2019 President's Budget Agricultural Research Service

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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.

<u>ARS' Headquarters Offices</u> 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, 2017, there were 5,329 permanent, full-time employees including 480 in the Headquarters offices and 4,849 in field offices.

OIG Reports (Completed)

11601-0001-41, 9/11/2017, Departmental Oversight of Final Action on OIG Audit Recommendations.

50401-0011-11, Department of Agriculture's Consolidated Balance Sheet for Fiscal Year 2016.

50501-0012-12, U.S. Department of Agriculture, Office of the Chief Information Officer, Fiscal Year 2016 Federal Information Security Modernization Act.

OIG Reports (In Progress)

50024-0001-22, CIGIE Purchase Card Initiative - USDA Controls over Purchase Card Use.

50401-0013-11, Department of Agriculture's Consolidated Balance Sheet for Fiscal Year 2017.

50501-0015-12, U.S. Department of Agriculture, Office of the Chief Information Officer, Fiscal Year 2017 Federal Information Security Modernization Act.

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

50701-0001-21, USDA Agency Activities for Agroterrorism Prevention, Detection, and Response.

GAO Reports (Completed)

GAO-17-63, 12/1/2016, Enterprise Risk Management: Selected Agencies' Experiences Illustrate Good Practices in Managing Risk.

GAO-17-73R, 10/31/2016, Reported Inventory, Use, and Cost of Federally Owned Aircraft.

GAO-17-94, 11/28/2016, Renewable Fuel Standard: Program Unlikely to Meet Its Targets for Reducing Greenhouse Gas Emissions.

GAO-17-108, 11/28/2016, Renewable Fuel Standard: Low Expected Production Volumes Make It Unlikely that Advanced Biofuels Can Meet Increasing Targets.

GAO-17-119, 10/14/2016, Environmental Protection: Information on Federal Agencies' Expenditures and Coordination Related to Harmful Algae.

GAO-17-192, 03/02/2017, Antibiotic Resistance: More Information Needed to Oversee Use of Medically Important Drugs in Food Animals.

GAO-17-240, 3/28/2017, U. S. Manufacturing: Federal Programs Reported Providing Support and Addressing Trends.

GAO-17-360, 04/13/2017, Avian Influenza: USDA Has Taken Actions to Reduce Risks but Needs a Plan to Evaluate Its Efforts.

GAO-17-373, 04/28/2017, Foot-And-Mouth Disease: USDA's Evaluations of Foreign Animal Health Systems Could Benefit from Better Guidance and Greater Transparency.

GAO-17-443, 9/15/2017, Imported Seafood Safety: FDA and USDA Could Strengthen Efforts to Prevent Unsafe Drug Residues.

GAO Reports (In Progress)

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

100398, Sustainable Chemistry Technology Assessment.

100751, Biodefense: Federal Efforts to Develop Biological Threat Awareness.

100924, Federal Facility Security: Selected Agencies Should Improve Methods for Assessing and Monitoring Risk.

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

101016, High-Containment Laboratories: Comparative Oversight Models.

101018, Excess Federal Personal Property Disposal.

101144, Southwest Border Security: Actions Needed to Enhance CBP's Maintenance of Roads Used for Its Operations.

- 101178, STEM Education Programs.
- 101189, Federal Research for Transformational Technological Advances.

101279, Arsenic in Rice.

101285, Committee on Foreign Investment in the United States (CFIUS).

101406, Renewable Fuel Standard (RFS) Effect on Transportation Fuel Prices and Greenhouse Gas Emissions in the United States.

- 101434, USDA's Regional Climate Hubs.
- 101680, Department of Defense Foreign Currency Methodologies for Budgeting Purposes.

101732, Federal Grants Workforce Training.

- 101985, Animal Welfare in Federal Research Facilities.
- 102051, USDA's Preparedness for Foot-and-Mouth Disease (FMD).
- 102077, Agent Orange.
- 102086, International Affairs Budget Justification Review.
- 102093, DOD Biosafety for Handling Select Agents and Toxins.
- 102103, Assessing Technologies that Can Help Reduce the Agricultural Sector's Impact on Water Supplies.

