quarter 2012.
	2000 Construction	4,400,000	
	2002 Design & Construction	5,000,000	
	2009 ARRA	15,084,486	
	Total	36,784,486	
South Carolina, Charleston	1988 Feasibility Study	$50,000	Construction of Phase 1 (laboratory) and Phase 2A (Headhouse) is complete. Phase 2B
U.S. Vegetable	1990 Planning and		(Greenhouse) construction was awarded 2nd Quarter 2007 and completed 4th Quarter 2008.
Laboratory	Construction	1,135,000	
	1994 Construction	909,000	
	1995 Construction	5,544,000	
	1996 Construction	3,000,000	
	1997 Construction	3,000,000	
	1998 Construction	4,824,000	
	2000 Construction	1,000,000 ***	
	2002 Construction	4,500,000	
	2003 Design	1,390,900	
	2004 Construction	3,131,415	
	2005 Construction	2,976,000	
	2006 Construction	1,980,000	
	2011 Rescission	($517)	
	Total	33,439,798	
***Reprogrammed from Horticultural Crop and Water Management Research Laboratory, Parlier, CA			
Texas, Kerrville	2008 Planning and Design	$1,390,200	POR was completed 2nd Quarter 2010.
Knipling Bushland Lab	2009 Planning and Design	1,957,000	
	2011 Rescission	($2,768,214)	
	Total	578,986	
Utah, Logan	2008 Planning and Design	$5,560,800	Lease completed 3rd Quarter 2010. POR completed 4th Quarter 2010.
Agricultural Research Center	2009 Design and Construction	4,351,000	
	2010 Construction	4,527,000	
	2011 Rescission	($13,839,929)	
	Total	598,871	

Location and Purpose	Year	Amount of Funds Provided	Description
Washington, Pullman	2004 Planning and Design	$3,936,636	Lease agreement with University is in place. Conceptual Design (35%) is complete.
ARS Research Lab	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,740,000	
	2011 Rescission	($17,240,830)	
	Total	1,062,375	
West Virginia, Kearneysville	2003 Planning and Design	$471,913	Construction of Phases 1 and 2 (immediate laboratory repairs and renovation) was completed 3rd Quarter 2007. The construction of the Greenhouse was completed 1st Quarter 2008. POR for the new laboratory was completed 2nd Quarter 2010. Conceptual design for new laboratory was completed 3rd Quarter 2011.
Appalachian Fruit Lab	2004 Construction	1,789,380	
	2005 Construction	3,608,896	
	2006 Construction	2,024,550	
	2008 Planning and Design	1,529,220	
	2009 Planning and Design	783,000	
	2010 Construction	2,000,000	
	2011 Rescission	($3,430,725)	
	Total	8,776,234	
West Virginia, Leetown	2002 Design & Construction	$2,200,000	Construction was completed 3rd Quarter 2008.
National Center for Cool	2006 Construction	891,000	
and Cold Water Aquaculture	2011 Rescission	($4,717)	
(Broodstock Facility)	Total	$3,086,283	
Wisconsin, Marshfield	2003 Planning, Design		Design (100%) of Phase 1 and Phase 2 is complete. Phase 1 (Nutrient Lab) construction was completed 4th Quarter 2008. Phase 2 construction (Animal Holding Facility) was awarded 4th Quarter 2007. Phase 2 construction was completed 1st Quarter 2010.
Nutrient Management	and Construction	$2,980,500	
Laboratory	2004 Construction	3,668,229	
	2005 Construction	4,860,800	
	2006 Construction	7,920,000	
	2011 Rescission	($18,229)	
	Total	19,411,300	
Wisconsin, Prairie du Sac	2008 Planning and Design	$2,502,360	POR completed 3rd Quarter 2011
Dairy Forage Agriculture Research	2009 Construction	2,002,000	
Center	2010 Construction	4,000,000	
	2011 Rescission	($7,675,381)	
	Total	828,979	

Summary of Budget and Performance
Statement of Department Goals and Objectives

ARS was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

The ARS mission is to conduct research to develop and transfer solutions to agricultural problems of high national priority and to 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.

ARS has strategic goals, management initiatives, objectives, performance measures, and targets that contribute to the Department's Strategic Goals. Not all of ARS' performance measures and targets are shown here.

USDA Strategic Goal: Ensure Our National Forests and Private Working Lands Are Conserved, Restored, and Made More Resilient to Climate Change, While Enhancing Our Water Resources.

Agency Strategic Goals	Agency Objectives	Programs that Contribute	Key Outcomes
Agency Goal Area 2: Natural Resources and Sustainable Agricultural Systems	Objective 2.1: Integrated, effective, and safe water resource management.	Water Availability and Watershed Management	Key Outcome 2.1: Safe, abundant, and reliable water resources.
	Objective 2.2: Improve quality of atmosphere and soil resources, and understand effects of climate change.	Climate Change, Soils, and Emissions Research	Key Outcome 2.2: Enhanced crop production and improved environmental quality.
	Objective 2.4: Manage and use manure and other agricultural and industrial byproducts in ways that maximize their benefits while protecting the environment and human/animal health.	Agricultural and Industrial Byproducts	Key Outcome 2,4: Manure reduction and development of beneficial uses of agricultural, industrial, and municipal byproducts.
	Objective 2.5: Develop/transfer economically viable and environmentally sustainable production and conservation practices, technologies, plant materials, and integrated management strategies that conserve/enhance	Pasture, Forage, and Rangeland Systems	Key Outcome 2.5: Range, pasture, hay, and turf land management systems that enhance economic viability and environmental services.

Agency Strategic Goals	Agency Objectives	Programs that Contribute	Key Outcomes
	natural resources on range, pasture, hay, and turf lands.		
	Objective 2.6: Develop integrated solutions to solve challenges related to agricultural system productivity, profitability, energy efficiency, and natural resource stewardship.	Agricultural System Competitiveness and Sustainability	Key Outcome 2.6: Reduction of production costs and economic risks, and enhanced environmental benefits.

Key Targets:

- Management practices/technologies which reduce gaseous emissions for agricultural operations.
- Scientific information for planning and managing carbon storage in soil.

Key Performance Measures:

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

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Developed one technology or decision tool to predict carbon sequestration in the soil. •Developed one management practice or control technology to reduce emissions from agricultural operations. •Reduced risks to agricultural production/ ecosystem services from interacting climate-related stresses.	•Developed one technology or decision tool to predict carbon sequestration in the soil. •Developed one management practice or control technology to reduce emissions from agricultural operations. •Reduced risks to agricultural production/ ecosystem services from interacting climate-related stresses.	•Developed one technology or decision tool to predict carbon sequestration in the soil. •Reduced risks to agricultural production/ ecosystem services from interacting climate-related stresses. •Adapted agricultural systems to climate variability and weather extremes.	• Develop one technology or decision tool to predict carbon sequestration in the soil. •Reduce risks to agricultural production and ecosystem services from interacting climate-related stresses. •Adapt agricultural systems to climate variability and weather extremes. •Reduce agriculture's vulnerability to climate change.	•Develop one technology or decision tool to predict carbon sequestration in the soil. •Reduce risks to agricultural production and ecosystem services from interacting climate-related stresses. •Develop technologies/ practices to adapt agricultural systems to climate variability and weather extremes.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Developed methods to genotypically/ phenotypically characterize large numbers of crop species and varieties in collections to develop high yielding and profitable crops. •Adapted agricultural systems to climate variability and weather extremes. •Advanced the capacity for assessing the impacts of climate and environment on food, feed, and fiber production.	•Developed methods to genotypically/ phenotypically characterize large numbers of crop species and varieties in collections to develop high yielding and profitable crops. •Adapted agricultural systems to climate variability and weather extremes. •Advanced the capacity for assessing the impacts of climate and environment on food, feed, and fiber production.	•Advanced the capacity for assessing the impacts of climate and environment on food, feed, and fiber production.	• Develop and deploy common standards for data formats and common vocabulary/ontologies that support germplasm (G), environmtal (E), and management (M) data integration, thus enabling the generation of computational models for plant and animal production that integrate genotype, environmental, and production factors into the adaptation of agriculture to climate change. • Develop and apply database mining and data integration methods to combine high volumes of ecogeographical and agroclimatic information from GIS databases with trait and genotypic data in GRIN-Global. This will accelerate the prediction, identification and delivery to crop improvement programs of germplasm with specific adaptations/tolerances to abiotic stresses, such as drought and heat.	•Reduce agriculture's vulnerability to climate change.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
			• Expand and integrate research teams of breeders, bioinformaticists, geneticists, genebank curators, and modelers to support the breeding climate resilient crops and livestock.	

