2018 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); Act of June 29, 1935 (7 U.S.C. 427); Agricultural Marketing Act of 1946, as amended (7 U.S.C. 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. 1281 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.

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 five 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, 2016, there were 5,522 permanent, full-time employees including 491 in the Headquarters offices and 5,031 in field offices.

OIG Reports (Completed)

02007-0001-31, 9/30/2016, U.S. Meat Animal Research Center Review.

02601-0001-21, 3/21/2016, Adequacy of Controls to Prevent the Release of Sensitive Technology.

50401-0009-11, 2/16/2016, Department of Agriculture's Consolidated Financial Statements for Fiscal Years 2015 and 2014.

50501-0008-12, 11/10/2015, Fiscal Year 2015 Federal Information Security Modernization Act.

50601-0001-12, 3/23/2016, Research, Education, and Economics' Compliance of Contractor Past Performance Reporting Requirements.

50601-0002-22, 2/24/2016, Department's Controls over Prioritization and Funding of Agricultural Research.

50601-0004-31, 3/30/2016, USDA's Response to Antibiotic Resistance.

OIG Reports (In Progress)

11601-0001-41, Departmental Oversight of Final Action on OIG Audit Recommendations.

50401-0011-11, Department of Agriculture's Consolidated Financial Statements for Fiscal Years 2016 and 2015.

50501-0010-12, USDA Continuous Diagnostics and Mitigation Oversight Project.

50501-0012-12, Fiscal Year 2016 Federal Information Security Management Act Audit.

50601-0006-31, Reviewing the Integrity of USDA's Scientific Research Program.

GAO Reports (Completed)

GAO-16-49, 11/30/2015, Aquatic Invasive Species: Additional Steps Could Help Measure Federal Progress in Achieving Strategic Goals.

GAO-16-122, 10/5/2015, Climate Change: HHS Could Take Further Steps to Enhance Understanding of Public Health Risks.

GAO-16-132, 12/15/2015, Emerging Animal Diseases: Actions Needed to Better Position USDA to Address Future Risks.

GAO-16-142, 12/21/2015, Foreign Assistance: USAID Venture Capital Approach Relies on Evidence of Results but Could Strengthen Collaboration among Similar Programs.

GAO-16-168, 3/15/2016, USDA Administrative Services: Streamlining Efforts Ongoing, but Actions Needed to Monitor Progress, Identify Benefits, and Share Lessons Learned.

GAO-16-220, 2/10/2016, Risks to Commercial and Native Honey Bee Populations and Related Federal Actions.

GAO-16-241, 3/15/2016, Genetically Engineered Crops: USDA Needs to Enhance Oversight and Better Understand Impacts of Unintended Mixing with Other Crops.

GAO-16-305, 3/21/2016, High-Containment Laboratories: Comprehensive and Up-to-Date Policies and Stronger Oversight Mechanisms Needed to Improve Safety.

GAO-16-468, 5/25/2016, Information Technology: Federal Agencies Need to Address Aging Legacy Systems.

GAO-16-474, 4/29/2016, Technology Assessment: Municipal Freshwater Scarcity: Using Technology to Improve Distribution System Efficiency and Tap Nontraditional Water Sources.

GAO-16-642, 8/30/2016, High-Containment Laboratories: Improved Oversight of Dangerous Pathogens Needed to Mitigate Risk.

GAO-16-648, 7/6/2016, Federal Real Property: Actions Needed to Enhance Information on and Coordination among Federal Entities with Leasing Authority.

GAO 16-667, 9/8/2016, Freedom of Information Act: Litigation Costs for Justice and Agencies Could Not Be Fully Determined.

GAO-16-669, 7/5/2016, U.S.-China Cooperation: Bilateral Clean Energy Programs Show Some Results but Should Enhance their Performance Monitoring.

GAO-16-768, 8/24/2016, Foreign Assistance: Actions Needed to Improve Transparency and Quality of Data on ForeignAssistance.gov.

100355, Food for Peace Implementation Costs.

361628, Federal Agencies' Requirements for Conducting Federally Funded Research.

GAO Reports (In Progress)

100182, Advanced Biofuels Research and Development.

100267, Federal Actions to Monitor and Control Antibiotic Resistance in Animals.

100294, Department of Agriculture's Process for Determining the Safety of Imported Beef from Countries with a History of Foot and Mouth Disease.

100303, Review of Foreign Assistance Monitoring Policies.

100340, Federal Funding for Harmful Algal Blooms Research.

100367, Federal Aviation Administration's Efforts to Address Issues Associated with Small Unmanned Aerial Systems.

100398, Sustainable Chemistry Technology Assessment.

100542, Seafood Safety.

100571, Biological Threat Characterization.

100668, Highly Pathogenic Avian Influenza.

100849, Federal Owned Aircraft.

100940, USDA's Standards to Control Pathogens in Meat and Poultry.

101016, High-Containment Laboratories: Comparative Oversight Models.

131349, Effectiveness and Coordination of Federal Programs Supporting U.S. Manufacturing.

361642, EPA Management of Annual Renewable Fuel Standard Volume Mandates.

451159, Federal Agencies Use of Enterprise Risk Management Leading Practices.

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

Item	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Salaries and Expenses:								
Discretionary Appropriations	$1,132,625	6,046	$1,143,825	5,970	$1,141,652	5,970	$993,144	5,296
Buildings and Facilities:								
Discretionary Appropriations	45,000	-	212,101	-	211,698	-	-	-
Rescission	-1,530	-	-	-	-	-	-	-
Transfers In	102	-	102	-	-	-	-	-
Adjusted Appropriation	1,176,197	6,046	1,356,028	5,970	1,353,350	5,970	993,144	5,296
Balance Available, SOY	13,220	-	57,735	-	263,554	-	303,873	-
Other Adjustments (Net)	11,030	-	9,193	-	-	-	-211,698 a/	-
Total Available	1,200,447	6,046	1,422,956	5,970	1,616,904	5,970	1,085,319	5,296
Lapsing Balances	-10,082	-	-7,331	-	-	-	-	-
Balance Available, EOY	-57,735	-	-263,554	-	-303,873	-	-13,075	-
Obligations	1,132,630	6,046	1,152,071	5,970	1,313,031	5,970	1,072,244	5,296
Obligations under other USDA appropriations:								
Animal & Plant Health Inspection Service	16,471	55	18,900	67	18,900	67	18,900	67
Economic Research Service	3,161	10	5,732	21	5,732	21	5,732	21
Food, Nutrition & Consumer Services	468	2	453	2	453	2	453	2
Food Safety & Inspection Service	2,617	9	3,771	14	3,771	14	3,771	14
Foreign Agricultural Service	1,103	4	745	3	745	3	745	3
Forest Service	5,839	19	1,412	5	1,412	5	1,412	5
Grain Inspection, Packers and Stockyard Administration	-	-	196	1	196	1	196	1
National Agricultural Statistics Servic	4,081	14	4,293	15	4,293	15	4,293	15
National Institute of Food and Agriculture	24,817	82	20,557	74	20,557	74	20,557	74
Natural Resources Conservation Service	3,988	13	3,607	13	3,607	13	3,607	13
Office of the Chief Financial Officer	989	3	-	-	-	-	-	-
Office of the Chief Economist	423	1	527	2	527	2	527	2
Utility and Recyclables	-	-	101	-	101	-	101	-
Misc., Other USDA Funds	305	1	416	2	416	2	416	2
Total, Other USDA	64,262	213	60,710	219	60,710	219	60,710	219
Total, Agriculture Appropriations	1,196,892	6,259	1,212,781	6,189	1,373,741	6,189	1,132,954	5,515
Other Federal Funds:								
Agency for International Development	6,802	23	9,013	32	9,013	32	9,013	32
Department of Defense	6,911	23	7,768	28	7,768	28	7,768	28
Department of Energy	886	3	1,338	5	1,338	5	1,338	5
Department of Health & Human Services	7,299	24	16,535	60	16,535	60	16,535	60
Department of Homeland Security	3,066	10	3,223	12	3,223	12	3,223	12
Department of State	2,482	8	326	1	326	1	326	1
Department of the Interior	3,160	11	2,712	10	2,712	10	2,712	10
Department of Treasury	136	1	136	1	136	1	136	1

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

Item	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Other Federal Funds: (continued)								
Environmental Protection Agency.....	343	1	537	2	537	2	537	2
Federal Emergency Management Agency	273	1	296	1	296	1	296	1
National Aeronautics & Space Administration.....	1,865	6	1,476	5	1,476	5	1,476	5
Misc., Other Federal Funds.....	4	-	1	-	1	-	1	-
Total, Other Federal.....	33,227	111	43,361	157	43,361	157	43,361	157
Non-Federal Funds:								
Agricultural Utilization Research Institute.....	100	-	-	-	-	-	-	-
Alabama, University of.....	247	1	281	1	281	1	281	1
Archbold Biological Research Station.....	-	-	115	-	115	-	115	-
Binational Agricultural Research & Development (BARD)...	333	1	173	1	173	1	173	1
Brigham Young University.....	119	-	-	-	-	-	-	-
California, State of.....	2,460	8	2,524	9	2,524	9	2,524	9
California, University of.....	2,003	7	1,293	5	1,293	5	1,293	5
Canola Council of Canada.....	103	-	-	-	-	-	-	-
Citrus Research and Development Foundation.....	1,974	7	2,140	8	2,140	8	2,140	8
Citrus Research Board.....	-	-	729	3	729	3	729	3
Colorado State University.....	-	-	140	-	140	-	140	-
Commodity Credit Corporation.....	150	-	189	1	189	1	189	1
Cornell University.....	1,092	4	856	3	856	3	856	3
Cotton Incorporated.....	1,023	3	1,128	4	1,128	4	1,128	4
Danforth Plant Science Center.....	182	1	-	-	-	-	-	-
Delaware, University of.....	386	1	113	-	113	-	113	-
Florida Citrus Packers Association.....	-	-	126	-	126	-	126	-
Florida, State of.....	472	2	1,311	5	1,311	5	1,311	5
Florida, University of.....	217	1	381	1	381	1	381	1
Georgia, University of.....	523	2	568	2	568	2	568	2
Idaho, State of.....	114	-	-	-	-	-	-	-
Idaho State University.....	198	1	246	1	246	1	246	1
Idaho, University of.....	-	-	159	-	159	-	159	-
Illinois, University of.....	641	2	446	2	446	2	446	2
Iowa State University.....	1,176	4	1,388	5	1,388	5	1,388	5
Kansas State University.....	316	1	995	4	995	4	995	4
Louisiana State University.....	215	1	232	1	232	1	232	1
Maine, University of.....	-	-	106	-	106	-	106	-
Maryland, University of.....	149	-	295	1	295	1	295	1
Massachusetts, University of.....	156	1	168	1	168	1	168	1
Michigan State University.....	567	2	819	3	819	3	819	3
Minnesota, State of.....	-	-	163	1	163	1	163	1
Minnesota, University of.....	240	1	343	1	343	1	343	1
Miscellaneous Collections.....	-	-	261	1	261	1	261	1
Mississippi Soybean Promotion.....	230	1	263	1	263	1	263	1

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

Item	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Non-Federal Funds: (continued)								
Mississippi State University	199	1	-	-	-	-	-	-
Missouri, University of	-	-	252	1	252	1	252	1
National Peanut Foundation	-	-	140	-	140	-	140	-
National Pork Board	257	1	230	1	230	1	230	1
Nebraska, University of	594	2	624	2	624	2	624	2
Neon, Inc	1,516	5	-	-	-	-	-	-
New Hampshire, University of	127	-	164	-	164	-	164	-
New Mexico Consortium	-	-	136	-	136	-	136	-
North Carolina State University	255	1	714	3	714	3	714	3
North Dakota State University	112	-	-	-	-	-	-	-
Ohio State University	308	1	325	1	325	1	325	1
Oklahoma State University	151	-	104	-	104	-	104	-
Oregon State University	111	-	-	-	-	-	-	-
Pennsylvania State University	273	1	202	1	202	1	202	1
Perdue University	183	1	215	1	215	1	215	1
Qualisoy Inc	537	2	-	-	-	-	-	-
Revocable Permits & Easements	1,361	5	565	2	565	2	565	2
Rutgers University	169	1	223	1	223	1	223	1
Sale of Animals & Personal Property (Proceeds)	11,185	37	11,808	42	11,808	42	11,808	42
South Florida Water Management District	878	3	289	1	289	1	289	1
Southern Illinois University	102	-	-	-	-	-	-	-
Southern Regional Aquaculture Center	126	-	-	-	-	-	-	-
Tennessee, University of	132	-	-	-	-	-	-	-
Tennessee A&M University	104	-	119	-	119	-	119	-
Texas Agrilife Research & Extension Center	164	1	131	-	131	-	131	-
United Sorghum Checkoff Program	133	-	133	-	133	-	133	-
United Soybean Board	4,952	16	5,202	19	5,202	19	5,202	19
Washington State University	206	1	232	1	232	1	232	1
Washington Tree Fruit Research Commission	460	2	487	2	487	2	487	2
Washington University School of Medicine	148	-	-	-	-	-	-	-
Wisconsin University	357	1	442	2	442	2	442	2
Misc., Non-Federal Funds	3,353	11	3,044	11	3,044	11	3,044	11
Total, Non-Federal Funds	43,839	145	43,732	156	43,732	156	43,732	156
Miscellaneous Contributed Funds:	29,750	121	25,991	85	25,991	85	25,991	85
Total, ARS	1,303,708	6,636	1,325,865	6,587	1,486,825	6,587	1,246,038	5,913

a/ Rescission of unobligated B&F balances

Permanent Positions by Grade and Staff Year Summary

Item	2015Actual			2016 Actual			2017 Estimate			2018 President's Budget		
	D.C.	Field	Total	D.C.	Field	Total	D.C.	Field	Total	D.C.	Field	Total
SES.....	12	20	32	12	20	32	12	20	32	12	20	32
GS/GM-15.....	50	681	731	49	703	752	49	703	752	35	625	660
GS/GM-14.....	59	558	617	64	524	588	64	524	588	46	466	512
GS/GM-13.....	127	347	474	129	329	458	129	329	458	93	293	386
GS-12.....	108	263	371	135	294	429	135	294	429	97	261	358
GS-11.....	61	531	592	49	528	577	49	528	577	35	470	505
GS-10.....	1	3	4	1	2	3	1	2	3	1	2	3
GS-9.....	53	924	977	50	939	989	50	939	989	36	835	871
GS-8.....	14	305	319	10	321	331	10	321	331	7	285	292
GS-7.....	52	581	633	50	576	626	50	576	626	36	512	548
GS-6.....	13	199	212	16	213	229	16	213	229	11	189	200
GS-5.....	13	125	138	10	139	149	10	139	149	7	124	131
GS-4.....	6	25	31	3	33	36	3	33	36	2	29	31
GS-3.....			0		25	25		25	25	0	22	22
GS-2.....			0		11	11		11	11	0	10	10
GS-1.....			0		6	6		6	6	0	6	6
Other Graded Positions.....	4	-	4	4	-	4	4	-	4	4	-	4
Ungraded Positions.....	-	449	449	-	470	470	-	470	470	-	470	470
Total Perm. Positions.....	573	5,011	5,584	582	5,133	5,715	582	5,133	5,715	422	4,619	5,041
Unfilled EOY..	82	93	175	91	102	193	91	102	193	91	102	193
Total Perm. Full-Time Employment, EOY.....	491	4,918	5,409	491	5,031	5,522	491	5,031	5,522	331	4,517	4,848
Staff Year Est..	520	6,116	6,636	502	6,085	6,587	502	6,085	6,587	342	5,571	5,913

Size, Composition and Cost of Motor Vehicle Fleet

The 2018 Budget Estimates propose the replacement of six passenger motor vehicles**.** These acquisitions will replace existing vehicles without increasing the 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						
FY2015	223	1,218	936	756	0	1	156	3,290	5,736
**Change	-3	-61	8	-32	0	1	4	-83	-429
FY2016	220	1,157	944	724	0	2	160	3,207	5,307
Change	0	0	0	0	0	0	0	0	159
FY2017	220	1,157	944	724	0	2	160	3,207	5,466
Change	0	0	0	0	0	0	0	0	177
FY2018	220	1,157	944	724	0	2	160	3,207	5,643

NOTES:

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

** Change is due to SIN corrects

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, [$1,143,825,000] $993,144,000: *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] $500,000, except for headhouses or greenhouses which shall each be limited to [$1,200,000] $1,500,0000, [and] except for 10 buildings to be constructed or improved at a cost not to exceed [$750,000] $1,100,000

1. each, and except for two buildings to be constructed at a cost not to exceed $3,000,000 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] $500,000, 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 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 [: *Provided further*, That of the appropriations hereunder, $57,192,000 may not be obligated until 30 days after the Secretary of Agriculture certifies in writing to the Committees on Appropriations of both Houses of Congress that the Agricultural Research Service has updated its animal care policies and that all Agricultural Research Service research facilities at which animal research is conducted have a fully functioning Institutional Animal Care and Use Committee, including all appropriate and necessary record keeping: *Provided further*, That such certification shall set forth in detail the factual basis for the certification and the Department's plan for ensuring these changes are maintained in the future: *Provided further*, That such certification shall be subject to prior consultation with the Committees on Appropriations of both Houses of Congress].

1. The first change in the language is for the purpose of amending the agency’s limitations on small buildings and to add a new small building authority limitation in the annual appropriations. The agency’s limitations on small buildings as authorized in the annual

appropriations for Salaries and Expenses have not been increased since 2001. Over the past 14 years, construction and building costs have increased substantially. The current limitations are no longer sufficient. The new proposed small building authority limitation would provide the agency additional flexibility to replace worn out and decrepit facilities with new, more efficient same size/purpose facilities. This authority will be used only where repair of existing structures/systems does not make sense and is not cost effective.