	2016 Act	tual	2017 Act	ual	2018 Estir	nate	2019 President's Budget		
Item	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	
Salaries and Expenses:					.		<i></i>		
Discretionary Appropriations	\$1,143,825	5,970	\$1,170,235	5,952	\$1,162,288	5,952	\$1,018,991	5,113	
Buildings and Facilities:									
Discretionary Appropriations	212,101	-	99,600	-	98,924	-	-	-	
	,		,		,				
Transfers In	102	-	90	-	-	-	-	-	
Adjusted Appropriation	1,356,028	5,970	1,269,925	5,952	1,261,212	5,952	1,018,991	5,113	
Balance Available SOV	57 735		263 554		221 110		192 000		
Other Adjustments (Net)	9 193	-	16 022	-	231,119	-	-192,000 a/	-	
Total Available	1 422 956	5 970	1 549 501	5 952	1 492 331	5 952	1 018 991	5 1 1 3	
Lapsing Balances	-7.331	-	-742	-	-	-	-		
Balance Available, EOY	-263,554	-	-231,119	-	-192,000	-	_	-	
Obligations	1,152,071	5,970	1,317,640	5,952	1,300,331	5,952	1,018,991	5,113	
Obligations under other USDA appropri	riations:								
Animal & Plant Health Inspection									
Service	-	-	141	1	141	1	141	1	
Animal & Plant Health Inspection	10,000	7	20.049	64	20.048	64	20.049	<i>C</i> 1	
Service	18,900	0/	20,048	64 11	20,048	64 11	20,048	04	
Economic Research Service	5,732	21	3,488	11	3,488	11	3,488	11	
Failli Service Agency	-	-	280	1	280	1	280	1	
Food Safety & Inspection Service.	433	2 14	4 014	13	244 4 014	13	4 014	13	
Foreign Agricultural Service	745	14	996	13	4,014	13	996	13	
Forest Service	1 412	5	1 019	3	1 019	3	1 019	3	
Grain Inspection Packers and Stockya	rd	5	1,017	5	1,017	5	1,017	5	
Administration	196	1	103	-	103	_	103	-	
Hazardous Waste	-	-	1.652	5	1.652	5	1.652	5	
National Agricultural Statistics Service	4.293	15	4,307	14	4.307	14	4,307	14	
National Institute of Food and	.,_>c	10	1,007		1,007		.,,	1.	
Agriculture	20.557	74	23,502	74	23,502	74	23,502	74	
Natural Resources Conservation	,		,		,		,		
Service	3,607	13	3,585	11	3,585	11	3,585	11	
Office of Secretary	-	-	400	1	400	1	400	1	
Office of the Chief Economist	527	2	356	1	356	1	356	1	
Quarters and Subsistence	-	-	462	2	462	2	462	2	
Revocable Permits & Easements	565	2	1,388	4	1,388	4	1,388	4	
Risk Management Agency	-	-	116	-	116	-	116	-	
Sale of Animals & Personal Property									
(Proceeds)	11,808	42	8,831	28	8,831	28	8,831	28	
Travel and Miscellaneous									
Reimbursables	-	-	103	-	103	-	103	-	
Utility and Recyclables	101	-	-	-	-	-	-	-	
Misc., Other USDA Funds	416	2	312	1	312	1	312	1	
Total, Other USDA	73,083	263	/5,347	238	75,347	238	75,347	238	
1 otal, Agriculture Appropriations	1,225,154	6,233	1,392,987	6,190	1,3/5,6/8	6,190	1,094,338	5,351	
Other Federal Funds:									
Agency for International Development	9,013	32	7,516	24	7,516	24	7,516	24	
Department of Defense	7,768	28	4,328	14	4,328	14	4,328	14	