Environmental Stewardship

Selected Past Accomplishments toward Achievement of the Key Outcome

- Developed a satellite-based drought system, the Evaporative Stress Index that provides an early warning of flash droughts and deteriorating crop and moisture conditions.
- Validated NASA's satellite-based rainfall estimates using long-term data from ARS' experimental watersheds.
- Assessed the feasibility and sustainability of bioenergy crop production from perennial grasses in the eastern and central United States.
- Developed a method to rapidly and inexpensively determine the total plant available nitrogen in soils, thereby reducing the amount of fertilizer applied and the environmental impacts from excess fertilizer applications.
- Made greenhouse gas flux, soil, vegetation, and other data accessible and publicly available.
- Found that applications of manure compost plus a gypsum byproduct and fertilizers provided an effective vegetative cover of clover and grasses to a barren 300 acre abandoned asbestos mining superfund site in Vermont.
- Found that the use of gas permeable membranes captured and recovered ammonia in poultry houses, providing cleaner air inside poultry houses, reduced ventilation costs, reduced ammonia volatilization, and a concentrated liquid ammonium salt that can be utilized as fertilizer.
- Developed the ARS Air Scrubber, which uses acids to bind the volatile and aerosol compounds, reducing the amount of ammonia, bacteria, dust, and odors from air exhausted from animal rearing facilities by as much as 70 percent.
- Developed a genetic selection approach for tall fescue and rye grass that provides forage breeders with breeding technologies similar to those used to increase the yield and adaptability of corn and other commodity crops.
- Developed a low cost, rapid DNA-based paternity testing laboratory assay for alfalfa. This new technology doubles the amount of genetic information available to alfalfa breeders enabling them to target and select specific genetic lines that will increase yields.
- Released "Liberty," a new lowland type switchgrass cultivar. It is the first bioenergy type cultivar for the Midwest and northern Great Plains.
- Assessed the growing of alyssum with organic romaine lettuce and identified a novel intercropping pattern that allowed farmers to grow lettuce and alyssum without displacing any lettuce. The intercropping provides food for beneficial insects that are natural enemies of aphids on lettuce.
- Found that soil solarization combined with natural product biofumigants provide a quick and effective method to reduce *E.coli* contamination in high value produce cropping soils.
- Found that oat and rye cover crops are viable management options for reducing nitrate losses from corn and soybean production, reducing nitrate levels in the Mississippi River basin.

Selected Accomplishments Expected at the 2015 Proposed Resource Level

- Develop tools and technologies to improve agricultural water management.
- Improve the scientific understanding of erosion, sedimentation, and containment transport processes from agricultural fields and landscapes to facilitate the development of tools and technologies to better protect agricultural water quality.
- Develop strategies to improve the effectiveness of agricultural conservation efforts.
- Conduct research to improve watershed management and ecosystem services in agricultural landscapes.
- Develop one technology or decision tool to predict carbon sequestration in the soil.
- Reduce risks to agricultural production/ecosystem services from interacting climate-related stresses.
- Develop one cost effective practice or strategy to restore degraded range lands.
- Develop one method or strategy to measure and monitor pasture and range land health.
- Develop technologies/practices to adapt agricultural systems to climate variability and weather extremes.
- Sustain agricultural production capacity for food and energy security and ecosystems services over long periods at landscape scale.
- Develop integrated programs to increase the sustainability of food animal and crop production systems.
- Reduce agriculture's vulnerability to climate change.

USDA Strategic Goal: Help America Promote Agricultural Production and Biotechnology Exports as America Works to Increase Food Security.

Agency Strategic Goals	Agency Objectives	Programs that Contribute	Key Outcomes
Agency Goal Area 3: Crop Production and Protection	Objective 3.1: Enhance the crop genetic resource base; increase knowledge of crop genes, genomes, and biological processes/ systems; and deliver technologies that improve production quality, health, and value of the Nation's crops.	Plant Genetic Resources, Genomics, and Genetic Improvement Crop Production	Key Outcome 3.1: Information and technology producers can use to compete more economically in the marketplace.
Agency Goal Area 4: Animal Production and Protection	Objective 4.1: Provide scientific information and biotechnologies to enhance management practices that will ensure an abundant supply of competitively priced animal/aquaculture products.	Food Animal Production Aquaculture	Key Outcome 4.1: Information and technology producers can use to compete more economically in the marketplace.
	Objective 4.2: Prevention/control of pests and animal diseases that pose a threat to agriculture, public health, and well-being of Americans.	Animal Health Veterinary, Medical, and Urban Entomology	Key Outcome 4.2: The knowledge the Nation needs for a secure agricultural production system and healthy food supply.

Key Targets:

- Healthier/more efficient agricultural crops and animals.
- Important genetic resources which have been identified and preserved.
- New/expanded markets for improved agricultural products.

Key Performance Measures:

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 Nation's crops.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Applied new genomic tools to accelerate genetic improvement of 'specialty crops' for superior product quality. •Deployed new breeding strategies or genetic engineering methods based on knowledge of gene function and expression to enhance the effectiveness of crop improvement programs. •Maintained and expanded USDA germplasm collections in a healthy, secure, and easily accessible form. •Distributed germplasm for research purposes. •Increased crop genetic resource regeneration, and safeguard collection.	•Applied new genomic tools to accelerate genetic improvement of 'specialty crops' for superior product quality. •Deployed new breeding strategies or genetic engineering methods based on knowledge of gene function and expression to enhance the effectiveness of crop improvement programs. •Maintained and expanded USDA germplasm collections in a healthy, secure, and easily accessible form. •Distributed germplasm for research purposes. •Increased crop genetic resource regeneration, and safeguard collection.	•Applied new genomic tools to accelerate genetic improvement of 'specialty crops' for superior product quality. •Deployed new breeding strategies or genetic engineering methods based on knowledge of gene function and expression to enhance the effectiveness of crop improvement programs. •Maintained and expanded USDA germplasm collections in a healthy, secure, and easily accessible form. •Distributed germplasm for research purposes. •Increased crop genetic resource regeneration, and safeguard collection.	•Apply new genomic tools to accelerate genetic improvement of 'specialty crops' for superior product quality. •Deploy new breeding strategies or genetic engineering methods based on knowledge of gene function and expression to enhance the effectiveness of crop improvement programs. •Maintain and expand USDA germplasm collections in a healthy, secure, and easily accessible form. •Distribute germplasm for research purposes. •Increase crop genetic resource regeneration, and safeguard collection.	•Develop leading edge genomic technologies, and breed superior new crops, varieties, and enhanced germplasm and genetic resources. •Devise innovative approaches to crop genetic improvement and trait analysis. •Expand crop genomic information resources and advanced bioinformatic capabilities. •Expand fundamental knowledge of plant biological and molecular processes. •Maintain and expand USDA germplasm collections in a healthy, secure, and easily accessible form.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Secured more wild relatives of crops in gene banks. •Expanded collections of crop genetic stocks key to genomic research. •Expanded the capacity for high value crop trait evaluation and marker analyses to rapidly identify key genes. •Developed more productive, disease free floricultural and nursery crops. •Applied a computer decision support system for crop and animal production that reduces production risks/losses. •Applied biocontrol technologies to crop plants to enhance disease resistance. •Developed sustainable crop production systems. •Developed plant varieties and ecologically-based soil/plant management strategies.	•Secured more wild relatives of crops in gene banks. •Expanded collections of crop genetic stocks key to genomic research. •Expanded the capacity for high value crop trait evaluation and marker analyses to rapidly identify key genes. •Developed more productive, disease free floricultural and nursery crops. •Applied a computer decision support system for crop and animal production that reduces production risks/losses. •Applied biocontrol technologies to crop plants to enhance disease resistance. •Developed sustainable crop production systems. •Developed plant varieties and ecologically-based soil/plant management strategies.	•Secured more wild relatives of crops in gene banks. •Expanded collections of crop genetic stocks key to genomic research. •Expanded the capacity for high value crop trait evaluation and marker analyses to rapidly identify key genes. •Developed more productive, disease free floricultural and nursery crops. •Applied a computer decision support system for crop and animal production that reduces production risks/losses. •Applied biocontrol technologies to crop plants to enhance disease resistance. •Developed plant varieties and ecologically-based soil/plant management strategies.	•Secure more wild relatives of crops in gene banks. •Expand collections of crop genetic stocks key to genomic research. •Expand the capacity for high value crop trait evaluation marker analyses to identify key genes. •Research maize, other cereals, and perennial grasses to provide better data analysis to accelerate crop yields, feed, and bioenergy. •Research tree fruit vegetable, and food legume crops to provide enhanced data analysis to improve yield, nutrition, quality. •Improve sustaina-bility of crop production systems. •Apply a computer decision support system for crop and animal production that reduces production risks/losses. •Apply biocontrol technologies to crop plants to enhance disease resistance.	•Increase crop genetic resource regeneration and safeguard collection. •Distribute germplasm for research purposes. •Evaluate and characterize germplasm of wild relatives of crops to facilitate its use in crop breeding and research. •Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency. •Integrate crop cultivars, management strategies for abiotic and biotic stresses, and mechanization technologies into improved, productive, profitable, and environmentally acceptable crop production systems. •Advance translational breeding including classical and genomics enabled breeding.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
			•Develop plant varieties and ecologically-based soil/plant management strategies.	

Key Performance Measures:

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

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Continued to increase stored germplasm resources and increase use of National Animal Germplasm Program. •Increased the number of populations with adequate germplasm stores to enable reconstitution if necessary. •Developed improved semen extenders and artificial insemination methodologies. •Used the completed chicken, cattle, and swine genome sequences to identify genes impacting efficiency of nutrient utilization and adaptation to the production environment.	•Continued to increase stored germplasm resources and increase use of National Animal Germplasm Program. •Increased the number of populations with adequate germplasm stores to enable reconstitution if necessary. •Developed improved semen extenders and artificial insemination methodologies. •Used the completed chicken, cattle, and swine genome sequences to identify genes impacting efficiency of nutrient utilization and adaptation to the production environment.	•Continued to increase stored germplasm resources and increase use of National Animal Germplasm Program. •Increased the number of populations with adequate germplasm stores to enable reconstitution if necessary. •Developed improved semen extenders and artificial insemination methodologies. •Used the completed chicken, cattle, and swine genome sequences to identify genes impacting efficiency of nutrient utilization and adaptation to the production environment.	•Continue to increase stored germplasm resources and increase use of National Animal Germplasm Program. •Increase the number of populations with adequate germplasm stores to enable reconstitution if necessary. •Develop improved semen extenders and artificial insemination methodologies. •Use the completed chicken, cattle, and swine genome sequences to identify genes impacting efficiency of nutrient utilization and adaptation to the production environment.	•Continue to increase stored germplasm resources and increase use of the National Animal Germplasm Program. •Increase the number of populations with adequate germplasm stores to enable reconstitution if necessary. •Develop improved semen extenders and artificial insemination methodologies. •Use the completed chicken, cattle, sheep, goat, poultry, and swine genome sequences to identify genes impacting efficiency of nutrient utilization and adaptation to the production environment.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Developed reduced Single Nucleotide Polymorphism chips to target specific livestock breeds and a particular suite of traits. •Increased depth of sequence coverage in key genomic regions to identify causative mutations. •Used metagenomics to identify microbial genes and microbial pathways affecting feed efficiency, animal health, and odor emissions in animal production. •Developed genome sequence resources for catfish, rainbow trout, sheep, and turkey. •Expanded the capacity for high value animal trait evaluation and marker analyses to rapidly identify key genes. •Developed integrated production systems that incorporate enhanced germplasm and pest/pathogen/ water/nutrient management strategies to optimize sustainable animal production.	•Developed reduced Single Nucleotide Polymorphism chips to target specific livestock breeds and a particular suite of traits. •Increased depth of sequence coverage in key genomic regions to identify causative mutations. •Used metagenomics to identify microbial genes and microbial pathways affecting feed efficiency, animal health, and odor emissions in animal production. •Developed genome sequence resources for catfish, rainbow trout, sheep, and turkey. •Expanded the capacity for high value animal trait evaluation and marker analyses to rapidly identify key genes. •Developed integrated production systems that incorporate enhanced germplasm and pest/pathogen/ water/nutrient management strategies to optimize sustainable animal production.	•Developed reduced Single Nucleotide Polymorphism chips to target specific livestock breeds and a particular suite of traits. •Increased depth of sequence coverage in key genomic regions to identify causative mutations. •Used metagenomics to identify microbial genes and microbial pathways affecting feed efficiency, animal health, and odor emissions in animal production. •Developed genome sequence resources for catfish, rainbow trout, sheep, and turkey. •Expanded the capacity for high value animal trait evaluation and marker analyses to rapidly identify key genes. •Developed integrated production systems that incorporate enhanced germplasm and pest/pathogen/ water/nutrient management strategies to optimize sustainable animal production.	•Develop reduced SNP chips to target specific livestock breeds and a particular suite of traits. •Increase depth of sequence coverage in key genomic regions to identify causative mutations. •Use metagenomics to identify microbial genes and microbial pathways affecting feed efficiency, animal health, and odor emissions in animal production. •Develop genome sequence resources for catfish, rainbow trout, sheep, and turkey. •Expand the capacity for high value animal trait evaluation and marker analyses to rapidly identify key genes. •Develop integrated production systems that incorporate enhanced germplasm and pest/pathogen/ water/nutrient management strategies to optimize sustainable animal production. •Use data to achieve improved feed efficiency and reduced	•Develop specific genome array technologies to target specific livestock industry needs for a particular suite of traits. •Increase depth of sequence coverage in key genomic regions to identify causative mutations. •Use metagenomics to identify microbial genes and microbial pathways affecting feed efficiency, animal health, and odor emissions in animal production. •Develop genome sequence resources for catfish and rainbow trout. •Expand the capacity for high value animal trait evaluation and marker analyses to rapidly identify key genes. •Develop integrated production systems that incorporate enhanced germplasm and pest/pathogen/ water/nutrient management strategies to optimize sustainable animal production. •Use data and develop technologies to

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Enhanced livestock production.	•Enhanced livestock production.	•Enhanced livestock production.	antimicrobial resistance in livestock.	achieve improved health, feed efficiency, and reduced antimicrobial resistance in livestock. •Improve the efficiency and productivity of ruminant grazing systems through nationally and regionally coordinated collaborative research initiatives. •Advance translational breeding including classical and genomics enabled breeding.