Lead-Off Tabular Statement

Salaries and Expenses

Budget Estimate, 2018	$993,144,000
2017 Annualized Continuing Resolution	1,141,652,000
Change in Appropriation	-148,508,000

Summary of Increases and Decreases
(Dollars in thousands)

	2015 Actual	2016 Change	2017 Change	2018 Change	2018 President's Budget
Discretionary Appropriations:					
Product Quality/Value Added	$100,156	+$800	-$192	-$29,692	$71,072
Livestock Production	86,859	-	-165	-11,359	75,335
Crop Production	215,166	+2,542	-414	-7,636	209,658
Food Safety	111,656	+134	-212	-9,106	102,472
Livestock Protection	90,632	+2,133	-177	-381	92,207
Crop Protection	191,413	+3,375	-370	-27,677	166,741
Human Nutrition	86,874	-	-164	-42,081	44,629
Environmental Stewardship	200,819	+2,216	-386	-13,667	188,982
National Agricultural Library	23,791	-	-45	-1,804	21,942
Repair and Maintenance	20,144	-	-38	-	20,106
Decentralized GSA and DHS Security Payments	5,115	-	-10	-5,105	-
Total Discretionary Appropriations	1,132,625	+11,200	-2,173	-148,508	993,144

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

Program	2015 Actual		2016 Actual		2017 Estimate		Inc. or Dec.		2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Salaries and Expenses										
Discretionary Appropriations:										
Product Quality/Value Added.....	$100,156	670	$100,956	659	$100,764	659	-$29,692 (1)	-133	$71,072	526
Livestock Production.....	86,859	425	86,859	417	86,694	417	-11,359 (2)	-54	75,335	363
Crop Production.....	215,166	1,250	217,708	1,233	217,294	1,233	-7,636 (3)	-50	209,658	1,183
Food Safety.....	111,656	659	111,790	659	111,578	659	-9,106 (4)	-44	102,472	615
Livestock Protection.....	90,632	440	92,765	436	92,588	436	-381 (5)	-8	92,207	428
Crop Protection.....	191,413	1,030	194,788	1,017	194,418	1,017	-27,677 (6)	-132	166,741	885
Human Nutrition.....	86,874	235	86,874	235	86,710	235	-42,081 (7)	-179	44,629	56
Environmental Stewardship.....	200,819	1,245	203,035	1,222	202,649	1,222	-13,667 (8)	-74	188,982	1,148
National Agricultural Library.....	23,791	92	23,791	92	23,746	92	-1,804 (9)	-	21,942	92
Repair and Maintenance.....	20,144	-	20,144	-	20,106	-	-	-	20,106	-
Decentralized GSA and DHS Security Payments.....	5,115	-	5,115	-	5,105	-	-5,105 (10)	-	-	-
Subtotal.....	1,132,625	6,046	1,143,825	5,970	1,141,652	5,970	-148,508	-674	993,144	5,296
Funds included for Homeland Security.....	(36,861)	-	(37,863)	-	(37,791)	-	(-2,063)	-	(35,728)	-
Total Adjusted Approp.....	1,132,625	6,046	1,143,825	5,970	1,141,652	5,970	-148,508	-674	993,144	5,296
Transfers In:										
Cong. Relations.....	102	-	102	-	-	-	-	-	-	-
Total.....	102	-	102	-	-	-	-	-	-	-
Bal. Available, SOY.....	11,690	-	13,680	-	14,889	-	-14,889	-	-	-
Other Adjustments (Net).....	10,937	-	9,063	-	-	-	-	-	-	-
Total Available.....	1,155,354	6,046	1,166,670	5,970	1,156,541	5,970	-163,397	-674	993,144	5,296
Lapsing Balances.....	-10,082	-	-7,331	-	-	-	-	-	-	-
Bal. Available, EOY.....	-13,680	-	-14,889	-	-	-	-	-	-	-
Total Obligations.....	1,131,592	6,046	1,144,450	5,970	1,156,541	5,970	-163,397	-674	993,144	5,296
Staff Years:										
Direct		6,046		5,970		5,970		-674		5,296
Other		590		617		617		-		617
Total, Staff Year Estimate		6,636		6,587		6,587		-674		5,913

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

Program	2015 Actual		2016 Actual		2017 Estimate		Inc. or Dec.		FY 2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Salaries and Expenses										
Discretionary Obligations:										
Product Quality/Value Added…	$99,958	670	$100,805	659	$100,764	659	-$29,692 (1)	-133	$71,072	526
Livestock Production……	86,688	425	86,729	417	86,694	417	-11,359 (2)	-54	75,335	363
Crop Production……	214,741	1,250	217,381	1,233	217,294	1,233	-7,636 (3)	-50	209,658	1,183
Food Safety……	111,656	659	111,790	659	111,578	659	-9,106 (4)	-44	102,472	615
Livestock Protection……	90,453	440	92,626	436	92,588	436	-381 (5)	-8	92,207	428
Crop Protection……	191,035	1,030	194,496	1,017	194,418	1,017	-27,677 (6)	-132	166,741	885
Human Nutrition……	86,874	235	86,874	235	86,710	235	-42,081 (7)	-179	44,629	56
Environmental Stewardship….	200,423	1,245	202,730	1,222	202,649	1,222	-13,667 (8)	-74	188,982	1,148
National Agricultural Library…	23,441	92	23,292	92	23,746	92	-1,804 (9)	-	21,942	92
Repair and Maintenance……	20,144	-	20,144	-	20,106	-	-	-	20,106	-
Decentralized GSA and DHS Security Payments……	5,115	-	5,115	-	5,105	-	-5,105 (10)	-	-	-
Subtotal	1,130,528	6,046	1,141,982	5,970	1,141,652	5,970	-148,508	-674	993,144	5,296
Funds included for Homeland Security	(36,861)	-	(37,923)	-	(37,791)	-	(-2,063)	-	(35,728)	-
Misc. Fees/Supplementals	1,064	-	2,468	-	14,889	-	-	-	-	-
Subtotal	1,064	-	2,468	-	14,889	-	-14,889	-	-	-
Total Obligations	1,131,592	6,046	1,144,450	5,970	1,156,541	5,970	-163,397	-674	993,144	5,296
Lapsing Balances	10,082	-	7,331	-	-	-	-	-	-	-
Bal. Available, EOY	13,680	-	14,889	-	-	-	-		-	-
Total Available	1,155,354	6,046	1,166,670	5,970	1,156,541	5,970	-163,397	-674	993,144	5,296
Transfers In	-102	-	-102	-	-	-	-	-	-	-
Bal. Available, SOY	-11,690	-	-13,680	0	-14,889	0	+14,889	-	-	-
Other Adjustments (Net)	-10,937	-	-9,063	0	-	0	-	-	-	-
Total Appropriation	1,132,625	6,046	1,143,825	5,970	1,141,652	5,970	-148,508	-674	993,144	5,296
Staff Years:										
Direct		6,046		5,970		5,970		-674		5,296
Other		590		617		617		-		617
Total, Staff Year Estimate		6,636		6,587		6,587		-674		5,913

Justification of Increases and Decreases

The President's 2018 Budget requests for ARS' Salaries and Expenses account $993 million, a decrease of $148.5 million from the Agency's 2017 Annualized Continuing Resolution budget level. Specifically, ARS' 2018 budget includes $161.5 million in program reductions of $141.3 million in decreases from ongoing research projects, and $20.2 million in decreases from extramural research projects. These reductions will include the closure of 17 ARS laboratories/locations/worksites. The costs associated with the relocation or separation of 674 employees impacted by the closures, and the disposal of related property is estimated to range from $50 to $70 million. ARS' 2018 budget also includes an increase of $13 million for employee pay costs. The Agency is not requesting funding under its Buildings and Facilities account.

ARS provides research support to other USDA agencies that require new science information and technologies to deliver their results to the public. ARS also partners with and supports the science needs of external Federal agencies as well as State and local governments. In addition, ARS supports the science needs of a broad array of private sector customers -- producers, businesses, nongovernmental organizations, and trade organizations -- to enable them to further develop and/or apply improved technologies to advance U.S. and global food and agricultural systems. These partnerships are designed to augment research programs, expedite the transfer of research results to the private sector, exchange information and knowledge, stimulate new business and economic development, enhance U.S. trade, preserve the environment, and improve the quality of life for all Americans.

ARS continuously reviews its operating and program activities in order to make the Agency more efficient and effective. In the past year, ARS utilized the "Lean Six Sigma" process to streamline its internal research reporting, resulting in an estimated reduction from 22,300 to 6,300 staff hours, and an annual cost reduction from $1.3 million to $350,000 -- a total annual savings of 16,000 staff hours for $950,000. This follows other recent Lean Six Sigma improvements which have streamlined and improved the effectiveness of ARS' Annual Resource Management Plans and its extramural agreements processes. ARS has also been making more of its activities "virtual," including the external panels which retrospectively review the Agency's National Programs, eliminating the travel and lodging costs of hosting the panels at headquarters in Beltsville, Maryland. The National Program retrospective assessments themselves ensure that the research conducted by the Agency is both efficient and effective. Conducted every five years for each of ARS' 17 National Programs, these assessments involve internal and external reviews of the research activities. Research that is determined to not be producing desired results often is reallocated to other research priorities.

New Products/Product Quality/Value Added

(1) A decrease of $29,692,000 and a reduction of 133 staff years ($100,764,000 and 659 staff years available in 2017).

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 for domestic and foreign markets; and providing higher quality, healthy foods that satisfy consumer needs in the United States and abroad.

The funding change is requested for the following items:

a. An increase of $1,448,000 for pay costs ($381,000 for annualization of the 2017 pay increase and $1,067,000 for the 2018 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.

b. An increase of $450,000 for GSA Rent and DHS Security Payments.

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

c. A decrease of $31,590,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

IL, Peoria - Technologies for Improving Process Efficiencies in Biomass Refineries (-$1,495,000)
IL, Peoria - Develop Technologies for Production of Platform Chemicals and Advanced Biofuels from Lignocellulosic Feedstocks (-$1,424,000)
IL, Peoria - Biochemical Technologies to Enable the Commercial Production of Biofuels from Lignocellulosic Biomass (-$926,000)
IL, Peoria - Industrial Monomers and Polymers from Plant Oils (-$1,247,000)
IL, Peoria - New Biobased Products and Improved Biochemical Processes for the Biorefining Industry (-$1,480,000)
IL, Peoria - Value-added Bio-oil Products and Processes (-$1,561,000)
IL, Peoria - Renewable Biobased Particles (-$1,826,000)
IL, Peoria - Conversion of Polysaccharides and Other Bio-based Materials to High-Value, Commercial Products (-$1,564,000)
IL, Peoria - Improved Utilization of Proteinaceous Crop Co-Products (-$1,071,000)
IL, Peoria - Improved Utilization of Low-Value Oilseed Press Cakes and Pulses for Health-Promoting Food Ingredients and Biobased Products (-$981,000)
IL, Peoria - Evaluation of the Chemical and Physical Properties of Low-Value Agricultural Crops and Products to Enhance Their Use and Value (-$1,589,000)
IL, Peoria - Improving Quality, Stability, and Functionality of Oils and Bioactive Lipids (-$1,311,000)
IL, Peoria - Innovative Processing Technologies for Creating Functional Food Ingredients with Health Benefits from Food Grains, their Processing Products, and By-products (-$926,000)
IL, Peoria - Replacement of Petroleum Products Utilizing Off-Season Rotational Crops (-$1,561,000)
IL, Peoria - Coordinated Analysis of Soybean Breeding Germplasm (-185,000)
IL, Peoria - Technologies for Producing Renewable Bioproducts (-$1,364,000)
IL, Peoria - Technologies for Producing Biobased Chemicals (-$1,594,000)
IL, Peoria - New Ovicidal Microbial Agents for the Biological Control of Mosquitoes (-$478,000)
MD, Beltsville - Forest Products Research (-$3,500,000)
MS, Oxford - Natural Products (-$2,606,000)
MS, Stoneville - Cotton Ginning Research to Improve Processing Efficiency and Product Quality in the Saw-Ginning of Picker-Harvested Cotton (-1,465,000)
PA, Wyndmoor - Improving the Quality of Animal Hides, Reducing Environmental Impacts of Hide Production, and Developing Value-Added Products from Wool (-$1,436,000)

Livestock Production

(2) A decrease of $11,359,000 and a reduction of 54 staff years ($86,694,000 and 417 staff years available in 2017).

ARS' Livestock Production research program is heavily focused on the development and application of genomics 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, and increasing reproductive rates and breeding animal longevity.

The funding change is requested for the following items:

a. An increase of $975,000 for pay costs ($242,000 for annualization of the 2017 pay increase and $733,000 for the 2018 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.

b. An increase of $490,000 for GSA Rent and DHS Security Payments.

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

c. A decrease of $12,824,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

AR, Stuttgart - Developing Nutritional, Genetic, and Management Strategies to Enhance Warmwater Finfish Production (-$2,395,000)
AR, Stuttgart - The Role of Mucosal Surfaces and Microflora in Immunity and Disease Prevention (-$1,212,000)
ID, Aberdeen - Aquaculture Systems - Rainbow Trout – Univ. of ID (-$321,000)
ID, Dubois - Improving the Efficiency of Sheep Production in Western Rangeland Production Systems (-$1,668,000)
KY, Lexington - Improved Forage Livestock Production (-$540,000)
MD, Beltsville - Bovine Genetics (-$216,000)
MT, Miles City - Alleviating Rate Limiting Factors that Compromise Beef Production Efficiency (-$2,429,000)
OR, Corvallis - Determine Genetic Diversity and Develop Tools for Genetic Improvement of Oyster Stocks for the Pacific Northwest (-$364,000)
WI, Madison - Combating Viral Hemorrhagic Septicemia and Improving Yellow Perch Aquaculture for the Great Lakes Region (-$1,479,000)
WV, Leetown - Aquaculture Systems - Rainbow Trout – Univ. of CT (-$441,000)
WV, Leetown - Aquaculture Research - Coldwater Aquaculture (-$1,759,000)

Crop Production

(3) A decrease of $7,636,000 and a reduction of 50 staff years ($217,294,000 and 1,233 staff years available in 2017).

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 funding change is requested for the following items:

a. An increase of $2,701,000 for pay costs ($711,000 for annualization of the 2017 pay increase and $1,990,000 for the 2018 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.

b. An increase of $1,328,000 for GSA Rent and DHS Security Payments.

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

c. A decrease of $11,665,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

FL, Miami - Genetic Characterization, Genetic Improvement, and Best Horticultural Management Practices for Subtropical/Tropical Ornamental Germplasm (-$1,168,000)
FL, Miami - Conservation, Genetic Analyses, and Utilization of Subtropical/Tropical Fruit Crops, Sugarcane, and Miscanthus Genetic Resources (-$1,225,000)
FL, Miami - Genetic Improvement of Cacao Through Genomics-Assisted Breeding (-$1,376,000)
HI, Hilo - Tropical Crops Research (-$401,000)
IA, Ames - Michael Fields Agricultural Institute (-$172,000)
IA, Ames - Bioinformatics Institute for Model Plants (-$593,000)
IL, Peoria - Genomic Analyses and Management of Agricultural and Industrial Microbial Genetic Resources and Associated Information (-$670,000)
LA, Houma - Integrated Crop, Soil, and Water Management Systems for Sustainable Production of Sugarcane for Bioenergy Feedstock (-$305,000)
LA, Houma - New Crop and Soil Management Systems to Improve Sugarcane Production Efficiency (-$847,000)
LA, Houma - Genetic Improvement of Sugarcane for Temperate Climates (-$1,411,000)
MD, Beltsville - Information Transfer - Genetic Resources (-$48,000)
MD, Beltsville - Staffing and Operation for National Clonal Repositories for Plant Germplasm (-$52,000)
MD, Beltsville - Evaluation of Germplasm of Horticultural and Sugarcrops (-$278,000)
MD, Beltsville - Cocoa, Coffee, and Alternative Crops Research (-$494,000)
MN, Morris - Enhancing Cropping System Sustainability Through New Crops and Management Strategies (-$651,000)
MO, Columbia - Mid-West/Mid-South Irrigation (-$51,000)
MS, Stoneville - Kenaf and Medicinal Plants (-$489,000)
MS, Stoneville - Agricultural Genomics (-$699,000)
OH, Wooster - Greenhouse and Hydroponics (-$222,000)
OR, Corvallis – Hops (-$85,000)
SD, Brookings - Soil and Crop Management for Enhanced Soil Health, Resilient Cropping Systems, and Sustainable Agriculture in the Northern Great Plains (-$428,000)

Food Safety

(4) A decrease of $9,106,000 and a reduction of 44 staff years ($111,578,000 and 659 staff years available in 2017).

ARS' Food Safety research program 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.

The funding change is requested for the following items:

a. An increase of $1,302,000 for pay costs ($360,000 for annualization of the 2017 pay increase and $942,000 for the 2018 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.

b. A decrease of $10,408,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

AR, Booneville – Agroforestry (-$111,000)
IL, Peoria - Understanding the Role of Commensal Anaerobic Bacteria in Odor, Emissions, and Antibiotic Resistance from Stored Livestock Manure (-$48,000)
IL, Peoria - Identification and Validation of Insect and Disease Resistance Mechanisms to Reduce Mycotoxin Production in Midwest Corn (-$735,000)
IL, Peoria - Improved Analytical Technologies for Detection of Foodborne Toxins and their Metabolites (-$1,117,000)
IL, Peoria - Genomic and Metabolomic Approaches for Detection and Control of Fusarium, Fumonisins and Other Mycotoxins on Corn (-$2,651,000)
IL, Peoria - Novel Methods for Controlling Trichothecene Contamination of Grain and Improving the Climate Resilience of Food Safety and Security Programs (-$2,830,000)
KY, Bowling Green - Waste Management (-$243,000)
MS, Stoneville - Center for Food Safety and Postharvest Technology (-$985,000)
PA, Wyndmoor - Food Safety Engineering (-$1,688,000)

Livestock Protection

(5) A decrease of $381,000 and a reduction of 8 staff years ($92,588,000 and 436 staff years available in 2017).