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

	2016 Act	ual	2017 Act	ual	2018 Estii	mate	2019 President's Budget		
Item	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	
Other Federal Funds:									
(continued)	1 220	_		_		_		_	
Department of Energy	1,338	5	1,522	5	1,522	5	1,522	5	
Department of Health & Human		- 0							
Services	16,535	60	20,632	65	20,632	65	20,632	65	
Department of Homeland Security	3,223	12	933	3	933	3	933	3	
Department of State	326	1	324	1	324	1	324	1	
Department of the Interior	2,712	10	2,566	8	2,566	8	2,566	8	
Department of Treasury	136	1	138	-	138	-	138	-	
Environmental Protection Agency	537	2	679	2	679	2	679	2	
Federal Emergency Management									
Agency	296	1	316	1	316	1	316	1	
National Aeronautics & Space									
Administration	1,476	5	1,118	4	1,118	4	1,118	4	
Misc., Other Federal Funds	1	-	6	-	6	-	6	-	
Total, Other Federal	43,361	157	40,078	127	40,078	127	40,078	127	
Non-Federal Funds									
A gricultural Litilization									
Pasaarch Institute									
Alabama University of	- 281	-	-	-	-	-	-	-	
Arabald Piological Passarah	201	1	-	-	-	-	-	-	
Station	115								
Directional Agricultural	115	-	-	-	-	-	-	-	
Bassarah & Davalarment (DADD)	172	1	100	1	100	1	100	1	
Research & Development (BARD)	175	1	199	1	199	1	199	1	
Brigham Young University	-	-	230	1	230	1	230	1	
California, State of	2,524	9	2,104	1	2,104	1	2,104	1	
California, University of	1,293	5	1,430	5	1,430	5	1,430	3	
Citrus Research and Development	2 1 40	0	1 (27	-	1 (07	-	1 (07	-	
Foundation	2,140	8	1,627	5	1,627	5	1,627	5	
Citrus Research Board	729	3	1,264	4	1,264	4	1,264	4	
Colorado State University	140	-	-	-	-	-	-	-	
Commodity Credit Corporation	189	1	231	1	231	1	231	1	
Cornell University	856	3	775	2	775	2	775	2	
Cotton Incorporated	1,128	4	850	3	850	3	850	3	
Delaware, University of	113	-	-	-	-	-	-	-	
Florida Citrus Packers Association	126	-	-	-	-	-	-	-	
Florida, State of	1,311	5	701	2	701	2	701	2	
Florida, University of	381	1	517	2	517	2	517	2	
Georgia Tech	-	-	135	-	135	-	135	-	
Georgia, University of	568	2	461	1	461	1	461	1	
Idaho, State of	-	-	109	-	109	-	109	-	
Idaho State University	246	1	155	1	155	1	155	1	
Idaho, University of	159	-	186	1	186	1	186	1	
Illinois, University of	446	2	335	1	335	1	335	1	
Iowa State University	1,388	5	938	3	938	3	938	3	
Kansas State University	995	4	958	3	958	3	958	3	
Louisiana State University	232	1	312	1	312	1	312	1	
Maine, University of	106	-	342	1	342	1	342	1	
Maryland, University of	295	1	-	-	-	-	-	-	
Massachusetts, University of	168	1	-	-	-	-	-	-	