Crop Production

Selected Past Accomplishments toward Achievement of the Key Outcome

- Developed "Sunpreme" raisins which dry themselves eliminating the costly post-harvesting process of tray drying in the field.
- Developed a novel micrografting technique that results in high survival rates of citrus germplasm maintained by cryopreservation. This new technique provides an effective means for safeguarding invaluable citrus germplasm, and serves as a new pathogen elimination method for producing disease free citrus propagating material.
- Discovered genes for drought tolerance in the common bean. This research will enhance marker assisted breeding to develop drought tolerant beans by seed companies.
- Mapped more than 40,000 single nucleotide polymorphism DNA markers to specific chromosomal locations on the soybean genome to facilitate identifying genes that control traits of interest.
- Completed an inventory of U.S. flora that contains more than 4,600 different types of crop wild relatives and wild species that could be exploited for food, forage, medicinal, ornamental, and industrial applications.
- Identified novel sorghum mutants that might significantly increase sorghum grain yield.
- Identified nematode genes as candidates for developing partial resistance against the nematode and root-knot nematode.
- Released the "Flavorfest" strawberry that is resistant to plant and fruit rot anthracnose, has a similar season to the current leading variety, and delivers up to a two-fold higher yield of large berries with excellent flavor and creamy texture.
- Developed more than 500,000 single nucleotide polymorphism genetic markers and genotyped 2,700 inbred lines, broadening the genetic diversity of U.S. corn.
- Developed a new barley variety, "Mesa," with high levels of inherent resistance to the wheat aphid.

- Developed a tool that helps growers assess and reduce the environmental impacts of wine grape production.
- Devised a treatment schedule to control Varroa mites in honey bee colonies.
- Determined that gasified rice hull biochar, a commercially abundant byproduct from the processing of rice, contains a high concentration of phosphorus and potassium, and as such, has the potential to serve as an alternative source in commercial potting substrates for greenhouse and nursery crops.

Selected Accomplishments Expected at the 2015 Proposed Resource Level

- Develop leading edge genomic technologies, and breed superior new crops, varieties, and enhanced germplasm and genetic resources.
- Devise innovative approaches to crop genetic improvement and trait analysis.
- Expand genomic information resources and advanced bioinformatic capabilities.
- Expand fundamental knowledge of plant biological and molecular processes.
- Evaluate and characterize germplasm of wild relatives of crops to facilitate its use in crop breeding and research.
- Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.
- Increase crop cultivars, and management strategies for abiotic and biotic stresses, and mechanization technologies into improved, productive, profitable, and environmentally acceptable crop production systems.
- Advance translational breeding including classical and genomics enabled breeding.
- Maintain and expand USDA germplasm collections in a healthy, secure, and easily accessible form.
- Distribute germplasm for research purposes.
- Increase crop genetic resource regeneration and safeguard collection.

Livestock Production

Selected Past Accomplishments toward Achievement of the Key Outcome

- Developed international genomic evaluations for young dairy bulls, providing access to a much larger genetic pool and increasing the rate of genetic progress for dairy production worldwide.
- Identified engineered antimicrobial proteins that eradicate staphylococcal mastitis pathogens. This technology presents a novel alternative mastitis treatment to effectively treat and potentially eliminate bovine mastitis and significantly reduce the need for conventional antibiotic use.
- Developed a new semen storage technology that will save turkey producers time and money in reproducing flocks.
- Demonstrated the ability to leverage the bovine genome sequence to improve the reproductive efficiency in beef cattle while reducing technology costs.
- Demonstrated an effective alternative, lysozyme, to traditional antibiotics in swine diets for improved health, well-being, growth, and efficiency.
- Confirmed that heifers that calve early in their first season remain in the production herd longer, increasing the profitability and viability of a beef production enterprise.
- Released genetic information for inherited defeats of dairy cattle which will provide the tools for dairy producers to decrease the frequency of undesired traits, and increase the rate of genetic progress for desired traits through improvements in reproductive efficiency, health, and animal well-being.
- Determined that freezing, then thawing and aging beef resulted in significant improvement in meat tenderness for the toughest cuts in a beef carcass.
- Developed a method to increase production of healthy omega-3 fatty acids in rainbow trout.
- Demonstrated that kaolinitic clay is a novel, non-antibiotic treatment which protects catfish from columnaris disease.
- Developed a bacterial cold water disease resistant rainbow trout line in farm trials.
- Developed an improved aerator for the catfish industry.

Selected Accomplishments Expected at the 2015 Proposed Resource Level

- Increase stored germplasm resources and increase use of National Animal Germplasm Program.
- Increase the number of populations with adequate germplasm stores to enable reconstitution if necessary.
- Develop improved semen extenders and artificial insemination methodologies.
- Use the completed chicken, cattle, and swine genome sequences to identify genes impacting efficiency of nutrient utilization and adaptation to the production environment.
- Develop specific genome array technologies to target specific livestock needs for a particular suite of traits.
- Increase depth of sequence coverage in key genomic regions to identify causative mutations.
- Use metagenomics to identify microbial genes and microbial pathways affecting feed efficiency, animal health, and odor emissions in animal production.
- Develop genome sequence resources for catfish and rainbow trout.
- Expand the capacity for high value animal trait evaluation and marker analyses to rapidly identify key genes.
- Develop integrated production systems that incorporate enhanced germplasm and pest/pathogen/water/nutrient management strategies to optimize sustainable animal production.
- Use data and develop technologies to achieve improved health, feed efficiency, and reduced antimicrobial resistance in livestock.
- Improve the efficiency and productivity of ruminant grazing systems through nationally and regionally coordinated collaborative research initiatives.
- Advance translational breeding including classical and genomics enabled breeding.

USDA Strategic Goal: Ensure that All of America's Children Have Access to Safe, Nutritious, and Balanced Meals.

Agency Strategic Goals	Agency Objectives	Programs that Contribute	Key Outcomes
Agency Goal Area 1: Nutrition, Food Safety, and Quality	Objective 1.1: Enable Americans to make health promoting, science-based dietary choices.	Human Nutrition	Key Outcome 1.1: Eating habits more consistent with the *Dietary Guidelines for Americans*.
	Objective 1.2: Protect food from pathogens, toxins, and chemical contamination during production, processing, and preparation.	Food Safety	Key Outcome 1.2: Reduction in foodborne illness associated with the consumption of meat, poultry, and egg products.
Agency Goal Area 2: Natural Resources and Sustainable Agricultural Systems	Objective 2.4: Use manure and other agricultural and industrial byproducts that maximize their benefits while protecting the environment and human/animal health.	Agricultural and Industrial Byproducts	Key Outcome 2.4: Manure reduction and development of beneficial uses of agricultural, industrial, and municipal byproducts.