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. Emphasis is given to methods and procedures to control animal diseases through the discovery and development of diagnostics, vaccines, biotherapeutics, animal genomics applications, disease management systems, animal disease models, and farm biosecurity measures.

The funding change is requested for the following items:

a. An increase of $950,000 for pay costs ($250,000 for annualization of the 2017 pay increase and $700,000 for the 2018 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.

b. An increase of $584,000 for GSA Rent and DHS Security Payments.

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

c. A decrease of $1,915,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

MD, Beltsville - Emerging Animal Diseases that Exist Offshore (-$199,000)
MD, Beltsville - Microbial Ecology of Antimicrobial Resistance (-$500,000)
MD, Beltsville - Develop Alternatives to Antibiotics for Priority Diseases in Animal Agriculture (-$500,000)
MS, Stoneville - Red Imported Fire Ants - MS State Univ. (-$215,000)
MS, Stoneville - Red Imported Fire Ants – Univ. of MS (-$501,000)

Crop Protection

(6) A decrease of $27,677,000 and a reduction of 132 staff years ($194,418,000 and 1,017 staff years available in 2017).

ARS' Crop Protection research program is directed at protecting crops from insect and disease loss. The research is designed to improving our knowledge and understanding of the ecology, physiology, epidemiology, and molecular biology of emerging diseases and pests. This knowledge is incorporated into pest risk assessments and management strategies to minimize chemical inputs and increase production.

The funding change is requested for the following items:

a. An increase of $2,224,000 for pay costs ($586,000 for annualization of the 2017 pay increase and $1,638,000 for the 2018 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.

b. An increase of $1,056,000 for GSA Rent and DHS Security Payments.

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

c. A decrease of $30,957,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities,

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) carried out by other research institutions.

CA, Salinas - Minor Use Pesticide Testing on Vegetables and Sugar Crops (-$222,000)
FL, Gainesville - Biological Control and Ag. Research (-$49,000)
FL, Miami - Methyl Bromide Replacement: Mitigation of the Invasive Pest Threat from the American Tropics and Subtropics (-$1,317,000)
GA, Tifton - Nematode, Disease, Weed, and Mite Control on Minor Food Crops and Ornamentals (-$243,000)
GA, Tifton - Magnitude of the Residue Analyses in Minor Crops from Experimental Applications of Pesticides (-$725,000)
HI, Hilo - U.S. Pacific Basin Ag Research – Univ. of HI (Manoa) (-$158,000)
HI, Hilo - U.S. Pacific Basin Ag Research – Univ. of HI (Hilo) (-$158,000)
HI, Hilo - Fruit Fly Eradication (-$151,000)
HI, Hilo - Minor Crop Pest Control (-$187,000)
HI, Hilo - Papaya Ringspot (-$196,000)
IL, Peoria - Use of Microorganisms to Manage Weeds and Insect Pests in Turf and Agricultural Systems (-$461,000)
IL, Peoria - Biocontrol Agent Production and Deployment Technologies for the Integrated Management of Plant Pathogens (-$1,066,000)
IL, Peoria - Development of Production and Formulation Technologies for Microbial Biopesticides in Conjunction with the Development of Attractants and Repellents for Invasive Insect Pests (-$1,088,000)
IL, Urbana - Minor Use Weed Management (-$15,000)
IN, Lafayette - Oat Virus (-$65,000)
LA, Houma - Effective Disease Management through Enhancement of Resistant Sugarcane (-$393,000)
LA, Houma - Integrated Weed and Insect Pest Management Systems for Sustainable Sugarcane Production (-$731,000)
MD, Beltsville - Wheat Stripe Rust Initiative (-$200,000)
MD, Beltsville - Coordination Activities for Research to Register Minor Use of Pesticides (-$306,000)
MD, Beltsville - Minor Use Pesticides Umbrella Project (-$336,000)
MD, Beltsville - National Plant Diseases Recovery System (-$1,384,000)
MD, Beltsville - Small Fruit and Nursery Research (-$1,071,000)
MD, Beltsville - Potato Research (-$1,342,000)
MD, Beltsville - Floriculture and Nursery Research Initiative (-$2,681,000)
MD, Beltsville - Fusarium Head Blight of Wheat and Barley (-$5,590,000)
MD, Beltsville - Area-Wide Management of Agricultural Pests (-$5,246,000)
MO, Columbia - Insect Biotechnology Products for Pest Control and Emerging Needs in Agriculture (-$1,735,000)
MS, Stoneville - Cropping Systems Research (-$120,000)
MS, Stoneville - Cotton Genomics and Breeding (-$272,000)
NY, Ithaca - Golden Nematode (-$207,000)
NY, Ithaca - Pear Thrips (Knapweed) (-$39,000)
OH, Wooster - Minor Use Pesticide-Food/Ornamentals (-$230,000)
OH, Wooster - Residue Analysis of Minor Use Pesticides (-$601,000)
OR,Corvallis - Minor Use Pesticide Testing on Floral and Nursery Crops (-$140,000)
SC, Charleston - Pesticide Trials in Vegetables and Ornamental Crops to Support the IR-4 Program (-$169,000)
SD, Brookings - Productive Cropping Systems Based on Ecological Principles of Pest Management (-$1,879,000)
WA, Wapato - Field Testing of Minor Use Pesticides (-$184,000)

Human Nutrition

(7) A decrease of $42,081,000 and a reduction of 179 staff years ($86,710,000 and 235 staff years available in 2017).

Maintenance of health throughout the lifespan along with prevention of obesity and chronic diseases are the major emphases of ARS' Human Nutrition research program. The research focuses on nutrition monitoring; providing the scientific basis for dietary recommendations; prevention of obesity and related diseases; and life stage nutrition and metabolism.

The funding change is requested for the following items:

a. An increase of $488,000 for pay costs ($129,000 for annualization of the 2017 pay increase and $359,000 for the 2018 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.

b. A decrease of $42,569,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

AR, Little Rock - Impact of Early Dietary Factors on Child Development and Health (-$8,374,000)
MA, Boston - Rural Aging Study (-$186,000)
MA, Boston - Plant Components and Aging (-$1,169,000)
MA, Boston - Nutrients, Aging, and Musculoskeletal Function (-$1,549,000)
MA, Boston - Nutritional Epidemiology (-$712,000)
MA, Boston - Genomics, Nutrition, and Health (-$1,257,000)
MA, Boston - Vision, Aging, and Nutrition (-$904,000)
MA, Boston - One Carbon Nutrients and Metabolism (-$655,000)
MA, Boston - Sarcopenia, Nutrition, and Physical Activity (-$1,083,000)
MA, Boston - Energy Regulation and Obesity (-$2,141,000)
MA, Boston - Immunity, Inflammation, and Nutrition in Aging (-$1,701,000)
MA, Boston - Cardiovascular Nutrition and Health (-$1,365,000)
MA, Boston - Cancer Prevention via Diet (-$1,381,000)
MA, Boston - Nutrition, Brain, and Aging (-$1,788,000)
MD, Beltsville - Healthy Eating and Lifestyle for Total Health (HEALTH) (-$3,914,000)
TX, Houston - Nutritional Metabolism in Mothers, Infants, and Children (-$2,902,000)
TX, Houston - Molecular, Cellular, and Regulatory Aspects of Nutrition during Development (-$2,737,000)
TX, Houston - Pediatric Clinical Nutrition (-$2,417,000)
TX, Houston - Childhood Obesity Prevention (-$3,105,000)
TX, Houston - Developmental Determinants of Obesity in Infants and Children (-$3,229,000)

Environmental Stewardship

(8) A decrease of $13,667,000 and a reduction of 74 staff years ($202,649,000 and 1,222 staff years available in 2017).

ARS' Environmental Stewardship research program emphasis is on developing technologies and systems that support sustainable production and enhance the Nation's vast renewable natural resource base. Specifically, the research program focuses on managing and improving water quality/quantity, air quality, and soil quality; on responding to global climate change; on conserving and restoring the Nation's range lands and pasture ecosystems/agroecosystems; and on developing whole system management strategies which reduce production costs and risks.

The funding change is requested for the following items:

a. An increase of $2,691,000 for pay costs ($709,000 for annualization of the 2017 pay increase and $1,982,000 for the 2018 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.

b. An increase of $1,197,000 for GSA Rent and DHS Security Payments.

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

c. A decrease of $17,555,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

AR, Booneville – Agroforestry (-$1,000,000)
CO, Akron - Adaptation of Dryland Cropping Systems for the Central Great Plains Region to Extreme Variation of Weather and Climate (-$2,201,000)
ID, Dubois - New Monitoring Technologies for Improving Rangeland Management (-$711,000)
IL, Peoria - Understanding the Role of Commensal Anaerobic Bacteria in Odor, Emissions, and Antibiotic Resistance from Stored Livestock Manure (-$430,000)
KY, Bowling Green - Waste Management (-$472,000)
KY, Lexington - Improved Forage Livestock Production (-$360,000)
LA, Houma - Integrated Crop, Soil, and Water Management Systems for Sustainable Production of Sugarcane for Bioenergy Feedstock (-$710,000)
MD, Beltsville - Combined Water Quality Initiative (-$96,000)
MD, Beltsville - Global Change Research (-$125,000)
MD, Beltsville - Air Quality Associated with Agricultural Operations (SDL) (-$628,000)
ME, Orono - Improved Crop Production Systems for the Northeast (-$1,031,000)
MN, Morris - Stewardship of Upper Midwest Soil and Air Resources through Regionally Adapted Management Practices (-$2,160,000)
MO, Columbia - Mid-West/Mid-South Irrigation (-$120,000)
MS, Oxford – Acoustics (-$784,000)
MT, Miles City - Adaptive Rangeland Management of Livestock Grazing, Disturbance, and Climatic Variation (-$1,743,000)

OK, Woodward - Sustaining Southern Plains Landscapes through Plant Genetics and Sound Forage-Livestock Production Systems (-$2,465,000)
SD, Brookings - Soil and Crop Management for Enhanced Soil Health, Resilient Cropping Systems, and Sustainable Agriculture in the Northern Great Plains (-$998,000)
TX, Bushland - Ogallala Aquifer - West TX A&M Univ. (-$113,000)
TX, Bushland - Ogallala Aquifer - TX Tech Univ. (-$269,000)
TX, Bushland - Ogallala Aquifer - TX A&M Univ. (-$538,000)
TX, Bushland - Ogallala Aquifer - KS State Univ. (-$601,000)

Library and Information Services

(9) A decrease of $1,804,000 and no reduction of staff years ($23,746,000 and 92 staff years available in 2017).

The National Agricultural Library (NAL), formed in 1862, is one of the largest and most accessible agricultural research libraries in the world. It was named in 1962 a national library by Congress, as "the primary agricultural information resource of the United States." NAL provides services directly to the staff of USDA and to the public primarily via the NAL web site. NAL is continually reviewing its programs and operations to improve their efficiency and effectiveness.

The funding change is requested for the following items:

a. An increase of $196,000 for pay costs ($52,000 for annualization of the 2017 pay increase and $144,000 for the 2018 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.

b. A decrease of $2,000,000 from ongoing research projects to help finance and support the Administration's budget priorities.

The goal of ARS research programs is to make the most effective use of taxpayer dollars within available resources. In order to respond to priority national needs, it is often necessary to set priorities within the existing portfolio of projects, so that some projects do not qualify for continuing support. The 2018 Budget has identified some existing projects which can no longer be funded because the research is: 1) mature and objectives have been mainly accomplished; 2) of relatively low impact, significance, or relevance to national priorities, 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) carried out by other research institutions.

MD, Beltsville – Ag. Law Partnership (-$2,000,000)

Decentralized GSA Rent and DHS Security Payments

(10) A decrease of $5,105,000 for GSA Rent and DHS Security Payments (Funding is spread among selected programs clusters).

Funding was appropriated in FY 2015 for decentralized GSA rent and DHS security payments. This funding is now part of the Agency's base and is spread among most of ARS' program clusters.

Repair and Maintenance

Sustained support for repairs and maintenance ($20,106,000 available in 2017).

ARS' Repair and Maintenance (R&M) program is intended to improve existing facilities, that is, primarily for protection of life and property, implementation of mandated regulations including energy conservation, compliance with building codes, and more effective space utilization. Examples of R&M expenditures include: HVAC/electrical/plumbing component repair and maintenance, roof replacement, site utility system replacement/maintenance/repair, fire protection installation/repair, road paving, correction of site damage, etc. There is currently a backlog of R&M needs. ARS will use existing funding levels to address the highest priority needs.

Proposed Laboratory Closures

Location/Laboratory

Arkansas, Little Rock *
    Arkansas Children's Nutrition Center
Arkansas, Stuttgart
    Harry K. Dupree National Aquaculture Research Center
Colorado, Akron *
    Central Plains Resource Management
Florida, Miami *
    Subtropical Horticulture Research Station
Idaho, Dubois *
    U.S. Sheep Experiment Station
Illinois, Peoria *
    National Center for Agricultural Utilization Research
Louisiana, Houma *
    Sugarcane Research Unit
Maine, Orono
    New England Plant, Soil and Water Research Laboratory
Massachusetts, Boston *
    Jean Mayer Human Nutrition Research Center
Minnesota, Morris *
    North Central Soil Conservation Research Laboratory
Mississippi, Stoneville
    Cotton Ginning Research Unit
Missouri, Columbia
    Biological Control of Insects Research Unit
Montana, Miles City*
    Livestock and Range Research Laboratory
Oklahoma, Woodward *
    Southern Plains Range Research Station
South Dakota, Brookings *
    Integrated Cropping System Research
Texas, Houston *
    Children's Nutrition Research Center
Wisconsin, Milwaukee (Worksite)
    Aquaculture Production

* Denotes Entire Location Closure

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

	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
ALABAMA, Auburn	$5,605	39	$6,821	38	$6,429	38	$6,429	38
ARIZONA								
Maricopa	9,742	70	10,511	67	9,782	67	9,782	67
Tucson	6,373	46	6,400	48	6,408	48	6,408	48
Total	16,115	116	16,911	115	16,190	115	16,190	115
ARKANSAS								
Booneville	4,163	16	4,178	18	3,921	18	2,921	18
Fayetteville	1,929	11	1,979	10	1,859	10	1,859	10
Jonesboro	1,220	3	1,366	6	1,422	6	1,422	6
Little Rock	7,728	- -	7,442	- -	7,745	- -	-	- -
Stuttgart	7,749	62	7,482	59	7,873	59	4,626	30
Total	22,788	92	22,447	93	22,819	93	10,828	64
CALIFORNIA								
Albany	39,056	206	38,939	205	37,990	205	37,990	205
Davis	11,715	82	12,332	88	11,651	88	11,651	88
Parlier	10,835	85	10,746	82	11,298	82	11,298	82
Riverside	5,129	35	5,169	33	5,154	33	5,154	33
Salinas	5,887	43	7,810	43	8,337	43	8,137	42
Total	72,622	451	74,996	451	74,429	451	74,229	450
COLORADO								
Akron	1,900	19	1,973	18	1,977	18	-	- -
Fort Collins	14,657	118	15,464	117	14,690	117	14,690	117
Total	16,557	137	17,437	135	16,668	135	14,690	117
DELAWARE								
Newark	2,467	14	1,938	13	1,997	13	1,997	13
DISTRICT OF COLUMBI								
National Arboretum	10,926	68	11,325	62	11,955	62	11,955	62
Headquarters Federal Administration	112,863	520	110,851	502	87,947	502	87,947	322
Total	123,789	588	122,175	564	99,902	564	99,902	384
FLORIDA								
Canal Point	2,697	26	2,893	25	2,930	25	2,930	25
Fort Lauderdale	2,286	26	2,390	30	2,441	30	2,441	30
Fort Pierce	13,929	121	14,480	120	13,347	120	13,347	120
Gainesville	11,342	97	11,689	98	11,890	98	11,846	98
Miami	4,412	34	4,586	32	4,569	32	-	- -
Total	34,666	304	36,038	305	35,177	305	30,564	273
GEORGIA								
Athens	23,026	132	25,913	141	23,365	141	23,365	141
Byron	5,189	30	3,497	33	3,552	33	3,552	33
Dawson	3,555	33	3,459	29	3,707	29	3,707	29
Griffin	2,420	19	2,390	19	2,406	19	2,406	19
Tifton	10,330	80	11,549	79	10,142	79	9,271	74
Total	44,519	294	46,808	301	43,172	301	42,301	296
HAWAII, Hilo	9,714	60	9,507	58	9,342	58	8,216	58