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

	2016 Act	tual	2017 Act	Jal	2018 Estir	nate	2019 President's Budget		
Item	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	
Non Endored Funda									
Noll-Federal Funds:									
(continued) Mishigan State University	910	2	1 0 2 0	4	1 0 2 0	4	1 020	4	
Minnagata Com Bassarah and	819	3	1,252	4	1,252	4	1,252	4	
Promotion Council			122		122		100		
Promotion Council	-	- 1	122	-	122	-	122	-	
Minnesota, State of	105	1	-	-	-	-	-	-	
Minnesota, University of	345	1	-	-	-	-	-	-	
Mississinni Sayhaan Promotion	201	1	-	-	-	-	-	- 1	
Mississippi Soybean Promotion	203	1	151	1	151	1	151	1	
Mississippi State University	-	-	129	-	129	-	129	-	
Ninnesota Corn Research and			142	1	1.42	1	142	1	
Promotion Council	-	-	145	1	143	1	143	1	
Missouri, University of	252	1	-	-	-	-	-	-	
National Cattlemen's Beer			102	1	102	1	102	1	
Association	-	-	192	1	192	1	192	1	
National Peanut Foundation	140	-	211	1	211	1	211	1	
National Pork Board	230	1	190	1	190	1	190	1	
Nebraska, University of	624	2	136	-	136	-	136	-	
New Hampshire, University of	164	-	-	-	-	-	-	-	
New Mexico Consortium	136	-	402	1	402	1	402	1	
New Mexico State University	-	-	198	1	198	l	198	1	
North Carolina State University	714	3	276	1	276	l	276	1	
North Dakota State University	-	-	174	1	174	l	174	1	
Ohio State University	325	1	439	1	439	1	439	1	
Oklahoma State University	104	-	-	-	-	-	-	-	
Oregon State University	-	-	248	1	248	1	248	1	
Pennsylvania State University	202	1	-	-	-	-	-	-	
Purdue University	215	1	106	-	106	-	106	-	
Qualisoy Inc	-	-	193	1	193	1	193	1	
Rutgers University	223	1	155	1	155	1	155	1	
South Dakota State University	-	-	270	1	270	1	270	1	
South Florida Water Management									
District	289	1	904	3	904	3	904	3	
Texas A&M University	119	-	-	-	-	-	-	-	
Texas Agrilife Research & Extension									
Center	131	-	-	-	-	-	-	-	
United Sorghum Checkoff Program	133	-	-	-	-	-	-	-	
United Soybean Board	5,202	19	3,592	11	3,592	11	3,592	11	
Vermont University	-	-	173	1	173	1	173	1	
Washington State University	232	1	250	1	250	1	250	1	
Washington Tree Fruit Research									
Commission	487	2	-	-	-	-	-	-	
Wisconsin University	442	2	236	1	236	1	236	1	
Misc., Non-Federal Funds	3,044	11	2,974	9	2,974	9	2,974	9	
Total, Non-Federal Funds	31,359	112	27,015	89	27,015	89	27,015	89	
Miscellaneous Contributed Funds:	25,991	85	25,389	77	25,389	77	25,389	77	
Total, ARS	1,325,865	6,587	1,485,469	6,483	1,468,160	6,483	1,186,820	5,644	

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

a/ Rescission of unobligated B&F balances

		2016 Act	ual	2	2017 Act	ual	2	018 Estir	nate	2019 Pr	esident's	Budget
Item	D.C.	Field	Total	D.C.	Field	Total	D.C.	Field	Total	D.C.	Field	Total
SES	12	20	32	12	17	29	12	17	29	12	17	29
GS/GM-15	49	703	752	50	717	767	50	717	767	35	608	643
GS/GM-14	64	524	588	59	488	547	59	488	547	42	414	456
GS/GM-13	129	329	458	135	308	443	135	308	443	95	261	356
GS-12	135	294	429	133	292	425	133	292	425	93	248	341
GS-11	49	528	577	42	521	563	42	521	563	30	442	472
GS-10	1	2	3	1	1	2	1	1	2	1	1	2
GS-9	50	939	989	55	956	1,011	55	956	1,011	39	810	849
GS-8	10	321	331	14	295	309	14	295	309	10	250	260
GS-7	50	576	626	34	546	580	34	546	580	24	463	487
GS-6	16	213	229	13	175	188	13	175	188	9	148	157
GS-5	10	139	149	4	101	105	4	101	105	3	86	89
GS-4	3	33	36	5	30	35	5	30	35	4	25	29
GS-3		25	25		19	19		19	19	0	16	16
GS-2		11	11		6	6		6	6	0	5	5
GS-1		6	6		3	3		3	3	0	3	3
Other Graded												
Positions	4	-	4	4	-	4	4	-	4	4	-	4
Ungraded												
Positions	_	470	470	-	442	442	-	442	442	-	442	442
Total Perm.												
Positions	582	5,133	5,715	561	4,917	5,478	561	4,917	5,478	401	4,239	4,640
Unfilled EOY	91	102	193	81	68	149	81	68	149	81	69	150
Total Perm. Full-Time Employment,												
EOY	491	5,031	5,522	480	4,849	5,329	480	4,849	5,329	320	4,170	4,490
Staff Vear Est	502	6.085	6 5 8 7	510	5 072	6/83	510	5 072	6/183	350	5 20/	5 611

Permanent Positions by Grade and Staff Year Summary

Size, Composition and Cost of Motor Vehicle Fleet

The 2019 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.