Agency Strategic Goals	Agency Objectives	Programs that Contribute	Key Outcomes
Agency Goal Area 3: Crop Production and Protection	Objective 3.1: Enhance the crop genetic resource base; increase knowledge of crop genes, genomes, and biological processes/ systems; and deliver technologies that improve production, quality, health, and value of the Nation's crops.	Plant Genetic Resources, Genomics, and Genetic Improvement Crop Production	Key Outcome 3.1: Information and technology producers can use to compete more economically in the marketplace.
	Objective 3.2: Protect the Nation's crops.	Plant Diseases Crop Protection and Quarantine Methyl Bromide Alternatives	Key Outcome 3.2: The knowledge the Nation needs for a secure agricultural production system and healthy food supply.
Agency Goal Area 4: Animal Production and Protection	Objective 4.2: Prevent/ control pest and animal diseases that pose a threat to agriculture, public health, and the well-being of Americans.	Animal Health Veterinary, Medical, and Urban Entomology	Key Outcome 4.2: The knowledge the Nation needs for a secure agricultural production system and healthy food supply.

Key Targets:

- Intervention strategies which reduce pathogens in animals used for food.
- New methodologies for detecting microorganisms/chemicals affecting food safety.

Key Performance Measures:

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

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Used population systems to understand the interrelationships of microorganisms in food environments, and the interrelationships among host, pathogen, and environment. •Used systems biology to understand the basic genetic components of pathogens, their expression, and directly relate this information to the microorganisms's biology and its potential effect on food safety. •Developed rapid systems to detect food pathogens that may enter through raw materials, contamination during processing, or retail to protect public health. •Developed production and processing intervention systems that may control, mitigate, or reduce biological and chemical contaminants in foods.	•Used population systems to understand the interrelationships of microorganisms in food environments, and the interrelationships among host, pathogen, and environment. •Used systems biology to understand the basic genetic components of pathogens, their expression, and directly relate this information to the microorganisms's biology and its potential effect on food safety. •Developed rapid systems to detect food pathogens that may enter through raw materials, contamination during processing, or retail to protect public health. •Developed production and processing intervention systems that may control, mitigate, or reduce biological and chemical contaminants in foods.	•Used population systems to understand the interrelationships of microorganisms in food environments, and the interrela-tionships among host, pathogen, and environment. •Used systems biology to understand the basic genetic components of pathogens, their expression, and directly relate this information to the microorganisms's biology and its potential effect on food safety. •Developed rapid systems to detect food pathogens that may enter through raw materials, contamination during processing, or retail to protect public health. •Developed production and processing intervention systems that may control, mitigate, or reduce biological and chemical contaminants in foods.	•Use population systems to understand the interrelationships of microorganisms in food environ-ments, and the interrelationships among host, pathogen, and environment. •Use systems biology to understand the basic genetic components of pathogens, their expression, and directly relate this information to the microorganisms's biology and its potential effect on food safety. •Develop rapid systems to detect food pathogens that may enter through raw materials, contamination during processing, or retail to protect public health. •Develop production and processing intervention systems that may control, mitigate, or reduce biological and chemical contaminants in foods.	•Examine the genetics of pathogens, relating this to the microorganism's biology, the interrelationships in food environments, and among the host, pathogen, and environment. •Develop technologies to detect foodborne pathogens, toxins, and chemical contaminants that may enter the food chain. •Utilize genomic technologies to identify and characterize foodborne pathogens. •Develop production and processing intervention systems that control, mitigate, or reduce biological and chemical contaminants in foods. •Develop technologies to predict the behavior of microorganisms in foods that may be used to support food safety measures and risk assessment.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Developed methods and models to predict the behavior of microorganisms in foods and may be use to support food safety measures and risk assessment. •Developed rapid systems to detect toxins and chemical contaminants to protect human health and the environment. • Developed and validate: two lab-based multi-platform contaminant detection technologies for the highest priority pathogens, toxins, and chemical residues; two multi-task on/in-line (in field) inspection technologies (for all size processors) that detect contaminants and changes in attributes at required line speeds; three detection methods for mycotoxins in foods to be used by CDC for public health outbreaks and for use in developing countries. • Developed five science-based management practices to prevent preharvest	•Developed methods and models to predict the behavior of microorganisms in foods and may be use to support food safety measures and risk assessment. •Developed rapid systems to detect toxins and chemical contaminants to protect human health and the environment. • Developed and validate: two lab-based multi-platform contaminant detection technologies for the highest priority pathogens, toxins, and chemical residues; two multi-task on/in-line (in field) inspection technologies (for all size processors) that detect contaminants and changes in attributes at required line speeds; three detection methods for mycotoxins in foods to be used by CDC for public health outbreaks and for use in develop-ing countries. • Developed five science-based management practices to prevent preharvest	•Developed methods and models to predict the behavior of microorganisms in foods and may be use to support food safety measures and risk assessment. •Developed rapid systems to detect toxins and chemical contaminants to protect human health and the environment. •Developed and validated two lab-based multi-platform contaminant detection technologies for the highest priority pathogens, toxins, and chemical residues; and two multi-task on/in-line (in field) inspection technologies (for all size processors) that detect contaminants and changes in attributes at required line speeds. • Developed three science-based management practices to prevent preharvest contamination of produce, by enteric pathogens, and implemented three intervention strategies to eliminate pathogen contamination: the control and	•Develop methods and models to predict the behavior of microorganisms in foods and may be use to support food safety measures and risk assessment. •Develop rapid systems to detect toxins and chemical contaminants to protect human health and the environment. •Evaluate the role of alternatives to antibiotics. •Identify/evaluate specific intervention strategies through the food production chain. •Control antimicrobial resistance in foodborne pathogens. •Develop/utilize emerging next generation sequencing technologies and molecular methods for identifying/ characterizing strain differences, virulence, and pathogenicity mechanisms, and host-pathogen interactions for fresh produce and animal-related foodborne pathogens.	•Examine the development of antimicrobial resistance in foodborne pathogens. •Evaluate the role of alternatives to antibiotics.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
contamination of produce, by enteric pathogens, and implement three intervention strategies to eliminate pathogen contamination: the control and prediction of the fate and transport of pathogens will be determined by specific tools developed; the role of the environment and animals in the prevalence, diversity, and quantity, and survival of pathogens in crops will be determined by specific analytic and field approaches; the specific pathogens and the effect of reduction strategies will be measured. • Developed five innovative processing intervention strategies to assure and maintain postharvest safety and quality. The effect of food processing technologies on overall reduction of pathogens at the end of production is estimated through various studies/ approaches.	contamination of produce, by enteric pathogens, and implement three intervention strategies to eliminate pathogen contamination: the control and prediction of the fate and transport of pathogens will be determined by specific tools developed; the role of the environment and animals in the prevalence, diversity, and quantity, and survival of pathogens in crops will be determined by specific analytic and field approaches; the specific pathogens and the effect of reduction strategies will be measured. • Developed five innovative processing intervention strategies to assure and maintain postharvest safety and quality. The effect of food processing technologies on overall reduction of pathogens at the end of production is estimated through various studies.	prediction of the fate and transport of pathogens was determined by specific tools developed; the role of the environment and animals in the prevalence, diversity, and quantity, and survival of pathogens in crops was determined by specific analytic and field approaches; the specific pathogens and the effect of reduction strategies was measured. • Developed three innovative processing intervention strategies to assure and maintain postharvest safety and quality. The effect of food processing technologies on overall reduction of pathogens at the end of production was estimated through various studies/approaches. •Evaluated the role of alternatives to antibiotics. •Identified/ evaluated specific intervention strategies through the food production chain.		