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

	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
IDAHO								
Aberdeen	6,267	44	6,545	48	6,082	48	5,793	48
Boise	2,546	21	2,338	20	1,974	20	1,974	20
Dubois	1,978	13	2,103	14	2,137	14	-	- -
Kimberly	4,056	36	4,439	39	4,262	39	4,262	39
Total	14,846	114	15,426	121	14,455	121	12,028	107
ILLINOIS								
Peoria	31,781	202	32,241	207	32,409	207	2,098	5
Urbana	5,770	42	5,566	38	5,551	38	5,538	38
Total	37,551	244	37,807	245	37,961	245	7,636	43
INDIANA, W. Lafayette	7,049	53	6,797	53	7,523	53	7,464	53
IOWA, Ames	53,189	360	53,403	362	54,142	362	53,453	362
KANSAS, Manhattan	13,183	85	14,804	85	14,368	85	14,368	85
KENTUCKY								
Bowling Green	2,609	13	2,688	14	2,616	14	1,973	14
Lexington	2,567	13	2,617	13	2,700	13	1,890	13
Total	5,176	26	5,306	27	5,316	27	3,863	27
LOUISIANA								
Baton Rouge	2,831	22	2,691	22	3,081	22	3,081	22
Houma	3,871	43	4,041	45	3,950	45	-	- -
New Orleans	20,542	135	20,677	132	20,741	132	20,741	132
Total	27,245	200	27,408	199	27,772	199	23,822	154
MAINE, Orono	2,249	14	2,657	15	2,256	15	1,327	11
MARYLAND								
Beltsville	119,147	651	118,431	637	118,072	637	117,878	637
National Ag Library	23,441	92	23,292	84	23,153	84	21,353	84
Frederick	5,866	39	5,923	37	6,085	37	6,085	37
Total	148,454	782	147,647	758	147,309	758	145,315	758
MASSACHUSETTS, Bost	15,177	8	15,774	9	14,965	9	-	- -
MICHIGAN, East Lansing	4,990	32	1,679	22	4,998	22	4,998	22
MINNESOTA								
Morris	2,743	25	2,822	25	2,525	25	-	- -
St. Paul	7,022	50	7,228	51	6,664	51	6,664	51
Total	9,765	75	10,050	76	9,189	76	6,664	51
MISSISSIPPI								
Mississippi State	9,026	71	8,960	69	9,234	69	9,234	69
Oxford	13,974	82	13,930	80	13,979	80	10,927	80
Poplarville	5,676	29	5,806	32	5,886	32	5,886	32
Stoneville	38,163	242	39,374	240	40,125	240	35,854	229
Total	66,837	424	68,070	421	69,224	421	61,901	410
MISSOURI, Columbia	9,077	71	9,203	72	9,305	72	7,589	60
MONTANA								
Miles City	3,487	22	3,569	24	3,748	24	-	- -
Sidney	4,802	41	5,308	43	5,261	43	5,261	43
Total	8,289	63	8,876	67	9,009	67	5,261	43

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

	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
NEBRASKA								
Clay Center	23,825	117	23,313	120	22,708	120	22,708	120
Lincoln	5,818	55	5,764	54	5,601	54	5,601	54
Total	29,643	172	29,077	174	28,309	174	28,309	174
NEVADA								
Reno	2,463	16	2,362	16	2,270	16	2,270	16
NEW MEXICO								
Las Cruces	7,048	50	7,110	51	7,031	51	7,031	51
NEW YORK								
Geneva	4,118	33	3,955	33	3,886	33	3,886	33
Greenport	4,014	27	4,297	25	4,123	25	4,123	25
Ithaca	11,762	52	12,209	50	11,458	50	11,237	50
Total	19,894	112	20,461	108	19,467	108	19,246	108
NORTH CAROLINA								
Raleigh	9,921	64	9,650	64	9,359	64	9,359	64
NORTH DAKOTA								
Fargo	15,431	103	15,532	97	15,595	97	15,595	97
Grand Forks	9,636	43	9,511	42	9,256	42	9,256	42
Mandan	3,720	29	5,032	34	4,158	34	4,158	34
Total	28,787	175	30,075	173	29,009	173	29,009	173
OHIO								
Columbus	1,781	16	1,541	15	1,451	15	1,451	15
Wooster	5,552	45	5,623	45	4,827	45	4,420	45
Total	7,333	61	7,164	60	6,278	60	5,871	60
OKLAHOMA								
El Reno	6,721	38	6,855	47	6,863	47	6,863	47
Stillwater	3,604	30	4,016	28	3,642	28	3,642	28
Woodward	2,177	15	2,316	16	2,214	16	-	- -
Total	12,502	83	13,187	91	12,719	91	10,504	75
OREGON								
Burns	2,472	23	2,288	20	2,602	20	2,602	20
Corvallis	12,937	95	13,280	96	11,801	96	11,272	95
Pendleton	1,967	19	2,140	17	1,896	17	1,896	17
Total	17,376	137	17,708	133	16,299	133	15,770	132
PENNSYLVANIA								
University Park	5,833	40	5,736	40	5,846	40	5,846	40
Wyndmoor	31,269	171	31,344	165	31,466	165	28,654	159
Total	37,102	211	37,080	205	37,311	205	34,500	199
SOUTH CAROLINA								
Charleston	4,436	37	4,696	38	4,580	38	4,429	38
Florence	3,858	25	3,961	26	3,912	26	3,912	26
Total	8,294	62	8,657	64	8,492	64	8,340	64
SOUTH DAKOTA								
Brookings	2,984	31	2,983	25	2,969	25	-	- -

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

	2015 Actual		2016 Actual		2017 Estimate		2018 President's Budget	
Location	Amount	SY	Amount	SY	Amount	SY	Amount	SY
TEXAS								
Bushland	6,315	40	6,246	40	6,834	40	5,466	40
College Station	13,193	92	13,724	85	13,100	85	13,100	85
Houston	15,970	7	15,025	7	13,498	7	-	- -
Kerrville	5,950	38	5,969	38	6,206	38	6,206	38
Lubbock	9,016	86	9,202	88	8,260	88	8,260	88
Temple	3,646	32	4,145	31	3,752	31	3,752	31
Total	54,088	295	54,310	289	51,650	289	36,784	282
UTAH, Logan	9,138	75	9,790	74	9,703	74	9,703	74
WASHINGTON								
Pullman	20,521	117	21,156	123	19,415	123	19,415	123
Wapato	6,234	52	6,440	50	5,874	50	5,167	45
Wenatchee	2,023	17	2,028	20	2,031	20	2,031	20
Total	28,778	186	29,623	193	27,321	193	26,614	188
WEST VIRGINIA								
Kearneysville	9,855	62	7,775	61	7,069	61	7,069	61
Leetown	7,468	35	7,802	34	7,575	34	5,594	34
Total	17,323	97	15,577	95	14,643	95	12,663	95
WISCONSIN, Madison	17,069	101	17,985	106	18,323	106	16,992	103
WYOMING, Cheyenne	3,175	22	3,129	23	3,605	23	3,605	23
PUERTO RICO								
Mayaguez	3,403	38	3,215	36	3,153	36	3,153	36
OTHER COUNTRIES								
France, Montpellier	3,650	2	3,361	2	3,195	2	3,195	2
Extramural and Funds Administered from Headquarters-Held Funds	19,553	- -	21,828	- -	56,524	- -	29,083	- -
Repair & Maintenance of Facilities	20,144	- -	20,133	- -	20,106	- -	20,106	- -
Obligations	1,131,592	6,636	1,144,450	6,587	1,141,652	6,587	993,144	5,913
Lapsing Balances	2,413	- -	2,191	- -	- -	- -	- -	- -
Bal. Available, EOY	13,680	- -	14,889	- -	- -	- -	- -	- -
Total Available	1,147,685	6,636	1,161,530	6,587	1,141,652	6,587	993,144	5,913

Salaries and Expenses

Classification by Objects
(Dollars in thousands)

		2015 Actual	2016 Actual	2017 Estimate	2018 President's Budget
Personnel Compensation:					
Washington D.C.		$43,071	$42,921	$42,816	$26,816
Field		439,640	438,111	437,040	402,999
11	Total personnel compensation	482,711	481,032	479,856	429,815
12	Personal benefits	161,281	170,001	169,978	152,252
13.0	Benefits for former personnel	547	393	-	-
	Total, personnel comp. and benefits	644,539	651,426	649,834	582,067
Other Objects:					
21.0	Travel and transportation of persons	10,790	11,837	11,808	11,730
22.0	Transportation of things	288	334	333	331
23.1	Rental payments to GSA	4,982	4,726	4,791	4,830
23.2	Rental payments to others	527	620	619	615
23.3	Communications, utilities, and misc. charges	49,162	45,415	45,227	44,860
24.0	Printing and reproduction	388	2,054	2,078	2,036
25.1	Advisory and assistance services	1,180	970	967	961
25.2	Other services from non-Federal sources	11,732	16,613	17,687	16,464
25.3	Other purchases of goods and services from Federal sources	4,221	4,184	4,174	4,147
25.4	Operation and maintenance of facilities	42,440	42,731	42,627	42,348
25.5	Research and development contracts	187,558	199,073	212,224	119,765
25.6	Medical care	245	289	288	286
25.7	Operation and maintenance of equipment	22,032	18,468	18,430	18,303
25.8	Subsistence and support of persons	2	1	1	1
26.0	Supplies and materials	73,222	75,149	75,066	74,474
31.0	Equipment	53,594	49,794	49,672	49,347
32.0	Land and structures	8,192	7,487	7,468	7,419
41.0	Grants, subsidies, and contributions	16,498	13,279	13,247	13,160
	Total, Other Objects	487,053	493,024	506,707	411,077
99.9	Total, new obligations	1,131,592	1,144,450	1,156,541	993,144
DHS Building Security payments (included in 25.3)		$137	$139	$130	$133
Position Data:					
Average Salary (dollars), ES Position		$129,430	$144,995	$144,640	$144,325
Average Salary (dollars), GS Position		$68,170	$68,490	$68,323	$68,174
Average Grade, GS Position		10.7	10.6	10.6	10.5

Shared Funding Projects
(Dollars in thousands)

	2015 Actual	2016 Actual	2017 Estimate	2018 President's Budget
Working Capital Fund:				
Administration:				
Material Management Service Center	$141	$176	$170	$138
Mail and Reproduction Services	1,666	1,549	1,190	952
HR Enterprise System Management	-	130	130	129
Integrated Procurement Systems	1,374	1,608	1,609	1,742
Procurement Operations	644	30	31	33
Subtotal	3,825	3,493	3,130	2,994
Communications:				
Creative Media & Broadcast Center	216	317	301	276
Finance and Management:				
National Finance Center	2,228	2,260	2,165	1,952
Controller Operations	-	-	-	-
Financial Systems	4,951	5,056	5,301	4,992
Internal Control Support Services	113	150	158	146
Subtotal	7,292	7,466	7,624	7,090
Information Technology:				
National Information Technology Center	1,812	1,135	1,189	1,114
Client Technology Service	614	521	3,640	3,387
Enterprise Network Services	1,106	1,243	1,507	1,602
International Technology Services	-	-	-	-
Telecommunications Services	-	-	-	-
Subtotal	3,532	2,899	6,336	6,103
Correspondence Management	71	106	119	107
Total, Working Capital Fund	14,936	14,281	17,510	16,570
Departmental Shared Cost Programs:				
1890 USDA Initiatives	201	225	242	218
Advisory Committee Liaison Services	3	4	4	3
Classified National Security Information	73	44	42	38
Continuity of Operations Planning	153	142	137	123
Emergency Operations Center	163	166	151	136
Facility and Infrastructure Review and Assessment	32	31	29	26
Faith-Based and Neighborhood Partnerships	28	27	26	23
Federal Biobased Products Preferred Procurement Program	-	-	-	-
Hispanic-Serving Institutions National Program	131	125	128	115
Honor Awards	6	5	5	5
Human Resources Transformation (inc. Diversity Council)	124	109	113	102
Identity and Access Management (HSPD-12)	488	481	435	392
Medical Services	42	43	47	42
People's Garden	52	46	42	38
Personnel Security Branch	71	65	59	53
Pre-authorizing Funding	274	265	239	215
Retirement Processor Web Application	43	41	39	35
Sign Language Interpreter Services	-	-	-	-
TARGET Center	101	102	93	84

Shared Funding Projects
(Dollars in thousands)

	2015 Actual	2016 Actual	2017 Estimate	2018 President's Budget
USDA 1994 Program	52	49	50	45
Virtual University	143	141	128	115
Visitor Information Center	-	-	-	-
Total, Departmental Shared Cost Programs	2,180	2,111	2,009	1,808
E-Gov:				
Budget Formulation and Execution Line of Business	7	7	7	7
Disaster Assitance Improvement Plan	-	-	-	-
Enterprise Human Resources Integration	152	139	126	126
E-Rulemaking	57	-	-	-
E-Training	201	178	-	-
Financial Management Line of Business	12	9	5	5
Geospatial Line of Business	-	-	-	-
GovBenefits.gov	-	-	-	-
Grants.gov	39	-	-	-
Grants Management Line of Business	-	-	-	-
Human Resources Line of Business	20	20	20	18
Integrated Acquisition Environment - Loans and Grants	137	-	-	-
Integrated Acquisition Environment	48	154	190	194
Total, E-Gov	673	507	348	350
Agency Total	17,789	16,899	19,867	18,728

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. The research supports USDA's Strategic Goals. A brief summary of the agency's selected 2016 accomplishments and current activities, including the National Agricultural Library, are detailed below.

Program Evaluations: In 2016, ARS conducted retrospective reviews of its Food Animal Production; Water Availability and Watershed Management; and Plant Genetic Resources, Genomics, and Genetic Improvement 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, customer/ stakeholder groups, and nonprofits. 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' 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 for domestic and foreign markets; and providing higher quality, healthy foods that satisfy consumer needs.

Selected Examples of Recent Progress:

New tomato variety developed from fruit taste study. Many years of breeding tomatoes for disease resistance, yield, and size has resulted in fruit that lack flavor. In a collaborative study involving ARS scientists in Fort Pierce, Florida, and the University of Florida tomato breeding program, researchers evaluated 38 tomato varieties over seven years to better understand tomato flavor. Tomato variety and harvest season significantly influenced sensory perception and chemical profiles. Based on this study, University of Florida collaborators developed a new variety, "Tasti-Lee," which is now readily available in supermarkets. When comparing the industry standard, "Florida 47," with "Tasti-Lee" for the 29 compounds that affect tomato aroma, eight were higher in "Tasti-Lee" compounds (which contributed to ripe fruit and floral aromas), whereas four were higher in "Florida 47" compounds (which contributed to non-ripe green fruit aromas). This chemical model for tomato flavor quality is available to breeders.

New tools for apple producers to avoid superficial scald. Apple fruit superficial scald results from chilling stress during the first month after harvest and results in dark, sunken peel tissue after three to six months of cold storage. Low oxygen controlled atmosphere storage can control superficial scald, but is not always effective for apples from different orchard lots and production seasons. ARS scientists in Wenatchee, Washington, have identified natural early warning compounds that accumulate in the peel of harvested apples before scald appears regardless of the prior growing conditions. When these early warning compounds occur, storage room oxygen levels can be reduced or fruit can be marketed before symptom development. This practice provides apple producers with methods to avoid superficial scald throughout the postharvest supply chain.

Potato cultivars with reduced acrylamide content identified. Acrylamide is an unwanted and potentially toxic by-product produced when carbohydrate rich foods, such as French fries, are processed at high temperatures. ARS researchers in Fargo, North Dakota, evaluated 56 advanced potato clones grown in Idaho, Maine, North Dakota, and Wisconsin for process quality, asparagine content, and acrylamide levels using standardized storage, processing, and evaluation procedures. Several clones exhibiting excellent processing characteristics and very low acrylamide levels were identified. These clones are being evaluated in more detailed trials to identify candidates to replace currently used varieties in the commercial production of processed potato products.

Novel microbes lower cost of cellulosic ethanol production. Developing cost-effective cellulosic ethanol production is difficult in part because of the expensive cellulolytic enzymes needed to break down biofeedstock before it can be converted into fuel. Researchers are also studying ways to manage inhibitory compounds that can result from fermentation and slow the conversion of biofeedstock to cellulosic ethanol. ARS scientists in Peoria, Illinois, worked with partners to develop a new yeast strain with a unique cellulolytic enzyme that efficiently breaks down biofeedstock, shows resistance to inhibitory compounds, and eliminates the need to add other enzymes to the production process. This technology which supports the rural economy is expected to reduce risks and increase profitability in existing industrial biorefineries that produce ethanol and other products.

Ethanol from coffee waste. The cost-effective production of fuels and chemicals from agricultural residues requires a microorganism that can convert all the available sugars in the biofeedstock. ARS scientists identified a strain of yeast that can convert inulin, a major polysaccharide derived from coffee processing waste, into cellulosic ethanol. Using this yeast provides a new method for disposing of waste products from coffee processing and furthers the development of environmentally cost-effective and profitable processes for managing agricultural byproducts.

Converting switchgrass and corn stover sugars into biodiesel and bio-jet fuel without costly enzymes. ARS researchers in Peoria, Illinois, worked with partners to demonstrate the feasibility of directly converting extracted plant sugars into oils that could be used as biodiesel or bio-jet fuel. This new process is suitable for producing a renewable intermediate for biodiesel or bio-jet fuel production. It is cost competitive with petroleum-based oils because sugars are extracted from plants without using enzymes that typically drive up costs in producing sugars from plant fibers. The actual savings of this technology has not been released but preliminary findings suggest it could reduce cellulosic ethanol production costs by 16 to 20 percent.

Livestock Production

Current Activities:

ARS' Livestock Production research program is directed toward fostering an abundant, safe, nutritionally wholesome, and competitively priced supply of animal products produced in a viable, competitive, and sustainable animal agriculture sector of the U.S. economy by: safeguarding and utilizing animal genetic resources, associated genetic and genomic databases, and bioinformatic tools; developing a basic understanding of food animal physiology to address priority issues related to animal production, animal well-being, and product quality and healthfulness; and developing information, best management practices, novel and innovative tools, and technologies that improve animal production systems, enhance human health, and ensure domestic food security. The research is heavily focused on the development and application of genomics 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.

Selected Examples of Recent Progress:

Rumen microbial community changes milk production efficiency. The efficiency of conversion of feed to milk (i.e., production efficiency) is a major factor affecting how the U.S. dairy industry impacts the environment, economics, and food supply of the country. Dairy cows vary in milk production efficiency, but only part of the variation among cows is explained by cow genetics. Dairy cows also have different communities of microbes in their rumens. In an effort to determine how these differences affect production efficiency, ARS researchers in Madison, Wisconsin, and collaborators performed near total exchange of rumen contents between high- and low-efficiency cows, and showed that these exchanges decreased or increased milk production efficiency of each cow for about seven days before returning to their previous levels. Additionally, after the rumen digesta exchange, the species composition of the rumen bacterial community gradually returned to a composition similar to the original unique profile of each host cow. The results directly implicated the rumen bacterial community as determinants of milk production efficiency. Improved production efficiency with its concomitant decrease in environmental impact and improvement in farm return over feed costs may be possible if factors controlling the rumen microbial community can be optimized.