		Number of Vehicles by Type *																			
Fiscal Year	Sedans and Station Wagons	Light Trucks, SUVs, and Vans		Light Trucks, SUVs, and Vans		Light Trucks, SUVs, and Vans		Light Trucks, SUVs, and Vans		Light Trucks, SUVs, and Vans		Light Trucks, SUVs, and Vans		Light Trucks, SUVs, and Vans		Medium Duty Vehicles	Ambu- lances	Buses	Heavy Duty Vehicles	Total Number of Vehicles	Costs (\$ in 000)
	W ugons	4X2	4X4					venieres													
2016	220	1,157	944	724	-	2	160	3,207	\$5,307												
Change	-5	-36	-12	+9	-	-	+8	-36	-751												
2017	215	1,121	932	733	-	2	168	3,171	4,556												
Change	-1	-	-	-	-	-	-	-1	+137												
2018	214	1,121	932	733	-	2	168	3,170	4,693												
Change	-	_	-	-	-	-	-	-	+141												
2019	214	1,121	932	733	_	2	168	3,170	4,834												

*Numbers include vehicles owned by the agency and leased from GSA.

Shared Funding Projects (Dollars in thousands)

	2016	2017	2010	2019
	2016	2017	2018	President's
	Actual	Actual	Estimate	Budget
Working Capital Fund:				
Administration:	¢176	¢170	¢141	¢1(C)
Material Management Service Center	\$170 1540	\$170 1.100	\$141	\$102
HD Enterprise System Management	1,349	1,190	932	100
Integrated Progurament Systems	1 609	1 600	1 7 5 2	100
Producement Operations	1,008	1,009	1,732	1,705
Subset	2 402	2 120	2 007	2 102
	5,495	3,130	3,007	5,102
Communications:	217	201	200	
Creative Media & Broadcast Center	317	301	298	414
Finance and Management:				
National Finance Center	2,260	2,165	2,285	2,295
Financial Management Services	5,056	5,301	5,417	5,524
Internal Control Support Services	150	158	147	146
Subtotal	7,466	7,624	7,849	7,965
Information Technology:				
National Information Technology Center	1,135	1,189	1,122	1,121
Client Technology Service	521	3,640	3,583	3,580
Enterprise Network Services	1,243	1,507	1,836	2,451
Subtotal	2,899	6,336	6,541	7,152
Correspondence Management	106	119	107	116
Total, Working Capital Fund	14,281	17,510	17,802	18,749
Department-Wide Shared Cost Programs:				
1890 USDA Initiatives	225	236	222	222
Advisory Committee Liaison Services	4	3	3	3
Classified National Security Information	44	41	38	38
Continuity of Operations Planning	142	130	125	125
Emergency Operations Center	166	149	138	138
Facility and Infrastructure Review and Assessment	31	29	26	26
Faith-Based and Neighborhood Partnerships	27	26	24	24
Hispanic-Serving Institutions National Program	125	125	117	117
Honor Awards	5	-	5	5
Human Resources Transformation (inc. Diversity Council)	109	106	104	104
Identity and Access Management (HSPD-12)	481	427	398	398
Medical Services	43	36	42	42
People's Garden	46	41	39	39
Personnel Security Branch	65	58	49	49
Pre-authorizing Funding	265	219	219	219
Retirement Processor Web Application	41	37	35	35
TARGET Center	102	93	85	85
USDA 1994 Program	49	51	46	46
virtual University	141	128	117	117
Total, Department-Wide Shared Cost Programs	2,111	1,935	1,832	1,832

Shared Funding Projects

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	2016	2017	2018	2019 President's
_	Actual	Actual	Estimate	Budget
E-Gov:				
Budget Formulation and Execution Line of Business	7	7	7	7
Enterprise Human Resources Integration	139	139	128	128
E-Training	178	-	-	-
Financial Management Line of Business	9	5	5	5
FOIA	-	-	-	2
Human Resources Line of Business	20	20	19	19
Integrated Acquisition Environment	154	190	194	209
Total, E-Gov	507	361	353	370
Agency Total	16,899	19,806	19,987	20,951

AGRICULTURAL RESEARCH SERVICE

The estimates include appropriations 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, [\$1,162,288,000]

1) \$1,018,991,000 of which \$10,600,000, to remain available until expended, shall be used to carry out the science program at the National Bio-and Agro-defense Facility located in Manhattan, Kansas: 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 \$500,000, except for headhouses or greenhouses which shall each be limited to \$1,500,000, except for 10 buildings to be constructed or improved at a cost not to exceed \$1,100,000 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 \$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.