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
		•Controlled antimicrobial resistance in foodborne pathogens. •Developed/utilized emerging next generation sequencing technologies and molecular methods for identifying/ characterizing strain differences, virulence, and pathogenicity mechanisms, and host-pathogen interactions for fresh produce and animal-related foodborne pathogens.		

Food Safety

Selected Past Accomplishments toward Achievement of the Key Outcome

- Developed a radio frequency (RF) energy process that eliminates 99.999 percent of *Salmonella* that may be present in eggs. The RF process is significantly faster than the current pasteurization process.
- Developed a screening method for fluoroquinolone residues used in veterinary medicine reducing the chances of the transfer of antibiotic microbial resistance.
- Found that antibiotic treatment of cattle in feedlots does not increase the prevalence of antibiotic resistant *E. coli*.
- Found that growing rice aerobically rather than via traditional flood culture can substantially lower grain arsenic levels.
- Found the use of antibiotic dietary supplements enhances the persistence of *E. coli*, and that it represents a risk factor where animal and crop production are geographically intertwined.
- Developed the portable BARDOT sensor instrument which is able to identify pathogenic bacteria including *E. coli*, Salmonella, and Listeria. Use of the instrument greatly improves the response detection time for foodborne illness outbreaks because it can be taken to the source.
- Developed a Raman chemical imaging system for detecting multiple adulterants in dry skim milk powder.
- Developed an integrated pathogen modeling program/tool that can be used by scientists and students to predict microbial shelf life and risk in food.
- Developed bacteriophage-based intervention treatments that kill *Vibrio tubiashii*, a bacterium that is responsible for larval shellfish mortality.

Selected Accomplishments Expected at the 2015 Proposed Resource Level

- Examine the genetics of pathogens, relating this to the microorganism's biology, the interrelationships in food environments, and among the host, pathogen, and environment.
- Develop production and processing intervention systems that may control, mitigate, or reduce biological and chemical contaminants in foods.
- Develop technologies to detect foodborne pathogens, toxins, and chemical contaminants that may enter the food chain.
- Utilize genomic technologies to identify and characterize foodborne pathogens.
- Evaluate the role of alternatives to antibiotics.
- Examine the development of antimicrobial resistance in foodborne pathogens.
- Develop technologies to predict the behavior of microorganisms in foods that may be used to support food safety measures and risk assessments.

Key Targets:
- New diagnostic tests for economically important animal diseases.
- New vaccines for priority animal diseases.
- Improved management/control of emerging animal diseases.
- Genetic lives of animals which are more disease resistant.

Key Performance Measures:

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.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Identified/ characterized gene functions/ mechanisms responsible for disease-resistance traits. •Implemented an integrated emerging disease research program in pathogenesis, diagnostics, and intervention. •Implemented a technology driven vaccinology research program for control and eradication of biological threat agents.	•Identified/ characterized gene functions/ mechanisms responsible for disease-resistance traits. •Implemented an integrated emerging disease research program in pathogenesis, diagnostics, and intervention. •Implemented a technology driven vaccinology research program for control and eradication of biological threat agents.	•Identified/ characterized gene functions/ mechanisms responsible for disease-resistance traits. •Implemented an integrated emerging disease research program in pathogenesis, diagnostics, and intervention. •Implemented a technology driven vaccinology research program for control and eradication of biological threat agents.	•Identify/ characterize gene functions/ mechanisms responsible for disease-resistance traits. •Implement an integrated emerging disease research program in pathogenesis, diagnostics, and intervention. •Implement a technology driven vaccinology research program for control and eradication of biological threat agents.	•Identify/ characterize gene functions/ mechanisms responsible for disease resistance traits. •Discover genetic profiles that convey protective immunity against infectious diseases/parasites. •Implement a technology driven vaccinology research program for control and eradication of biological threat agents.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
•Discovered genetic profiles that convey protective immunity against infectious diseases/parasites. •Developed control programs for invasive drug resistant nematodes and protozoa. •Modeled the distribution of white-tailed deer and exotic ungulates in Southern Texas in order to be able to target measures to re-eradicate the cattle fever tick. •Refined medicated baits and self treatment devices as tools for treatment of ticks on white-tailed deer, providing practical tools for eradicating the cattle fever tick. •Transformed experimental screwworm flies in Panama using technology developed to create a male-only strain. •Developed waterproof fire and ant baits; characterize biological control agents. •Provided new information on host and pest/pathogen interaction to	•Discovered genetic profiles that convey protective immunity against infectious diseases/parasites. •Developed control programs for invasive drug resistant nematodes and protozoa. •Modeled the distribution of white-tailed deer and exotic ungulates in Southern Texas in order to be able to target measures to re-eradicate the cattle fever tick. •Refined medicated baits and self treatment devices as tools for treatment of ticks on white-tailed deer, providing practical tools for eradicating the cattle fever tick. •Transformed experimental screwworm flies in Panama using technology developed to create a male-only strain. •Developed waterproof fire and ant baits; characterize biological control agents. •Provided new information on host and pest/pathogen interaction to	•Discovered genetic profiles that convey protective immunity against infectious diseases/parasites. •Developed control programs for invasive drug resistant nematodes and protozoa. •Developed alternatives to antibiotics to prevent/treat pathogens affecting poultry health. •Selected vaccine candidates for prevention of cattle fever tick infestations. Continued basic research on deer immunology to develop anti-tick vaccines. Determined probable effects of climate change on distribution of livestock ticks. Determined associations of soft tick vectors of African swine fever and feral hogs. •Performed tests to achieve FDA licensing of ivermectin medicated bait block for cattle, eliminating the need to dip infected cattle every two weeks. Developed an experimental bait block for deer.	•Discover genetic profiles that convey protective immunity against infectious diseases/parasites. •Develop control programs for invasive drug resistant nematodes and protozoa. •Select vaccine candidates for prevention of cattle fever tick infestations. Continue basic research on deer immunology to develop anti-tick vaccines. Determine probable effects of climate change on distribution of livestock ticks. Determine associations of soft tick vectors of African swine fever and feral hogs. •Perform tests to achieve FDA licensing of ivermectin medicated bait block for cattle, eliminating the need to dip infested cattle every two weeks. Develop an experimental bait block for deer. •Continue to transform lines of screwworm flies with DNA insertions intended to create lethal, female-linked genes	•Continue to investigate the biology and genomics of important animal pathogens. •Continue to investigate the epidemiology and ecology of important animal pathogens. •Continue to form new partnerships and continue old partnerships with industry, universities, and other government agencies to promote production and marketing of inventions that protect animals from pathogens. •Implement an integrated emerging disease research program in pathogenesis, diagnostics, and intervention. •Develop control programs for invasive drug resistant nematodes, protozoa, and pests of livestock and poultry. •Develop alternatives to antibiotics to prevent/treat pathogens affecting poultry health.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
develop protective mechanisms. •Developed strategies to improve animal well-being.	develop protective mechanisms. •Developed strategies to improve animal well-being.	•Continued to transform lines of screwworm flies with DNA insertions intended to create lethal, female-linked genes that induce mortality. Evaluated nutritional requirements of screwworm flies to create diets with alternate ingredients. •Developed new and safer insecticides for treatment of livestock and public health pests. •Evaluated biological control of fire ants throughout the Southeastern U.S. •Developed tools for control of other invasive ants, including the Argentine ant and the Rasberry Crazy ant. •Determined specific physiology of vector-pathogen associations for viruses that affect livestock. •Identified cryptic species or populations of mosquitos that have different capabilities as vectors of pathogens.	that induce mortality. Evaluate nutritional requirements of screwworm flies to create diets with alternate ingredients. •Develop new and safer insecticides for treatment of livestock and public health pests. •Evaluate biological control of fire ants throughout the Southeastern U.S. •Develop tools for control of other invasive ants, including the Argentine ant and the Rasberry Crazy ant. •Determine specific physiology of vector-pathogen associations for viruses that affect livestock. •Identify cryptic species or populations of mosquitos that have different capabilities as vectors of pathogens. •Improve animal well-being, food safety, and animal health through development of tools for IPM of house and stable flies.	•Develop alternatives in farm animals to prevent/control animal diseases, reduce antibiotic resistance, and enhance livestock production. •Discover and develop new diagnostic platforms for priority animal diseases. •Improve integrated pest management of pests that affect the health and well-being of livestock, poultry, and humans. •Assess the risks associated with climate change as it affects pests that harm livestock, poultry, and humans.