Identification of markers associated with susceptibility to liver abscesses. Liver abscesses are found at processing in approximately 13 percent of cattle being fed high energy density rations, as this diet makes them more susceptible to infection from rumen bacteria that generate acid conditions in the digestive tract. The acidosis and associated liver abscesses seldom result in outward clinical signs, but reduce carcass weight and quality, and cost the processor $20 to $80 per affected animal in lost revenue. The prevalence of abscesses will likely increase as the use of antibiotics for promoting growth decreases. Also, because the abscesses are not outwardly detectable, there is a need for alternate management practices to prevent them. ARS researchers in Clay Center, Nebraska, identified 35 genetic markers associated with abscess susceptibility and detailed their study in a peer reviewed journal. These genetic markers may be useful in genetic selection programs to reduce the incidence of disease.

Glucosamine supplementation during late gestation increases sow litter size. Litter size in swine is a component of the efficiency of the breeding herd. Previous studies indicated that glucosamine supplementation beneficially altered placental development, but subsequent studies on commercial sows indicated that glucosamine had equivocal effects on litter size. ARS researchers in Clay Center, Nebraska, in collaboration with an industry partner, demonstrated that supplementation of sow gestation diets with 20 grams of glucosamine per day during the last third of pregnancy increased litter size by more than one piglet per litter born alive. The increase in litter size did not reduce average birth weights or preweaning survival. Routine supplementation of sow diets with glucosamine would contribute to improved reproductive efficiency in sow herds and improved profitability of swine production.

Expanded national genomic evaluation service for dairy cattle. Dramatic increases in the effectiveness of genetic selection in dairy cattle have been accomplished through genomic analyses, but the process is ongoing and many more traits could be added. Control of the dairy cattle national database and responsibility for routine delivery of genetic evaluations was transferred from ARS in Beltsville, Maryland, to the Council on Dairy Cattle Breeding (CDCB). A copy of the CDCB database is maintained at ARS to allow expanded research on genetic evaluation development and methodology; and the CDCB employees interact with ARS on a daily basis. The arrangement enables the CDCB to continue expanding data collection and services to the dairy industry while ARS staff focuses on research. Projects completed jointly by ARS and the CDCB include exchange of Holstein bull genotypes with Switzerland (in March 2016) and Japan (in May 2016); genomic prediction of breed composition (in June 2016); and expansion of genomic evaluations to Guernseys as a fifth dairy cattle breed (in April 2016) in cooperation with the United Kingdom and the Isle of Guernsey. The collaboration between ARS and the dairy industry has produced a world leading genomic prediction system, and a vast database that producers in about 50 countries now use routinely to accelerate genetic progress and select parents who can produce healthier, more productive dairy cattle.

Using genomics to improve disease resistance in rainbow trout. Bacterial cold water disease (BCWD) of rainbow trout is a continuing challenge to the American aquaculture industry, responsible for losses up to 39 percent in hatchery stocks. ARS researchers in Leetown, West Virginia, attempted to improve disease resistance in fish using genome-based breeding instead of traditional pedigree only breeding. They have shown that the genome predictions are substantially better at selecting traits that confer resistance to BCWD over successive generations of fish. Using this relatively new process of genomic selection will likely reduce the amount of time, money, labor, and the number of fish needed to achieve the same level of improvements. Applying a similar genomic selection strategy to improve other commercially important animal traits, including resistance to other diseases, increased fillet yield, or improved carcass quality offers opportunities to increase farm productivity, enhance product quality, improve animal welfare, and the overall sustainability of rainbow trout production systems.

Evaluation of algal sources of omega-3 fatty acids to replace fish oil in trout feeds. Fish oil is derived from capture fisheries, such as sardines and menhaden, and has been the traditional source of omega-3 fatty acids in feeds for farmed fish such as trout. However, the limited availability of fish oil from natural resources is currently limiting the expansion of aquaculture production which aims to provide healthy protein sources to a growing global population. ARS researchers in Aberdeen, Idaho, determined the nutrient digestibility, palatability, and functionality of a number of new commercial sources of algae that are high in omeaga-3 fatty acids. All algal products exhibited high digestibility of omega-3 fatty acids with no effect on feed intake and minimal effect on feed manufacturing. Identifying alternative sources of omega-3 fatty acid for aquaculture feeds that do not reduce production efficiency or product quality, such as these algae, will decrease dependence on ocean harvested fish and remove production barriers to increasing the availability/sustainability of this healthy protein source.

Crop Production

Current Activities:

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 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:

GRIN-Global information system implemented. Researchers and breeders require access to comprehensive descriptions of plant germplasm's traits to accelerate progress in crop genetic improvement. ARS software developers and plant germplasm curators in Beltsville, Maryland, and Ames, Iowa, completed the first major update in 20 years for the Germplasm Resources Information Network (GRIN), the global standard for managing and delivering information associated with plant germplasm. The new "GRIN-Global" was implemented in 2015 in the U.S. National Plant Germplasm System and adopted by six international genebank systems. During 2016, GRIN-Global provided breeders and researchers with access to key descriptions for plant germplasm via more than 1.5 million individual Web page visits, and facilitated distribution of more than 240,000 plant germplasm samples domestically and internationally. Collectively, distribution of germplasm and associated information constituted a technology package that contributed significantly to strengthening crop breeding and research.

High yielding drought tolerant soybean cultivar. Drought is a major problem for many crops that has not been thoroughly addressed in soybean research. Drought resistant soybean cultivars are virtually non-existent in the United States. The first drought resistant Asian soybean accession from the USDA National Plant Germplasm System (NPGS) was reported only in 1989. ARS researchers in Raleigh, North Carolina, using classical breeding methods, have incorporated drought resistance traits from the Asian accession into a new high yielding cultivar "USDA-N8002." The newly released cultivar exhibits slow, or delayed canopy wilting, sustained nitrogen fixation during drought stress, and a water conserving transpiration response when exposed to atmospheric vapor pressure deficit conditions. It has very stable yields over the southeast United States in both full season and double cropping production. This new cultivar is available for production and use as parental stock for commercial breeding programs aimed at breeding drought resistance into soybean cultivars. The release was featured in the Crop Science Society of America news magazine, *CSA News*.

Reduced allergen wheat. Wheat flour is one of eight foods responsible for 90 percent of food allergies in the United States. ARS scientists in Albany, California, created transgenic wheat lines in which the omega-5 gliadins, the major sensitizing allergens in a severe food allergy called "wheat dependent exercise induced anaphylaxis" (WDEIA), were significantly reduced in the flour without adverse effects on flour quality. In collaboration with scientists at the French National Institute for Agricultural Research, the allergenic potential of these lines was evaluated using sera from a collection of WDEIA patients. Most patients showed little or no reactivity to omega-5 gliadins in the transgenic lines, indicating that the transgenic lines could be considered reduced allergen. However, low levels of reactivity with other gluten proteins were also observed with the transgenic lines. While flour from the transgenic lines would not be suitable for individuals diagnosed with WDEIA, introduction of wheat lacking omega-5 gliadins could reduce the number of consumers who become sensitized to these proteins and decrease the overall incidence of this food allergy.

Release of high phytonutrient potato varieties. Health professionals and consumers are placing increased importance on the nutritional value of foods, a key component of food security. Consumers are also increasingly demanding that their food be produced using less agrochemicals, which is problematic for potato producers since they commonly have to apply fungicides throughout the growing season to control diseases. Potatoes are nutritionally dense crops that are very low in fat, while being rich sources of protein, fiber, antioxidants, minerals, and calories. ARS scientists in Prosser, Washington, working with collaborators in the TriState Breeding Program, released two new high phytonutrient potato varieties. "Yukon Nugget" and "Smilin Eyes" are yellow flesh potato varieties that have higher yields, improved disease resistance, and greater antioxidant concentrations than "Yukon Gold," the standard commercial yellow flesh potato variety. These new varieties enable growers to produce potatoes that require fewer chemicals to control disease and meet consumer preferences for nutritional foods.

Durable Sunflower Rust and Downy Mildew Resistance. Rust and Downy Mildew are two of the most devastating diseases of sunflower. Very few suitable sunflower inbred lines with high levels of rust resistance are available to commercial sunflower breeders. ARS scientists in Fargo, North Dakota, developed and released a sunflower germplasm resistant to both Rust and Downy Mildew that was derived from the annual crop wild relative of sunflower. The stacking of these genes in one germplasm incorporates dominant genes with resistance to all known races of North American sunflower rust and all known races of the pathogen causing Downy Mildew. The molecular markers relating to both of these genes have been provided to the sunflower industry to enable breeders to develop additional varieties with resistance to multiple pathogens, thus assuring sustainable sunflower production in the presence of these two devastating diseases.

New genomics powered database tools address breeder needs for maize (corn) and rice. The data generated by U.S. maize and rice geneticists is expanding rapidly as is the demand for bioinformatic tools that enable researchers and breeders to utilize this knowledge. ARS scientists in Ames, Iowa, and Stuttgart, Arkansas, developed three new bioinformatic tools to accelerate maize and rice breeding and research.

New soft white winter club wheat cultivar "Pritchett" released. The club wheat market class represents approximately eight percent of the total wheat production in the Pacific Northwest region of the United States. There are, however, no private or other public sector research programs developing club wheat. Club wheat is characterized by its compact head and is exported to Asian markets where it is highly valued as a main ingredient of sponge cakes. Existing club wheat cultivars do not emerge well from deep sowing in dry conditions; are susceptible to preharvest sprouting; or suffer from lower quality at harvest. ARS researchers in Pullman, Washington, in collaboration with wheat breeders from Washington State University, developed and released a new winter club wheat cultivar, "Pritchett." The new cultivar has generated excitement among growers in the drier areas of the club wheat production zone because it has excellent emergence from deep sowing and can be grown with reduced fungicide inputs because it is resistant to stripe rust and cephalosporium stripe, and is moderately resistant to eyespot. Additionally, "Pritchett" possesses better milling and baking quality than the current standard variety.

Food Safety

Current Activities:

ARS' Food Safety research program 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 REE agencies, as well as with FSIS, APHIS, FDA, Centers for Disease Control and Prevention (CDC), Department of Homeland Security (DHS), and the 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.

Selected Examples of Recent Progress:

Antimicrobial carryover and Salmonella. Salmonella can be transmitted to humans through the consumption of contaminated foods, including poultry. Contamination of raw poultry products occurs during live animal production and slaughter operations. FSIS monitors contamination of poultry through a testing program to protect consumers. ARS demonstrated that the current FSIS protocol for Salmonella testing of whole chicken carcasses may potentially lead to carryover of intervention solutions which are used to reduce pathogens in poultry processing into the collection broth tested by FSIS inspectors. This carryover could result in under estimating Salmonella levels in poultry processing operations. ARS scientists in Athens, Georgia, developed a modified collection broth capable of neutralizing a wide range of sanitizers which resulted in a statistically more accurate reporting of Salmonella in poultry processing. FSIS subsequently validated and approved this new modified collection broth for regulatory sampling. FSIS inspectors implemented the new protocol in their collection of samples for Salmonella testing.

Re-evaluation of produce metrics. Current metrics used by the California Leafy Greens Marketing Agreements (LGMA) for leafy greens to ascertain the microbial safety of fresh produce required re-evaluation. ARS scientists in Beltsville, Maryland, examined the 60 day interval between flooding of fields and replanting of crops, and a 30 foot "no harvest" zone from the edge of the flood currently employed to prevent fecal contamination of crops. In intentionally flooded spinach fields with a five percent slope, *E. coli* populations were found to decline more slowly in fall trials than in spring trials, and E. coli in soils and on spinach plants were detected 30 feet from the edge of the flood. These results suggest that LGMA metrics should be revised to include considerations of field and weather conditions that may promote bacterial movement and survival.

Imaging device for meat safety inspection. Current meat inspection in slaughter plants for food safety and quality attributes, including potential fecal contamination, is conducted through visual examination by human inspectors working under conditions that are poorly suited to conventional fluorescence detection methods that require ambient darkness. ARS researchers in Beltsville, Maryland, developed a handheld fluorescence-based imaging device (HFID) to highlight contaminated food and equipment surfaces on a display monitor during use under ambient lighting. This technology, which is patented and under license and commercial development by an industry partner, will support and improve meat safety inspection programs implemented by U.S. processors and regulatory inspectors.

Antimicrobial resistance. The impact of potential antimicrobial resistant bacteria in livestock waste runoff has been a growing topic of public concern. ARS scientists in Clay Center, Nebraska, compared the populations of antimicrobial resistant bacteria and the presence of antimicrobial resistance genes within samples of livestock and municipal waste streams discharged from municipal wastewater treatment facilities, cattle feedlot runoff catchment ponds, swine waste lagoons, and environments considered low impact (i.e., a municipal lake and a prairie). It was concluded that antimicrobial resistance is a very widespread phenomenon where antimicrobial resistance can be found in cattle, swine, and human waste streams, though a higher diversity of antimicrobial resistance can be found in human waste streams. This was previously unknown and indicates that agricultural systems are not the only source of antimicrobial resistance.

Livestock Protection

Current Activities:

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 through the discovery and development of diagnostics, vaccines, biotherapeutics, animal genomics applications, disease management systems, animal disease models, and farm biosecurity measures. 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 core competencies in bovine, swine, ovine, and avian 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. The ARS animal research program includes the following core components: biodefense research, animal genomics and immunology, zoonotic diseases, respiratory diseases, reproductive and neonatal diseases, enteric diseases, parasitic diseases, and transmissible spongiform encephalopathies.

Selected Examples of Recent Progress:

Understanding the genetics of a glycoprotein and its potential as a vaccine candidate for Classical Swine Fever. A DNA codon is a series of three nucleotides that maintain the codes for specific amino acids which are the building blocks of proteins. Some amino acids have more than one codon, and some codons are used more often than others. This tendency to use a particular codon can vary between microorganisms and their animal hosts. ARS scientists in Orient Point, New York, determined that the E2 glycoprotein, a determinant of virulence of Classical Swine Fever Virus (CSFV), had a similar codon usage bias as pigs, its natural host. They explored the effect of switching the native codons in E2 for less frequently used codons. Their studies showed that the genetically altered CSFV no longer caused disease. Although this phenomenon is still a subject of investigation, it is thought to occur because a changing codon affects the ability of a gene to be expressed. Interestingly, when ARS scientists explored the potential use of this phenomenon to generate a vaccine strain, they found that the altered virus was able to protect animals against the disease. By using synonymous codons and not changing a single amino acid, this potential vaccine leaves all natural antigenic epitopes intact. The benefits of producing vaccines using these genetic alterations is that the antigenic profile of the virus remains intact which is important for inducing a protective immune response. Additionally, by changing the nucleotide composition, genetic markers are now available that could be used to differentiate between vaccinated and infected animals.

A better understanding of classical versus atypical Bovine Spongiform Encephalopathy. In 2006, a case of atypical Bovine Spongiform Encephalopathy (BSE-H) was diagnosed in a cow with a heritable genetic mutation in the bovine prion protein gene (PRNP). Unlike classical BSE, which is caused in cattle that eat contaminated BSE material, it is thought that atypical BSE cases may occur spontaneously in cattle due to genetic mutations in the PRNP. ARS scientists in Ames, Iowa, conducted a series of pathogenicity studies and showed that the survival time of the cattle with the genetic mutation and inoculated with BSE-H was shorter (i.e.,10 months) than cattle without the mutation (i.e., 18 months). This genetic effect was not observed when cattle with or without the genetic mutation were inoculated with classical BSE. Their survival time was 26 months, regardless of whether or not the cattle carried the genetic mutation. The results of these studies demonstrate that the genetic mutation associated with atypical BSE exhibits a number of features that differ from classical BSE. Understanding the association between this genetic mutation and BSE provides important information on the potential health risk of atypical BSE.

A better understanding of Marek's disease. Marek's disease (MD) is a herpes virus infection in chickens; highly virulent strains continue to be a problem on poultry farms. Recent interest in the role of the microbiome (i.e., the collection of microorganisms that live in the body) in preventing diseases led ARS scientists in East Lansing, Michigan, in collaboration with Michigan State University scientists, to investigate the potential role of the microbiome in MD resistance. The results of this research showed differences in splenic T cells and the cecal microbiome in two genetically distinct varieties of chicken, one that was resistant and the other susceptible to MD. Interestingly, the composition of the microbiome was different between resistant and susceptible birds. When MD virus was administered to the chickens, both bird varieties demonstrated similar metabolic profiles, but there were differences between the two varieties in both amino acid and lipid metabolism. These results provide insights into differences in the immune response of MD resistant chickens and potential interplay with the microbiome during infection with an oncogenic virus, information which may be useful in reducing MD losses.

Presence of vaccine derived Newcastle Disease viruses in wild birds. The loss of ecological species barriers, which permits opportunistic pathogens to cause disease in wildlife (i.e., animals that are not susceptible to an infectious agent provide a natural barrier for other animal species), is a major factor influencing disease emergence in wild birds. ARS scientists in Athens, Georgia, in collaboration with University of Georgia scientists, found vaccine derived Newcastle Disease viruses (NDV) from different species of wild birds across four continents, from 1997

through 2014. The data indicate that at least 17 species from 10 avian orders occupying different habitats excrete vaccine derived NDV. Examining the extent of spillover of live vaccines such as NDV from poultry into wild birds is crucial because the downstream epidemiological consequences of such spillovers are still unknown. Circulating live vaccine viruses could present additional risks such as reversion to virulence and recombination with wild type strains. In addition, the immune response of wild birds induced by infection with vaccine strains may result in greater virulence. The finding of live attenuated NDV in other avian species provides important evidence these vaccines should be monitored to assess their effect on the environment and the emergence of new viral strains.

A better understanding of avian viruses with zoonotic potential in Pakistan. Significant economic losses from poultry death and decreased egg production have resulted from infections caused by H9N2 low pathogenic avian influenza virus (LPAIV) across North Africa, the Middle East, and Asia. This group of viruses has also caused sporadic infections in mammals, including humans, and has been associated with some specific genetic changes that suggests increasing pandemic potential. The H9N2 LPAIVs have been endemic in Pakistani poultry since 1996, but no new viruses had been reported since 2010. Because novel genotypes of Pakistani H9N2 contain mammalian host specific markers, ongoing surveillance is essential to better understand any continuing public health risk. ARS scientists in Athens, Georgia, in collaboration with Pakistani scientists, reported this year the characterization of four new H9N2 LPAIVs, three found in 2015, and one found in 2012. All of the viruses tested in this study originated in the Middle East. Importantly, these viruses all contained mammalian host specific markers, suggesting that Pakistan avian H9N2 viruses have the capacity to infect mammals. This information underscores the continued need to undertake surveillance in poultry and mammals to monitor the spread of these and other influenza strains and understand the potential for zoonotic infections.

An early warning system for Rift Valley Fever (RVF). RVF is a devastating, mosquito-borne disease that affects both livestock and humans. Few opportunities exist to validate or evaluate warnings and control measures in areas where the risk of transmission is high. To better understand, validate, and evaluate the risk for transmission of RVF and other diseases such as Zika and dengue, ARS scientists and several U.S. government colleagues studied the potential for outbreaks of this disease in Kenya and developed models based on key environmental signals. Alerts produced by the ARS developed outbreak warning system compelled the government of Kenya to conduct a mass vaccination of domestic livestock, thereby possibly averting a major outbreak of the disease.

Evaluating pesticide application methods to control Zika vectors. The capability of larvicide sprays to penetrate into buildings or through vegetation where mosquitoes may be resting or hiding is not well known. ARS researchers in Gainesville, Florida, in partnership with the Florida Army National Guard, investigated the efficacy of liquid larvicide against mosquitoes that are responsible for the spread of Zika, chikungunya, yellow fever, and dengue viruses. The scientists compared spray applications of a larvicide that targets mosquitoes in a simulated urban environment to mimic conditions in Florida, a hot arid desert environment as one would find in California, and a dry season tropical environment typical in Thailand. Results indicated poor penetration into buildings and vegetation in all three environments, even when sprayed at point blank range. These field trials demonstrate that it may not be possible to effectively control these mosquitoes with traditional methods, but instead will require techniques and formulations that have not yet been tried or discovered.

Crop Protection

Current Activities:

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 address quarantine issues.

Selected Examples of Recent Progress:

Using genetic diversity to breed cotton with nematode resistance. Reniform nematodes are roundworms that cause significant economic loss to cotton each year, and because new races of nematodes frequently infest cotton, breeders are continuously seeking new sources of resistance. The USDA National Plant Germplasm System (NPGS) contains more than 1,600 types of cotton seed that may contain resistance, but it would be time consuming and costly to screen all of them. ARS researchers in Stoneville, Mississippi, used genome-wide DNA sequencing data to compare 375 varieties of Asiatic cotton germplasm from the NPGS and found resistance to reniform nematode in 122 varieties. As lines of cotton with genes for nematode resistance are identified, the DNA sequencing data will be used to develop DNA markers that can be used to more rapidly transfer the resistance genes to upland cotton.

Two new watermelon breeding lines show resistance to Fusarium Wilt. Fusarium Wilt of watermelon is an economically significant disease. ARS researchers in Charleston, South Carolina, developed seed from two Fusarium resistant varieties of watermelon, USVL246-FR and USVL252-FR, and have distributed them to more than 20 seed companies for evaluation. Several companies have found the new lines to be more resistant than other breeding lines currently in use, and two companies have begun using these resistant lines in their own breeding programs. These highly resistant watermelon lines provide strong protection against the damaging Fusarium Wilt disease and will prove very useful to the U.S. watermelon industry.

Using genes to fight citrus greening. Huanglongbing disease, also known as citrus greening, is a destructive invasive disease of citrus that has spread throughout Florida and threatens other citrus producing parts of the country. One method of fighting the disease is by developing citrus tree varieties with resistance to the disease. ARS researchers in Parlier, California, the Central California Tristeza Eradication Agency in California (CCTEA), and the Citrus Research and Education Center in Florida, successfully modified the expression of a citrus gene using a Citrus Tristeza Virus (CTV) vector which proved the usefulness of this approach. Additional research is being conducted with this vector to alter other citrus genes that induce premature fruit drop and the plugging of the nutrient transport system in the plants. The CTV vector can be further modified to produce antimicrobial peptides and RNA interference to specifically target the citrus greening pathogen and the insect that spreads the disease. If regulatory approval is obtained, this process could be used for short- to mid-term control of citrus greening to reduce the reliance on insecticides to manage the insect vector.

Resistance to cereal cyst nematode found in adapted wheat varieties. Cyst nematodes are responsible for about $51 million in annual losses in the dryland wheat fields of the Pacific Northwest. Currently, farmers have no options for using chemicals or resistant plant varieties to control the pathogen. ARS scientists in Pullman, Washington, developed several wheat varieties, including SY Steelhead, Svevo, and ARS Crescent and screened them for nematode resistance, in both greenhouses using infested soil and in known infested fields. These new varieties are available for immediate use by growers to manage the disease. The discovery of this resistance will aid plant breeders in quickly developing additional resistant varieties without having to breed out undesirable characteristics that exist in wheat seeds not well adapted to the Pacific Northwest.

New findings in Ug99 wheat Stem Rust resistance genes. Stem Rust is an important disease of wheat in the United States and around the world that can cause severe crop losses. An extremely virulent form of this pathogen from Africa, Ug99, currently threatens global wheat production. While the pathogen has not yet entered the United States, ARS scientists in St. Paul, Minnesota, are using preventive breeding to develop new forms of wheat resistant to it, that is, by using DNA sequence information to develop wheat varieties that carry multiple genes for Ug99 resistance. The scientists have been able to transfer a gene, Sr59, from rye into wheat that conveys resistance to Ug99. The DNA sequences of three additional Ug99 resistance genes (i.e., Sr22, Sr45, and Sr50) were also identified in cooperation with international collaborators. Continued selection and transfer of genes into wheat that resist stem rust is essential for the development of wheat cultivars with resistance to Ug99.

Identifying new strains of CTV in California that do not require quarantine. CTV has caused hundreds of millions of dollars in losses to citrus producers throughout the world. Infected trees in California are detected using a protein

(antibody) test that is specific for the MCA-13 strain of CTV which causes rapid tree decline and death. As part of the overall effort by the California Department of Food and Agriculture (CDFA) to eradicate CTV, trees that test positive for the MCA-13 strain are removed from orchards and destroyed. ARS scientists in Parlier, California, in collaboration with the CCTEA and tree fruit scientists in Bari, Italy, identified two new strains of CTV that also tested positive using the antibody test specific for the MCA-13 strain. The strains, RB and S1, produce mild disease symptoms in citrus, not the rapid death and decline associated with MCA-13. In addition, the two new strains can be distinguished from MCA-13 on the basis of their RNA sequences. These results, which have been presented at meetings of citrus researchers, offer a better way to detect mild strains of CTV which allows growers to preserve infected trees for productive purposes instead of removing and destroying them. Both the CDFA and the CCTEA have applied this information in their CTV eradication efforts.

New technology for controlling gypsy moths. The voracious gypsy moth is a devastating pest that is rapidly spreading across the United States. It defoliates millions of acres of hardwood forest annually, often in U.S. urban greenscapes. ARS scientists in Beltsville, Maryland, used gypsy moth RNA to develop technologies for creating RNA interference (RNAi)-based molecular biopesticides specifically designed to deactivate and silence genes crucial to gypsy moth survival. Gypsy moth caterpillars that consumed these compounds were less able to reproduce. These highly specific biopesticide technologies will be useful tools for controlling gypsy moth pests and protecting U.S. trees from infestations while sparing non-target insects.

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 primary public health concerns in the U.S. 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 requirements but have health promoting qualities. Four specific areas of research are emphasized: nutrition monitoring; the scientific basis for dietary recommendations; prevention of obesity and related diseases; 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.

Selected Examples of Recent Progress:

A database for branded food products. The National Nutrient Database, maintained by ARS in Beltsville, Maryland, contains information on the chemical composition of commonly consumed foods. However, although as many as 400,000 to 500,000 foods may be available in the U.S. food supply and the typical grocery store makes more than 30,000 items available to consumers, until recently the database contained information on fewer than 9,000 individual items. A public-private partnership among ARS, the North American branch of the International Life Sciences Institute, 1World Sync, and Label Insight brought nutritional label information of almost 90,000 additional foods to the database. This addition will strengthen the ability of USDA and other Federal health agencies to more accurately monitor the food supply and estimate nutrient consumption by consumers.

The glycemic index is not reproducible enough for diet advice nor does it affect metabolism. Use of the glycemic index (GI) remains controversial. Although some health organizations and a few countries promote use of the GI for dietary recommendations, the USDA/HHS *Dietary Guidelines for Americans* do not. Only limited data exist on variability between and within individuals and sources of that variability. ARS supported researchers and Tufts University collaborators examined these factors in 63 healthy adult volunteers. Using white bread as the standard GI food, variation between people was 20 percent but within the same person, repeated measures varied 25 percent, which indicates too large a difference to be useful or reproducible. Blood measures of insulin and glucose status together explained almost one-third of that variability. In another study, 91 obese adults ate reduced calorie diets with either high or moderate total carbohydrate levels and high or low GI for 17 weeks. There was no effect of any

diet on weight loss, fat loss, resting metabolic rate, or metabolic adaptation. These results demonstrate that GI is unlikely to be useful for guiding food choices in people.

A component of milk helps reduce the negative effects of higher saturated fat intake. The U.S. *Dietary Guidelines* urge limited intake of saturated fat because epidemiological data suggest it is associated with cardiovascular disease. However, results from previous human studies indicate this may not always be true. Consequently, ARS researchers at the Western Regional Research Center examined the effect of a high saturated fat meal on inflammatory markers in obese men and women for six hours following the meal. T wo different forms of saturated fat (i.e., palm oil and whipping cream) were ingested with and without the addition of milk fat globule membrane (MFGM). MFGM surrounds the fat globules in milk and has been shown to reduce inflammation associated with some foods. ARS researchers found that consumption of MFGM with either palm oil or whipping cream resulted in lower total cholesterol, LDL cholesterol, insulin, and small molecules associated with inflammation. This suggests that the addition of MFGM ameliorates the negative effect of a high saturated fat meal in overweight men and women.

Naturally occurring trans fatty acids have adverse effects on serum lipids. It is generally accepted that industrially produced trans fatty acids (TFA) found in partially hydrogenated oils lower beneficial HDL cholesterol and raise harmful LDL cholesterol, but no studies had ever directly examined the effects of consuming naturally occurring TFA from ruminant animals. ARS scientists in Beltsville, Maryland, conducted a feeding trial in 106 healthy adult volunteers who ate for 24 days three percent industrial TFA, three percent ruminant TFA, or one percent conjugated linoleic acid (i.e., CLA, another naturally occurring TFA but with a different chemical structure). Both types of TFA raised LDL cholesterol levels in the volunteers, and ruminant TFA also raised HDL cholesterol levels, whereas CLA led to lower triglyceride levels and had no effect on other lipids. These results support the current FSIS and FDA labeling guidelines.

Long-term caloric restriction reduces inflammation without impairing immunity. Calorie restriction (CR) slows aging and cancer growth in many animal species, but its relevance to humans is unknown. Inflammation is now deemed a major contributor to chronic diseases including heart disease and cancer. ARS supported scientists in Boston, Massachusetts, collaborated with colleagues at several other institutions to directly study this question by assigning 143 healthy, nonobese adults to CR, and 75 individuals to continue their usual intake for two years. CR led to a 10 percent weight loss and a reduction in circulating inflammatory markers. Long-term CR was associated with reductions in C-reactive protein and tumor necrosis factor-alpha by 40 percent and 50 percent, respectively. Both of these markers are associated with increased heart disease, cancer, and other chronic health problems. CR had no effect on the immune response as measured by antibody response to vaccines and delayed type hypersensitivity responses in the skin. Long-term CR appears to improve the health of young to middle-aged adults and may decrease risk of major chronic diseases.

Aging results in a decline of skeletal muscle quantity and function; these factors are major determinants of independent physical functioning in later life. ARS funded researchers and Tufts University collaborators examined 3-year changes in muscle mass, strength, power, and physical performance among older adults and mobility limited older subjects. They found that declining muscle function (i.e., strength and power) is an independent contributing factor, not just to falling, but to increased fear of falling and to deteriorations in quality of life. These findings reinforce the importance of preserving muscle health with advancing age to reduce fall risk.

Baseline data for the 2020 *Dietary Guidelines for Americans*. One of the gaps in dietary recommendations is the lack of science for dietary advice aimed at children from birth to 24 months of age. The U.S. government is committed to adding this age group to the dietary guidelines. Researchers from the ARS Children's Nutrition Research Center collaborated with investigators at Deakin University in Australia to analyze dietary intake reported by mothers of 2,740 infants and toddlers in a U.S. national survey from 2005 to 2012. In children younger than one year, infant formulas and baby foods were the leading source of calories and nutrients. In children aged 12 to 24 months, milk, 100 percent juice, and grain-based mixed dishes were important sources of calories and nutrients, but a number of foods contributing to energy intake had low nutritional quality, including sweet bakery products, sugar-sweetened beverages, and savory snacks. Nonflavored milk and ready-to-eat cereals were the most important contributors to micronutrient intakes. These data will help formulate future recommendations for this age group.

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

Current Activities:

ARS' Environmental Stewardship research program emphasis is on developing technologies and systems that support sustainable 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' research also focuses on 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 land 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:

Risk assessment tool for landscape management. Rangelands are vulnerable to soil erosion, runoff, and other damaging environmental processes. Prediction technologies are critical for managing rangeland resources. ARS scientists in Tucson, Arizona, developed the Rangeland Hydrology and Erosion Model (RHEM) tool to evaluate and illustrate how different rangeland conditions can affect the risk of excessive rangeland runoff and soil erosion. Users can program this Web-based tool to run alternative scenarios for a particular rangeland site, including a user-defined "baseline" scenario, optimal scenarios, or alternative scenarios. The program uses the baseline scenario for a specific site to project low, medium, high, and very high yearly erosion rates and then produces comparable estimates for other scenarios. This tool will greatly facilitate the development of formal Ecological Site Descriptions used by the NRCS, Forest Service, and Bureau of Land Management to characterize the hydrologic and vegetation functions of land resources, particularly for grazing lands.

New software helps prioritize sites for dam rehabilitation. More than 11,800 flood control dams have been constructed across the United States since 1948. Many are nearing the end of their planned life span of 50 years and some need rehabilitating to ensure their continued functionality. ARS, Kansas State University, and the NRCS developed and released Windows Dam Analysis Modules (WinDAM C), a Common Computing Environment (CCE)-certified software that incorporates algorithms developed by ARS scientists for predicting embankment dam failure because of internal erosion and embankment overtopping. This technology is designed to help dam safety engineers in NRCS, the Tennessee Valley Authority, the Federal Energy Regulatory Commission, and other Federal and state agencies identify embankment dams that are in the most urgent need of repair and rehabilitation. Dam experts in Brazil, Spain, and the United Kingdom have also expressed interest in using WinDAM C.

Enhanced efficiency nitrogen fertilizers can reduce nitrous oxide emissions. A portion of the nitrogen fertilizer that is applied to crop soils can be lost as nitrous oxide gas which is a potent greenhouse gas. ARS researchers in Kimberly, Idaho, monitored greenhouse gas emissions from a silage corn–barley–alfalfa rotation that received a stabilized urea fertilizer (SuperU), conventional granular urea in the spring, or dairy manure in the fall or spring. They found that SuperU reduced nitrous oxide emissions by 52 percent when corn was grown, but nitrous oxide emissions were not reduced when barley was grown. In all cases, nitrous oxide emissions from the soils were less than one percent of the applied nitrogen. However, nitrous oxide emissions were slightly higher when manure was applied, but the season of application did not impact the amounts emitted. This research demonstrates that SuperU

can reduce nitrous oxide emissions from selected (i.e., corn) irrigated cropping systems in the semiarid western United States which can help reduce greenhouse gas emissions from agricultural operations.

Increasing soil carbon sequestration and reducing carbon dioxide emissions with conservation tillage. Financial constraints and the lack of long-term research projects have limited studies of soil carbon sequestration rates and other changes in soil chemical properties under long-term conservation and conventional tillage. ARS scientists at Florence, South Carolina, created a 34 year tillage and crop management experiment on sandy soils. They found that it took a few decades to accumulate a significant amount of topsoil organic carbon, but that over the 34 year study, conservation tillage resulted in a net accumulation of about seven metric tons per hectare of soil organic carbon compared to conventional tillage. During the 34 year course of this experiment, 25 metric tons of carbon dioxide equivalents per hectare were sequestered. These results affirm that conservation tillage management can benefit U.S. producers by increasing soil organic carbon content and reducing greenhouse gas emissions.

Improved recovery of pathogenic *E. coli* from a bioaerosol sampler. Airborne pathogens generated during manure management are a potential health risk, however, these pathogens are often not recovered from liquid-based bioaerosol samplers. ARS researchers at Kimberly, Idaho, evaluated the effectiveness of several low viscosity collection fluids to improve the recovery of viable *E. coli* cells from bioaerosol samplers that monitor pathogen levels. Viable *E. coli* recovery rates ranged from 87 to 98 percent after 90 minutes of operating bioaerosol samplers with peptone or antifoam agents in comparison to lower recoveries using simple buffers or water. The results indicate that using these substances or similar agents will help organisms survive stresses associated the sampling process and improve the accuracy of bioaerosol sampling which will help researchers more accurately assess the abundance of airborne pathogens that may present a risk to human health.