2011 Actual	2012 Actual	2013 Actual	2014 Target	2015 Target
		•Improved animal well-being, food safety, and animal health through development and use of IPM tools on house/stable/horn flies.	•Develop alternatives to antibiotics to prevent/treat pathogens affecting poultry health. •Develop a Veterinary Insect Genomics Information Center. •Develop alternatives in farm animals to prevent/control animal diseases, reduce antibiotic resistance, and enhance livestock production. •Discover/develop new diagnostic platforms for priority animal diseases. •Discover/transfer new technologies for protection of animals/humans from biting arthropods. •Conduct research on countering biological threats.	

Livestock Protection

Selected Past Accomplishments toward Achievement of the Key Outcome

- Worked as part of a "Situational Awareness Coordination" team to understand the epidemiology of H7N9 infections among humans and animals in China, in response to an outbreak in March/April 2013.
- Produced a new "leaderless" Foot-and-Mouth Disease (FMD) vaccine which will enable the safe production of FMD vaccines and eliminate concerns that FMD vaccine viruses might escape from a manufacturing plant and cause an FMD outbreak.
- Developed a treatment regimen which eliminates *Theileria equi* from infected horses and removes the risk of the transmission of the pathogen to other horses.

- Developed an experimental vaccine that has been shown to be protective against brucellosis in feral swine. The vaccine shows promise in reducing the risk of *Brucella* transmission from feral swine to domestic livestock and humans.
- Isolated five virulent Newcastle disease virus strains which is critical to ensuring detection of emerging viruses from China that pose a threat to the U.S.
- Discovered new methods to improve insect repellents, including DEET, which may be more effective in preventing mosquito bites.
- Developed a new "gene silencing" technology which leads to safer mosquito control.
- Discovered viruses that can be used to reduce the fire ant population in the southeastern United States.
- Sequenced the genome of the cattle tick and identified anti-tick vaccine candidates that should provide an effective tool in the development of new tick pesticides.
- Developed a new synthetic carbamate insecticide for the control of horn, stable, and sand flies.
- Assessed the risk of Rift Valley Fever to the Nation's livestock and to the U.S. population.

Selected Accomplishments Expected at the 2015 Proposed Resource Level

- Identify and characterize gene functions/mechanisms responsible for disease resistance traits.
- Implement an integrated emerging disease research program in pathogenesis, diagnostics, and intervention.
- Implement a technology driven vaccinology research program for control and eradication of biological threat agents.
- Discover genetic profiles that convey protective immunity against infectious diseases/parasites.
- Develop control programs for invasive drug resistant nematodes, protozoa, and pests of livestock and poultry.
- Discover and develop new diagnostic platforms for priority animal diseases.
- Develop alternatives to antibiotics to prevent/treat pathogens affecting poultry health.
- Develop alternatives in farm animals to prevent/control animal diseases, reduce antibiotic resistance, and enhance livestock production.
- Improve integrated pest management of pests that affect the health and well-being of livestock, poultry, and humans.
- Assess the risks associated with climate change as it affects pests that harm livestock, poultry, and humans.

Strategic Goal Funding Matrix
(Dollars in thousands)

Program / Program Items	2012 Actual	2013 Actual	2014 Estimate	Inc. or Dec.	2015 Estimate
Department Strategic Goal: Assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving					
Product Quality/Value Added	$100,541	$93,102	$98,756	-$9,032	$89,724
Staff Years	759	682	734	-	734
Livestock Production	38,027	35,213	43,342	-1,726	41,616
Staff Years	208	188	202	-	202
Crop Production	127,495	117,475	108,875	+677	109,552
Staff Years	917	827	889	-	889
National Agricultural Library	20,919	20,691	23,791	+108	23,899
Staff Years	105	72	72	-	72
Repair and Maintenance	17,468	18,614	20,144	-	20,144
Staff Years	-	-	-	-	-
Decentralized GSA and DHS Security Payments	-	-	-	+4,670	4,670
Staff Years	-	-	-	-	-
Total Costs, Strategic Goal	304,450	285,095	294,908	-5,303	289,605
Total Staff Years, Strategic Goal	1,989	1,769	1,897	-	1,897
Department Strategic Goal: Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources					
Environmental Stewardship	189,034	175,047	200,819	-1,193	199,626
Staff Years	1,390	1,254	1,348	-	1,348
Total Costs, Strategic Goal	189,034	175,047	200,819	-1,193	199,626
Total Staff Years, Strategic Goal	1,390	1,254	1,348	-	1,348
Department Strategic Goal: Help America promote agricultural production and biotechnology exports as America works to increase food security					
Livestock Production	38,027	35,213	43,342	-1,726	41,616
Staff Years	208	188	202	-	202
Crop Production	101,512	93,304	106,792	+1,485	108,277
Staff Years	720	650	698	-	698
Total Costs, Strategic Goal	139,539	128,517	150,134	-241	149,893
Total Staff Years, Strategic Goal	928	838	900	-	900
Department Strategic Goal: Ensure that all of America's children have access to safe, nutritious, and balanced meals					
Food Safety	106,210	97,962	111,701	-1,799	109,902
Staff Years	783	783	783	-	783
Human Nutrition	85,438	80,328	86,328	+2,299	88,627
Staff Years	279	279	279	-	279
Livestock Protection	76,166	70,530	89,632	-2,561	87,071
Staff Years	456	411	442	-	442
Crop Protection	193,810	179,469	188,960	-9,281	179,679
Staff Years	1,161	1,047	1,124	-	1,124
Total Costs, Strategic Goal	461,624	428,289	476,621	-11,342	465,279
Total Staff Years, Strategic Goal	2,679	2,520	2,628	-	2,628
Total Costs, All Strategic Goals	1,094,647	1,016,948	1,122,482	-18,079	1,104,403
Total FTEs, All Strategic Goals	6,986	6,381	6,773	-	6,773

Full Cost by Department Strategic Goal
(Dollars in thousands)

Department Strategic Goal: Assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving

PROGRAM	PROGRAM ITEMS	FY 2012	FY 2013	FY 2014	FY 2015
	Direct Costs:				
	Research and Development	257,387	239,875	247,288	238,312
	Indirect Costs:				
	Program and Administrative/Financial Management	21,709	20,232	20,857	20,100
	USDA Central Charges	6,498	6,056	6,243	6,016
	Task Force, Advisory Committees, and Other Support Costs	392	365	376	363
	Total Indirect Costs	28,599	26,653	27,476	26,479
	Total Costs	**285,986**	**266,528**	**274,764**	**264,791**
	FTEs	1,989	1,769	1,897	1,897

Performance Measures:

Create new scientific knowledge and innovative technologies that represent scientific/technological advancements or breakthroughs applicable to bioenergy.