Creating value added products from agro-industrial residues. Textile, leather, rubber, plastics, and food industries use synthetic dyes such as methylene blue (MB) to color their products. The wastewater generated by these processes commonly contains toxic compounds and/or carcinogens, is highly colored, and is commonly discharged into the environment. This contaminated discharge lowers oxygen levels and reduces light levels in the receiving waters, which leads to reduced photosynthesis in aquatic environments. ARS scientists from Bowling Green, Kentucky, used an acid dissolution precipitation process to extract silica and residual ash from agro-industrial residues and found the silica and ash provided a low cost adsorbent for removing MB from aqueous waste streams. These findings can potentially lead to an eco-friendly and sustainable method for transforming agro-industrial wastes into value added starting materials for different industrial applications, as well as for developing adsorbent materials that can be used to treat chemical pollution.

Finding genetic resistance in cattle to poisoning by toxic grazing plants. Cattle grazing on western U.S. rangelands are at risk of grazing on larkspur and other neurotoxic rangeland plants. ARS scientists conducted DNA testing to identify Angus bull and steer genes that convey resistance to larkspur toxins and then selected Angus bulls expressing these genes for progeny testing. This information will benefit ranchers where larkspur and other neurotoxic plants infest rangelands, and will help producers reduce cattle losses by making genetic-based grazing decisions and by increasing livestock holdings with heifers and bulls that exhibit resistance.

Innovative approaches for remotely monitoring land surface conditions. Better remote sensing methodologies and data acquisition technologies are needed to accurately assess and map rangeland vegetation and monitor rangeland health. ARS scientists compared actual ground-based phonology data with canopy greenness data remotely collected by tower cameras (i.e., phenocams), UAV-based digital imagery, and satellite sensors. Remotely collected information on canopy greenness is useful for estimating plant phenology and production. The results demonstrated that inexpensive phenocams provide valuable data in near real time. An ARS scientist in Las Cruces, New Mexico, was invited to two workshops hosted by the National Coordinating Office of the National Phenology Network as part of an effort to integrate phenological observations collected at different scales. These efforts contribute to the ongoing development of an LTAR cross-site multi-scale phenology data network. Land managers will benefit from technologies that gather landscape information more quickly and accurately.

Growers profit from segregating wheat by protein content. Conventional harvest practices often include bulking high protein wheat, which typically has a higher commodity value, together with other harvested wheat grains. ARS scientists in Pendleton, Oregon, designed and constructed a complete harvesting system consisting of: 1) an optical

sensor for measuring grain protein on a combine harvester; 2) an electrical/mechanical device for physically separating low and high quality grain during harvest; and 3) software for calculating the best economic point at which to segregate grain into two bins. They tested this system to determine if segregating hard red spring wheat into two bins was more profitable than conventional bulking into one bin. Their results indicated that segregating wheat by protein content can under certain conditions increase the value of each bushel of grain. During years with large market price spreads and above average yields, net returns from segregating wheat were up to $9.32 per acre greater than returns from bulking into a single bin. Growers can use this system to evaluate potential returns from grain segregation when economic conditions favor grain segregation which may improve producer profits.

Corn growth simulation model testing reveals huge range of water use predictions. Growth models that simulate corn (maize) growth predict plant water use rates to estimate how many days growth can occur following a rain or irrigation event before the soil water supply is exhausted. Eight years of water use (i.e., evapotranspiration or ET) measurements collected by an ARS researcher at Ames, Iowa were used for comparison testing as part of the international Agricultural Model Inter-comparison and Improvement Project (AgMIP). An ARS collaborator at Maricopa, Arizona, compiled initial ET predictions from 24 models run by 16 research groups around the world, including ARS researchers at Maricopa, Arizona, and Beltsville, Maryland. ET estimates from the models were found to vary by almost a factor of four and many of the predictions differed greatly from measured water use. This test conclusively identifies a weakness of many crop growth models and highlights the need for focused research to improve model routines for calculating crop water use.

High temperature impacts on corn hybrids. Projected increases of air temperatures have the potential to affect plant growth, but different crop varieties may be affected in different ways because of genetic variability. ARS researchers at Ames, Iowa, evaluated how high temperatures affected growth rates and grain yields of three corn hybrids. All three hybrids showed a faster rate of growth and large grain yield reductions when grown under higher air temperatures that are expected to occur by the end of this century. The most significant air temperature factor affecting grain yield was exposure to high nighttime temperatures during the grain filling period. These results will help the development of new crop varieties and management practices as growing conditions change.

LTAR network rangeland wind erosion research and model calibration. Wind erosion from rangelands degrades soil productivity, causes highway fatalities from reduced visibility, creates human health problems, and causes abrasive damage to infrastructure. Rangeland wind erosion data is needed to advance basic research, develop models for simulating how management actions mitigate rangeland erosion, and develop effective management options for reducing rangeland soil erosion. Working within the LTAR network, scientists in Las Cruces, New Mexico, coordinated the installation of wind erosion monitoring sites at three LTAR network locations. Installations at four other LTAR sites are scheduled to become operational during 2017. Instruments at the three completed sites are now collecting a suite of measurements (e.g., sediment mass flux, meteorological conditions, and dust deposition) with automated real time relay of the data to researchers. The long-term study of wind erosion on multiple ecological sites across the western United States will provide data needed to assess how land management and land use affects rangeland wind erosion. It will also support the development of mitigation strategies for protecting natural resources and human health and enhancing agricultural productivity.

Library and Information Services

Current Activities:

The National Agricultural Library (NAL) is one of the largest and most accessible agricultural research libraries in the world. NAL provides services directly to the staff of USDA and to the public, primarily via the NAL Web site, http://www.nal.usda.gov. NAL was formed 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:

PubAg. NAL continued technical development of PubAg, as well as building up content of the service. In September 2016, PubAg reached 49,000 full text scientific articles written by USDA researchers and 1,340,030 citations to peer reviewed, agriculture related scientific articles. Each article citation in PubAg includes NAL Thesaurus subject terms, and a link to the article, if available from the internal NAL repository, PubMed Central, and the publisher. The third phase of PubAg is expected to add 6,000 full text articles resulting from USDA funding and 400,000 highly relevant citations from scholarly agricultural and allied journals. PubAg can be found at http://PubAg.nal.usda.gov.

i5K Workspace at NAL. NAL implemented new tools, added new data, and performed updates to the i5k Workspace@NAL, a Web resource for arthropod genome access and curation. New tools include Web applications for the HMMER and Clustal search and alignment algorithms. Ten new species (for a total of 52) and 70 new datasets were contributed by the community and added. A new user interface, new gene pages, the SOLR search engine, and a new metadata submission system were implemented. The i5k Workspace's user base grew to more than 450 registered users. Training was held to familiarize them with available data sets and resources. Eleven articles were published in 2016 citing the i5k Workspace. A high profile genome project published in 2016, the bed bug, relied on the i5k Workspace infrastructure for its manual curation effort at (www.nature.com/articles/ncomms10165).

Ag Data Commons. NAL continued development of the Ag Data Commons catalog for agricultural research datasets (https://data.nal.usda.gov). Development focused on feature enrichment, increasing transparency for submitters, and adding a curation workflow. Currently, more than 230 datasets with 730 resources for ARS and USDA funded research results have been deposited. Alliances were initiated with several USDA agencies to encourage dataset deposition in Ag Data Commons and collaborate on technology development.

LTAR Data Portal. NAL developed new data portal components including a viewer to compare historical imagery with almost 600 images of the LTAR locations, and tools to protect data integrity, particularly tracking corrections to data values during the scientist's quality control and quality assurance processes. Portal data grew to over a half million meteorological observations, and 36 cameras taking high resolution photographs in two spectral bands to record agricultural field conditions.

Life Cycle Assessment Commons. NAL added the openLCA product system feature to its unit process data for field crop production. A draft MOU, "Cooperation on Data, Research, and Information Systems for Life Cycle Assessment Analysis," was submitted to the USDA Office of Chief Scientist for signature. Co-signers to the MOU include: the EPA, DOE, and the National Institute for Standards and Technology. Work was completed on the basic infrastructure and prototype data management application for a LCA Collaboration Server. This technology enables LCA modelers using openLCA to collaborate on modeling activities then commit data to the LCA Commons using Web services.

NAL Digital Collections. NAL digital repository grew to ten collections, including 49,000 peer reviewed journal articles authored by USDA researchers and more than 30,000 historical documents and reports. In FY 2016, users downloaded 13,447,529 full text items.

NAL Mass Digitization. NAL digitized and created citation information for 20,275 items (1,083,197 pages), bringing the total number of digitized items in the library's collection to 115,500 (approx. 5,400,000 pages). NAL continues a large scale digitization project to digitize agricultural literature and provide public online access.

DigiTop. NAL and USDA partners licensed on behalf of USDA users a $5.3 million portfolio of content consisting of full text and databases to support research and scientific discovery.

Automated Indexing. NAL continued improving full scale production -- automated indexing/text analytics software to generate the AGRICOLA Index of agricultural literature.

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

Buildings and Facilities

[For the acquisition of land, construction, repair, improvement, extension, alteration, and purchase of fixed equipment or facilities as necessary to carry out the agricultural research programs of the Department of Agriculture, where not otherwise provided, $212,101,000 to remain available until expended.]

Agricultural Research Service

Lead-Off Tabular Statement

Current Law

Buildings and Facilities

Budget Estimate, 2018	-
2017 Annualized Continuing Resolution	$211,698,000
Change in Appropriation	-211,698,000

Summary of Increases and Decreases
(Dollars in thousands)

	2015 Actual	2016 Change	2017 Change	2018 Change	2018 President's Budget
Discretionary Appropriations:					
Total	$45,000	+$167,101	-$403	-$211,698	-

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

Program	2015 Actual		2016 Actual		2017 Estimate		Inc. or Dec.		2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Buildings and Facilities										
Discretionary Appropriations:										
Buildings and Facilities	$45,000	-	$212,101	-	$211,698	-	-$211,698	-	-	-
Subtotal	45,000	-	212,101	-	211,698	-	-211,698	-	-	-
Total Appropriation	45,000	-	212,101	-	211,698	-	-211,698	-	-	-
Rescission	-1,530		-	-	-	-	-211,698	-	-$211,698	-
Balance Available, SOY	1,530		44,055	-	248,665	-	55,208	-	303,873	-
Recoveries, Other (Net)	94		28	-	-	-	-	-	-	-
Total Available	45,094	-	256,184	-	460,363	-	-368,188	-	92,175	-
Bal. Available, EOY	-44,055	-	-248,665	-	-303,873	-	290,798	-	-13,075	-
Total Obligations	1,039	-	7,519	-	156,490	-	-77,390	-	79,100	-

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

Program	2015 Actual		2016 Actual		2017 Estimate		Inc. or Dec		2018 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Buildings and Facilities										
Discretionary Obligations:	$1,039	-	$7,519	-	$156,490	-	-$77,390	-	$79,100	-
Total Obligations.....	1,039	-	7,519	-	156,490	-	-77,390	-	79,100	-
Bal. Available, EOY.....	44,055	-	248,665	-	303,873	-	-290,798	-	13,075	-
Total Available.....	45,094	-	256,184	-	460,363	-	-368,188	-	92,175	-
Rescission.....	1,530	-		-	-	-	+211,698	-	211,698	-
Bal. Available, SOY.....	-1,530	-	-44,055	-	-248,665	-	-55,208	-	-303,873	-
Recoveries, Other (Net).....	-94	-	-28	-	-	-	-	-	-	-
Total Appropriation.....	45,000	-	212,101	-	211,698	-	-211,698	-	-	-

Buildings and Facilities

Classification by Objects
(Dollars in thousands)

		2015 Actual	2016 Actual	2017 Estimate	2018 President's Budget
Other Objects:					
32.0	Land and structures	$1,039	$7,519	$156,490	$79,100
99.9	Total, new obligations	1,039	7,519	156,490	79,100

Status of Construction Projects as of March 2017

Status of research facilities authorized or funded in prior years and reported as uncompleted in the 2017 Explanatory Notes, are as follows:

NOTE: Program Of Requirement: 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%. YEARS: All references to years are fiscal years.

Location and Purpose	Year	Amount of Funds Provided	Description
Arizona, Tucson Southwest Watershed Research Center	2016 Design and Construction	$12,400,000	Design/Programming was awarded in the 4th Quarter of 2016 and will be completed in the 4th Quarter of 2017. Construction will be awarded in the 3rd Quarter of 2018 and completed in the 1st Quarter of 2020.
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) was completed 1st Quarter 2010. Construction contract award for the final phases 3 thru 6 was awarded 3rd Quarter 2010 with ARRA funding and was completed 3rd Quarter 2015.
Western Regional Research Center	2001 Construction	4,889,220	
(Research and Development Facility)	2002 Construction	3,800,000	
	2009 ARRA	15,624,460	
	2015 Rescission	($166)	
	Total	26,913,514	
California, Davis	2004 Planning and Design	$2,684,070	POR completed 2nd Quarter 2007. Lease agreement with University was not executed.
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	A design update was awarded in the 1st Quarter of 2017 and will be completed in the 3rd Quarter of 2017. Construction schedules will be developed once funding is available.
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($14,937,644)	
	2016 Design	$1,300,000	
	Total	$5,116,375	
Connecticut, Storrs	2008 Planning and Design	$1,869,819	POR completed 4th Quarter 2010. Lease agreement was not executed.
Center of Excellence for Vaccine Research	2009 Design and Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($7,221,296)	
	Total	494,523	

Location and Purpose	Year	Amount of Funds Provided	Description
District of Columbia U.S. National Arboretum	2000 Planning and Design 2001 Design and Construction 2002 Design and Construction 2003 Design and Construction 2008 Construction 2009 ARRA 2011 Rescission Total	$500,000 3,322,674 4,600,000 1,688,950 695,100 8,041,842 ($2,066,637) 16,781,929	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.
Florida, Canal Point Agricultural Research Service Laboratory	2008 Planning and Design 2009 Planning and Design 2010 Construction 2011 Rescission 2015 Rescission Total	$521,325 1,096,000 3,422,000 ($4,106,211) ($149,125) 783,989	POR completed 2nd Quarter 2011. Land purchases complete. Historic preservation consultation completed and building demolition contract awarded 4th quarter of 2016. Demolition will be completed in the 3rd quarter of 2017.
Georgia, Athens Southeast Poultry Research Laboratory	1992 Planning 1993 Construction 2008 Planning and Design 2009 Planning and Design 2011 Rescission 2015 Planning, Design, Const. 2016 Construction Total	$400,000 677,000 2,780,400 2,427,000 ($5,832,898) 45,000,000 113,701,000 159,152,502	Draft POR completed 1st Quarter 2007. The POR was awarded in the 3rd Quarter of 2015 and completed 4th Quarter 2015. Design was awarded 4th Quarter 2015 and completed in the 3rd Quarter 2016. Design Build Contract Award is planned for 3rd Quarter of 2017. Total contract duration from notice to proceed to completion is expected to take 5½ years (all work completed 3rd Quarter 2023). However the Government will take ownership of buildings as they are completed and accepted. The estimated completion by building is as follows: B49 Hatchery/Brooding - 1st Quarter 2019 B47 BLS-3 Animal Holding/Laboratory - 2nd Quarter 2020 B48 SPF Animal Holding - 3rd Quarter 2020 B45 Laboratory/Office/Administration - 1st Quarter 2021 B46 BSL-2 Animal Holding - 2nd Quarter 2022 Finalize Roadways, Sidewalks etc. - 3rd Quarter 2023
Hawaii, Hilo U.S. Pacific Basin Agricultural Research Center	1999 Planning and Design 2000 Construction 2001 Construction 2002 Construction 2003 Design and Construction 2004 Construction 2005 Construction 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission 2015 Rescission Total	$4,500,000 4,500,000 4,989,000 3,000,000 2,980,500 4,831,326 2,976,000 3,588,750 1,737,750 1,565,000 5,000,000 ($7,730,452) ($129,570) 31,808,304	Design of Phases 1 and 2 is complete. Construction of Phase 1 completed 3rd Quarter 2007. Construction contract for Phase 2 awarded 4th Quarter 2010 and completed 1st Quarter 2012.
Idaho, Hagerman Aquaculture Facility	2005 Planning and Design 2006 Construction 2008 Construction 2009 Construction 2011 Rescission Total	$992,000 990,000 695,100 544,000 ($2,907,600) 313,500	Lease agreement is in place. POR completed 3rd Quarter 2007.

Location and Purpose	Year	Amount of Funds Provided	Description
Illinois, Peoria	2000 Construction Design	$1,800,000	The modernization of the Chemical Wing was completed in 3 segments. The construction of phases 1 and 2 is complete. Construction for all remaining phases of the Central Wing awarded 2nd Quarter 2010 using ARRA funding and completed 3rd Quarter 2012.
National Center for Aquacultural	2002 Construction	6,500,000	
Utilization Research	2004 Construction	2,684,070	
(Central Wing)	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2009 ARRA	16,237,165	
	2015 Rescission	($142,565)	
	Total	37,705,239	
Iowa, Ames	2001 Design and 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. -Phase 1 Lab/Office (APHIS) completed in 2004. -Large Animal BSL-3Ag facilities construction completed 2nd Quarter 2007. -Central Utility Plant and Infrastructure, Phase 1 and 2 construction is complete. Phase 3 construction completed 1st Quarter 2009. -Construction of the Consolidated Laboratory Facility completed 2nd Quarter 2009. -Low Containment Large Animal Facility construction completed 1st Quarter of 2009. Demolition of existing facilities on 1st and 2nd Street completed 3rd Quarter 2012. Bldgs. 1 and 2 demo will be completed in the 4th Quarter of 2017, as site restoration work was added to the scope.
National Centers for Animal Health	2002 Design and Construction	40,000,000	
	2002 Construction	50,000,000	
	2002 APHIS Transfers	15,753,000	
	[Supplemental]	[14,081,000]	
	[Other Transfers]	[1,672,000]	
	2002 Construction	25,000,000	
	2003 Construction	32,785,500	
	2003 Construction	110,000,000	
	2005 Construction	121,024,000	
	2006 Construction	58,212,000	
	2015 Rescission	($1,108,686)	
	Total	460,646,014	
Iowa, Ames	2016 Design and Construction	$13,500,000	Design awarded 4th Quarter 2016 and will be completed in the 3rd Quarter of 2017. Construction will be awarded in the 1st Quarter of 2018 and completed in the 3rd Quarter of 2019.
National Laboratory for Agricultural and the Environment			
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 completed 2nd Quarter 2012.
Animal Waste Management Research	2006 Construction	2,970,000	
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	POR is complete. Lease agreement terminated 2016. Design (100%) was completed 2nd Quarter 2011.
Forage Animal Research Laboratory	2006 Construction	3,960,000	
	2008 Construction	2,085,300	
	2009 Construction	1,632,000	
	2010 Construction	2,000,000	
	2011 Rescission	($9,678,689)	
	Total	2,974,611	

Location and Purpose	Year	Amount of Funds Provided	Description
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 completed 2nd Quarter 2008. Phase 1A construction 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	
	2015 Rescission	($100)	
	Total	15,935,504	
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 completed 4th Quarter 2008. Construction of the LTR awarded 3rd Quarter 2009 and completed 3rd Quarter 2011.
Southern Regional Research Center	1999 Modernization	6,000,000	
(Industrial Wing)	2000 Modernization	5,500,000	
	2006 Supplemental (design)	4,900,000	
	2006 Supplemental (construction)	20,000,000	
	Total	37,500,000	
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 and Construction	2,684,070	
	2005 Design and Construction	2,976,000	
	2006 Design and Construction	2,475,000	
	2011 Rescission	($2,012,504)	
	Total	20,707,591	
Maryland, Beltsville	1988 Design and Construction	$5,750,000	Study to evaluate boiler plants, steam lines, and electrical distribution completed 4th Quarter 2009. Construction contract for repairs to boiler plants and portions of the steam distribution system awarded 4th Quarter 2010 with ARRA funding and completed 2nd Quarter 2012. Design-Build contract for major renovations to Building 306 awarded 4th Quarter 2010 with ARRA funding and completed 4th Quarter 2012.
Beltsville Agricultural Research	1989 Design and Construction	6,100,000	
Center, (BARC)	1990 Design and Construction	9,860,000	
	1991 Design and Construction	15,999,792	
	1992 Design and Construction	16,000,000	
	1993 Design and Construction	13,547,000	
	1994 Design and Construction	19,700,000	
	1995 Design and Construction	3,960,000	
	1996 Design and Construction	8,000,000	
	1997 Design and Construction	4,500,000	
	1998 Design and Construction	3,200,000	
	1999 Design and Construction	2,500,000	
	2000 Design and Construction	13,000,000	
	2001 Design and Construction	13,270,740	
	2002 Design and Construction	3,000,000	
	2003 Design and Construction	4,152,830	
	2004 Design and Construction	2,684,070	
	2005 Design and Construction	2,976,000	
	2006 Design and Construction	3,588,750	
	2009 Design and Construction	2,192,000	
	2009 ARRA	21,513,046	

Location and Purpose	Year	Amount of Funds Provided	Description
	2010 Construction	3,000,000	A design update for Building 307 was awarded in the 4th Quarter of 2016 and will be completed in
	2011 Rescission	($9,831,954)	completed in the 4th Quarter of 2017. Construction will be awarded in the 2nd
Renovate Building 307	2016 Design and Construction	37,100,000	Quarter of 2018 and completed in the 4th Quarter of 2019.
	Total	205,762,274	
Maryland, Beltsville	1998 Design and Construction	$2,500,000	Renovation of the NAL building continues. Completed projects include: replacement of the
National Agricultural Library	1999 Design and Construction	1,200,000	computer room HVAC and fire suppression systems; completion of chiller replacement and brick
	2001 Design and Construction	1,766,106	repairs of three building elevations; and 14th floor window replacements. Construction for the
	2002 Construction	1,800,000	deteriorated building envelope, repair of brick facade, and replacement of the plumbing system
	2003 Design and Construction	1,490,250	awarded 1st Quarter 2010 using ARRA funding and completed 3rd Quarter 2012.
	2004 Design and Construction	894,690	
	2009 ARRA	6,357,422	
	2011 Rescission	($115,175)	
	Total	15,893,293	
Maryland, Frederick (Fort Detrick)	2016 Design	$4,900,000	Design/Programming was awarded in the 4th Quarter of 2016 and will be completed in the 1st
Foreign Disease-Weed Science Research Laboratory			Quarter of 2018. Construction schedules will be developed once funding is available.
Michigan, East Lansing	1992 Planning	$250,000	Design (100%) for this multi-phased facility modernization is complete.
Avian Disease and Ocology Laboratory	1993 Planning	212,000	
	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 completed 4th Quarter 2009.
Biotechnology Laboratory	2008 Planning and Design	1,390,200	POR 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 awarded 4th Quarter 2007 and completed 1st Quarter
Thad Cochran Southern Horticulture	2003 Construction	9,140,200	2008.
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%) completed 1st Quarter 2008.
Poultry Science Research Facility	2006 Construction	4,950,000	
	2008 Construction	1,390,200	
	2009 Construction	3,177,000	
	2011 Rescission	($10,345,645)	
	Total	2,147,555	

Location and Purpose	Year	Amount of Funds Provided	Description
Mississippi, Stoneville	2004 Construction	$4,831,326	Design (100%) completed. Construction of Phase 1 completed. Construction of mechanical, electrical, and plumbing systems for phases 2 thru 5 (of 5 total) and repair of deteriorated building envelope awarded 3rd Quarter 2010. Phase 2 and 3 completed 1st Quarter 2013, Phase 4 completed 2nd Quarter 2015, and Phase 5 completed 2nd Quarter 2016.
Jamie Whitten Delta States	2005 Construction	2,976,000	
Research Center	2008 Construction	2,780,400	
	2009 ARRA	36,347,783	
	2010 Construction	4,000,000	
	2011 Rescission	($6,047,327)	
	2015 Rescission	($134)	
	Total	44,888,048	
Missouri, Columbia	2004 Planning and Design	$2,415,663	Design (100%) 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	
Montana, Bozeman	2005 Planning and Design	$1,984,000	Lease agreement in place. Conceptual Design (35%) 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) completed in 2003 and Phase 2 (Quarantine Lab) 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 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	

Location and Purpose	Year	Amount of Funds Provided	Description
New York, Ithaca	2004 Planning and Design	$3,847,167	Design (100%) 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 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	
Oklahoma, Woodward	2002 Planning and Design	$1,500,000	Phases 1 and 2 of the three-phased construction project completed.
Southern Plains Range Research Center	2003 Construction	7,948,000	
	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 completed 2nd Quarter 2012.
	2000 Construction	4,400,000	
	2002 Design and Construction	5,000,000	
	2009 ARRA	15,084,486	
	2015 Rescission	($2)	
	Total	36,784,484	
South Carolina, Charleston	1988 Feasibility Study	$50,000	Construction of Phase 1 (laboratory) and Phase 2A (Headhouse) completed. Phase 2B (Greenhouse)
U.S. Vegetable Laboratory	1990 Planning and Construction	1,135,000	construction awarded 2nd Quarter 2007 and completed 4th Quarter 2008.
	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

Location and Purpose	Year	Amount of Funds Provided	Description
Texas, Houston Children's Nutrition Research Center	2016 Design and Construction	$29,200,000	Design awarded in the 4th Quarter of 2016 and will be completed in the 3rd Quarter of 2017. Construction on hold pending decisions about 2018, including decisions about the possible redirection of funds from Houston to another project on the 2012 ARS CIS priority list.
Texas, Kerrville	2008 Planning and Design	$1,390,200	POR 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	
Washington, Pullman	2004 Planning and Design	$3,936,636	Lease agreement with University in place. Conceptual Design (35%) completed.
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) completed 3rd Quarter 2007. The construction of the Greenhouse completed 1st Quarter 2008. POR for the new laboratory completed 2nd Quarter 2010. Conceptual design for new laboratory 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 and Construction	$2,200,000	Construction completed 3rd Quarter 2008.
National Center for Cool and Cold	2006 Construction	891,000	
Water Aquaculture	2011 Rescission	($4,717)	
(Broodstock Facility)	Total	$3,086,283	

Location and Purpose	Year	Amount of Funds Provided	Description
Wisconsin, Marshfield Nutrient Management Laboratory	2003 Planning, Design and Construction	$2,980,500	Design (100%) of Phase 1 and Phase 2 completed. Phase 1 (Nutrient Lab) construction completed 4th Quarter 2008. Phase 2 construction (Animal Holding Facility) awarded 4th Quarter 2007. Phase 2 construction completed 1st Quarter 2010.
	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 Dairy Forage Agriculture Research Center	2008 Planning and Design	$2,502,360	POR completed 3rd Quarter 2011
	2009 Construction	2,002,000	
	2010 Construction	4,000,000	
	2011 Rescission	($7,675,381)	
	Total	828,979	

Summary of Budget and Performance

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.

The Department will be revising the USDA Strategic Plan later in the spring and expects to release it with the FY 2019 President's Budget.

Key Performance Measures:

Environmental Stewardship

Improve management tools to ensure quality atmosphere and soil resources; informed responses to climate variability; and safe and beneficial utilization of manure and other byproducts.		
2016 Actual	**2017 Target**	**2018 Target**
• Assess the potential risks and benefits to agricultural systems from climate change, and develop agricultural management practices and decision support strategies that enable producers to take advantage of the beneficial effects, and adapt to the adverse effects of climate change. • Develop management practices and decision tools to improve soil quality, protect the environment, and contribute to the sustainability of agricultural systems. • Assess the greenhouse gas emissions from agricultural systems and develop methods for reducing the emissions.	• Develop management practices and decision tools to improve quality and resilience of agricultural soils, protect air quality, improve production amidst climate variability, and reduce net GHG emissions. • Manage odor and reduce atmospheric emissions from animal production facilities, including increased efficiency of recovery and utilization of manure nutrients, biogas and other byproducts. • Develop management practices that promote soil biological components and improve agricultural system productivity resulting in validated and quantitative positive impacts on agro-ecosystem function. • Reduce the abundance, movement and environmental impact of pathogens in manure and Pharmaceutically Active Compounds (PACs), and assess the presence, distribution, and	• Develop management practices and decision tools to improve quality and resilience of agricultural soils, protect air quality, improve production amidst climate variability, and reduce net GHG emissions. • Manage odor and reduce atmospheric emissions from animal production facilities, including increased efficiency of recovery and utilization of manure nutrients, biogas and other byproducts. • Develop management practices that promote soil biological components and improve agricultural system productivity resulting in validated and quantitative positive impacts on agro-ecosystem function. • Reduce the abundance, movement and environmental impact of pathogens in manure and Pharmaceutically Active Compounds (PACs), and assess the presence, distribution, and

2016 Actual	2017 Target	2018 Target
	impact of antibiotic resistant bacteria and antibiotic resistance genes in manures, soils and surrounding environments.	impact of antibiotic resistant bacteria and antibiotic resistance genes in manures, soils and surrounding environments.

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

2016 Actual	2017 Target	2018 Target
• Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management. • Develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality. • Develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.	• Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management. • Develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality. • Develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.	• Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management. • Develop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality. • Develop new or improved knowledge, tools, technologies, guidelines, and/or conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve watershed management and ecosystem services in agricultural landscapes.

Selected Past Accomplishments Toward the Achievement of the Key Outcome:

- Monitored greenhouse gas emissions from a silage corn-barley-alfalfa rotation and found that enhanced efficiency nitrogen fertilizers can reduce nitrous oxide emissions.
- Developed “Windows Dam Analysis Modules” software for predicting embankment dams that are in the most urgent need of repair or rehabilitation.
- Developed the “Rangeland Hydrology and Erosion Model Tool” to evaluate and illustrate how different rangeland conditions can affect the risk of excessive runoff and soil erosion.
- Conducted research that affirmed that conservation tillage management can benefit U.S. producers by increasing soil organic carbon content and reducing greenhouse gas emissions from agricultural production.
- Found that current crop growth models are inadequate and highlighted the need to develop improved models for calculating crop water use.

Crop Production

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.

2016 Actual	2017 Target	2018 Target
• Breed superior new crops, varieties, and enhanced germplasm. • Devise innovative approaches to crop genetic improvement and trait analysis. • Expand crop genomic information resources and advanced bioinformatic capabilities. • Conserve and encourage the use of plant and microbial genetic resources and associated information. • Expand fundamental knowledge of plant biological and molecular processes. • Develop more effective methods to enhance biotechnology for crop improvement. • Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency. • Improve pollinator health, bee systematics and germplasm lines, and pollination.	• Breed superior new crops, varieties, and enhanced germplasm. • Devise innovative approaches to crop genetic improvement and trait analysis. • Expand crop genomic information resources and advanced bioinformatic capabilities. • Conserve and encourage the use of plant and microbial genetic resources and associated information. • Expand fundamental knowledge of plant biological and molecular processes. • Develop more effective methods to enhance biotechnology for crop improvement. • Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency. • Improve pollinator health, bee systematics and germplasm lines, and pollination.	• Breed superior new crops, varieties, and enhanced germplasm. • Devise innovative approaches to crop genetic improvement and trait analysis. • Expand crop genomic information resources and advanced bioinformatic capabilities. • Conserve and encourage the use of plant and microbial genetic resources and associated information. • Expand fundamental knowledge of plant biological and molecular processes. • Develop more effective methods to enhance biotechnology for crop improvement. • Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency. • Improve pollinator health, bee systematics and germplasm lines, and pollination.

Selected Past Accomplishments Toward the Achievement of the Key Outcome:

- Completed a major update of the Germplasm Resources Information Network (GRIN), the global standard for managing and delivering information associated with plant germplasm.

- Released a new, high yielding drought tolerant Soybean cultivar, "USDA-N8002."
- Created transgenic wheat lines in which the omega-5 gliadins, the major sensitizing allergens in a severe food allergy, were significantly reduced in the flour without adverse effects on flour quality.
- Released two new high phytonutrient potato varieties, "Yukon Nugget," and "Smilin Eyes," that have higher yields, improved disease resistance, and greater antioxidant concentrations.
- Developed and released a sunflower germplasm resistant to Sunflower Rust and Downy Mildew, two of the most devastating diseases of sunflower.
- Developed three new bioinformatic tools to accelerate maize and rice breeding and research.
- Developed and released a new winter club wheat cultivar, "Pritchett," resistant to several wheat diseases, and with better milling and baking quality than the standard variety.
- Released eight new high yielding sugarcane varieties that are especially adapted to the sandy soils in Florida, and that have improved resistance to rust diseases.

Livestock Production

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

2016 Actual	2017 Target	2018 Target
• Identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.	• Identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.	• Identify underlying genetic and/or physiologic mechanisms relating to food animal production and production efficiencies for traits associated with growth physiology, nutrient utilization, reproductive physiology, health, and well-being in food animals.
• Develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals	• Develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals	• Develop genomics infrastructure and tools to efficiently identify genes, their function, and interactions with environmental factors for exploitation in genome enabled improvement programs for food animals.
• Develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.	• Develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.	• Develop and improve sustainable production systems for food animals; incorporating strategies to optimize production system efficiency while ensuring economic and environmental sustainability.
• Characterize nutrient requirements of food animals; measure nutrient availability of traditional and nontraditional feedstuffs; and develop strategies for improving nutrient use efficiency.	• Characterize nutrient requirements of food animals;	• Characterize nutrient requirements of food animals; measure nutrient availability of traditional and nontraditional feedstuffs; and develop strategies for improving nutrient use efficiency.

2016 Actual	2017 Target	2018 Target
• Characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.	measure nutrient availability of traditional and nontraditional feedstuffs; and develop strategies for improving nutrient use efficiency. • Characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.	• Characterize food animal germplasm for traits of importance and continue to increase the inventory of germplasm stored within the National Animal Germplasm Repository to preserve biodiversity.

Selected Past Accomplishments Toward the Achievement of the Key Outcome:

- Conducted research which found that the rumen bacterial community in dairy cows affects milk production efficiency.
- Identified 35 genetic markers associated with liver abscess susceptibility in cattle. These markers may be useful in genetic selection programs to reduce the incidence of the disease.
- Demonstrated that glucosamine supplementation during late gestation increases sow litter size.
- Produced a database that dairy producers use in about 50 countries to accelerate genetic progress and select parents who can produce healthier, more productive dairy cattle.
- Demonstrated that coating catfish feed with the enzyme phytase, which destroys phytate, can boast the uptake of iron and other key nutritional minerals, improving the health and production of farmed catfish.
- Found that an oral vaccine for Enteric Septicemia of catfish improves fish health, growth rates, and production.

Livestock Protection

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.

2016 Actual	2017 Target	2018 Target
• Describe 5 new discoveries or developments significant for their scientific or applied value. • Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of animal pathogens,	• Describe 5 new discoveries or developments significant for their sientific or applied value. • Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of	• Describe 5 new discoveries or developments significant for their scientific or applied value. • Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new methods for detection and identification of

2016 Actual	2017 Target	2018 Target
arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification. • Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.	animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification. • Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.	animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification. • Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.

Selected Past Accomplishments Toward the Achievement of the Key Outcome:

- Conducted research on the genetics of a “glycoprotein” and evaluated its potential as a vaccine for Classical Swine Fever.
- Conducted research which provides a better understanding of classical versus atypical Bovine Spongiform Encephalopathy (BSE), important information on the potential public health risk of atypical BSE.
- Gained insights into the differences in the immune response of Marek’s disease resistant chickens which may be used in the future in reducing losses from the disease.
- Developed an early warning system for Rift Valley Fever in Kenya.
- Investigated the efficacy of liquid larvicide against mosquitoes that are responsible for spread of Zika, chikungunya, yellow fever and dengue viruses.
- Developed a new anti-cattle fever tick vaccine which is now being used in an integrated vector control program.
- Developed a field portable, rapid detection kit to identify imported fire ants. APHIS plans to use the kits at interdiction sites to enforce the quarantine.