Develop cost effective, functional industrial and consumer products, including higher quality, healthy foods, that satisfy consumer demand in the United States and abroad.

Develop systems and technologies to reduce production costs and risks while enhancing natural resource quality.

Develop new technologies, tools, and information contributing to improved precision animal production systems to meet current and future food animal production needs of diversified consumers, while simultaneously minimizing the environmental footprint of production systems and enhancing animal well-being.

Expand, maintain, and protect our genetic resource base, increase our knowledge of genes, genomes, and biological processes, and provide economically and environmentally sound technologies that will improve the production efficiency, health, and value of the Nation's crops.

The services and collections of the National Agricultural Library continue to meet the needs of its customers.

The National Agricultural Library and partners implement the National Digital Library for Agriculture.

Priority buildings/facilities projects are completed on schedule and within budget.

Repair and Maintenance	17,319	17,762	20,144	20,144
Miscellaneous Fees	241	110	9,632	0
Decentralized GSA and Security Payments	0	0	0	4,670
FTEs	0	0	0	0
Total Costs for Department Strategic Goal 1 (program, direct, indirect)	**303,546**	**284,400**	**304,540**	**289,605**
FTEs	**1,989**	**1,769**	**1,897**	**1,897**

Department Strategic Goal: Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources

PROGRAM	PROGRAM ITEMS	FY 2012	FY 2013	FY 2014	FY 2015
	Direct Costs:				
	Research and Development	169,250	157,172	180,737	179,663
	Indirect Costs:				
	Program and Administrative/Financial Management	14,275	13,257	15,244	15,154
	USDA Central Charges	4,273	3,968	4,563	4,536
	Task Force, Advisory Committees, and Other Support Costs	258	239	275	273
	Total Indirect Costs	18,806	17,464	20,082	19,963
	Total Costs for Department Strategic Goal 2 (program, direct, indirect)	**188,056**	**174,636**	**200,819**	**199,626**
	FTEs	1,390	1,254	1,348	1,348

Performance Measures:

Develop technology and practices to reduce the delivery of agricultural pollutants by water on farms and ranches and quantify the environmental benefit of conservation practices in watersheds.

Develop practices and technologies to enhance soil resources and reduce emissions of particulate matter and gases from crop production lands, agricultural processing operations, and animal production systems.

Improved management practices and technologies for managing pasture and range lands to improve economic profitability and enhance environmental values.

Department Strategic Goal: Help America promote agricultural production and biotechnology exports as America works to increase food security

PROGRAM	PROGRAM ITEMS	FY 2012	FY 2013	FY 2014	FY 2015
	Direct Costs:				
	Research and Development	124,169	114,845	135,121	134,904
	Indirect Costs:				
	Program and Administrative/Financial Management	10,473	9,687	11,396	11,378
	USDA Central Charges	3,135	2,899	3,411	3,406
	Task Force, Advisory Committees, and Other Support Costs	189	175	206	205
	Total Indirect Costs	13,797	12,761	15,013	14,989
	Total Costs for Department Strategic Goal 3 (program, direct, indirect)	**137,966**	**127,606**	**150,134**	**149,893**
	FTEs	928	838	900	900

Performance Measures:

Develop systems and technologies to reduce production costs and risks while enhancing natural resource quality.

Develop new technologies, tools, and information contributing to improved precision animal production systems to meet current and future food animal production needs of diversified consumers, while simultaneously minimizing the environmental footprint of production systems and enhancing animal well-being.

Expand, maintain, and protect our genetic resource base, increase our knowledge of genes, genomes, and biological processes, and provide economically and environmentally sound technologies that will improve the production efficiency, health, and value of the Nation's crops.

Department Strategic Goal: Ensure that all of America's children have access to safe, nutritious, and balanced meals

PROGRAM	PROGRAM ITEMS	FY 2012	FY 2013	FY 2014	FY 2015
	Direct Costs:				
	Research and Development	414,204	384,933	428,959	418,751
	Indirect Costs:				
	Program and Administrative/Financial Management	34,936	32,467	36,180	35,320
	USDA Central Charges	10,456	9,717	10,829	10,571
	Task Force, Advisory Committees, and Other Support Costs	631	586	653	637
	Total Indirect Costs	46,023	42,770	47,662	46,528
	Total Costs for Department Strategic Goal 4 (program, direct, indirect)	**460,227**	**427,703**	**476,621**	**465,279**
	FTEs	2,679	2,520	2,628	2,628

Performance Measures:

Develop new technologies that assist ARS customers in detecting, identifying, and controlling foodborne diseases that affect human health.

Provide scientific information to protect animals, humans, and property from the negative effects of pests, infectious diseases, and other disease causing entities.

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.

Develop control strategies based on fundamental and applied research to reduce losses caused by plant diseases, nematodes, arthropods, and weeds that are effective and affordable while maintaining environmental quality. Develop technically and economically feasible alternatives to preplant and postharvest use of methyl bromide.

Provide needed scientific information and technology that is environmentally acceptable to producers of agriculturally important plants in support of exclusion, early detection and eradication, control, and monitoring of invasive arthropods, weeds, nematodes, and pathogens; enhanced sustainability; and restoration of affected areas. Conduct biologically-based integrated and area-wide management of key invasive species.

Provide environmentally sound fundamental and applied scientific information and technologies to action agencies, producers, exporters, and importers of commercially important plant and animal products in support of exclusion, early detection, and eradication of quarantine pests and pathogens that can impede foreign trade.

Monitor food consumption/intake patterns of Americans, including those of different ages, ethnicity, regions, and income levels, and measure nutrients and other beneficial components in the food supply. Provide the information in databases to enable ARS customers to evaluate the healthfulness of the American food supply and the nutrient content of the American diet.

Define the role of nutrients, foods, and dietary patterns in growth, maintenance of health, and prevention of obesity and other chronic diseases. Assess bioavailability and health benefits of food components. Conduct research that forms the basis for and evaluates nutrition standards and Federal dietary recommendations.

Publish research findings not encompassed under the other performance measures for this objective likely to significantly advance the knowledge of human nutrition, extensively influence other researchers in the same or related field, or yield important new directions for research.

Total Costs for all Department Strategic Goals (program, direct, indirect)		**1,089,795**	**1,014,345**	**1,132,114**	**1,104,403**
	FTEs	6,986	6,381	6,773	6,773
Total Costs for Buildings and Facilities		**0**	**0**	**0**	**0**
	FTEs	0	0	0	0
Grand Total Costs for all Department Strategic Goals		**1,089,795**	**1,014,345**	**1,132,114**	**1,104,403**
	FTEs	**6,986**	**6,381**	**6,773**	**6,773**