<u>The first change</u> adds language to provide no year authority for funds used to cover costs associated with the transition of research programs from the Plum Island Animal Disease Center to the National Bio and Agro-Defense Facility.

Lead-Off Tabular Statement Current Law

Budget Estimate, 2019	\$1,018,991,000
2018 Annualized Continuing Resolution	1,162,288,000
Change in Appropriation	-143,297,000

Program	2016 Ac	ctual	2017 Ac	ctual	2018 Esti	mate	Inc.	or Dec		2019 Pres Budge	ident's et
	Amount	SYs	Amount	SYs	Amount	SYs	Amount		SYs	Amount	SYs
Salaries and Expenses											
Discretionary Appropriations:											
Product Quality/Value Added	\$100,956	659	\$101,544	656	\$100,854	656	-\$35,730	(1)	-154	\$65,124	502
Livestock Production	86,859	417	89,365	415	88,758	415	-15,157	(2)	-67	73,601	348
Crop Production	217,708	1,233	225,876	1,229	224,342	1,229	-19,434	(3)	-101	204,908	1,128
Food Safety	111,790	659	112,441	659	111,678	659	-14,113	(4)	-58	97,565	601
Livestock Protection	92,765	436	94,305	434	93,664	434	-4,582	(5)	-20	89,082	414
Crop Protection	194,788	1,017	197,922	1,014	196,578	1,014	-41,091	(6)	-180	155,487	834
Human Nutrition	86,874	235	87,380	235	86,787	235	-42,282	(7)	-179	44,505	56
Environmental Stewardship	203,035	1,222	217,467	1,218	215,991	1,218	-21,508	(8)	-104	194,483	1,114
National Agricultural Library	23,791	92	23,791	92	23,629	92	-2,000	(9)	-	21,629	92
Repair and Maintenance	20,144	-	20,144	-	20,007	-	-		-	20,007	-
National Bio-Agro Defense Facility							+52,600	(10)	+24	52,600	24
Decentralized GSA and										-	-
DHS Security Payments	5,115	-	-	-	-	-	-		-	-	-
Subtotal	1,143,825	5,970	1,170,235	5,952	1,162,288	5,952	-143,297		-839	1,018,991	5,113
Funds included for											
Homeland Security	(37,923)	-	(40,107)	-	(40,107)	-	(50,403)		-	(90,510)	-
Total Adjusted Approp	1,143,825	5,970	1,170,235	5,952	1,162,288	5,952	-143,297		-839	1,018,991	5,113
Transfers In:											
Cong. Relations	102	-	90	-	-	-	-		-	-	-
Total	102	-	90	-	-	-	-		-	-	-
Bal. Available, SOY	13,680	-	14,889	-	30,123	-	-30,123		-	-	-
Other Adjustments (Net)	9,063	-	16,023	-	-	-	-		-	-	-
Total Available	1,166,670	5,970	1,201,237	5,952	1,192,411	5,952	-173,420		-839	1,018,991	5,113
Lapsing Balances	-7.331	-	-742	-	-	-	-		-	-	-
Bal. Available, EOY	-14,889	-	-30,123	-	-	-	-		-	-	-
Total Obligations	1,144,450	5,970	1,170,372	5,952	1,192,411	5,952	-173,420		-839	1,018,991	5,113
Staff Years:											
Direct		5 970		5 952		5 952			-830		5 1 1 3
Other		5,970 617		531		531			-059		531
		017		551		551			-		551
Total, Staff Year Estimate		6,587		6,483		6,483			-839		5,644

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

										2019 Pres	ident's
Program	2016 Ac	tual	2017 Ac	tual	2018 Esti	mate	Inc.	or Dec		Budg	et
	Amount	SYs	Amount	SYs	Amount	SYs	Amount		SYs	Amount	SYs
Salaries and Expenses											
Discretionary Obligations:											
Product Quality/Value Added	\$100,805	659	\$101,378	656	\$100,854	656	-\$35,730	(1)	-154	\$65,124	502
Livestock Production	86,729	417	89,219	415	88,758	415	-15,157	(2)	-67	73,601	348
Crop Production	217,381	1,233	225,507	1,229	224,342	1,229	-19,434	(3)	-101	204,908	1,128
Food Safety	111,790	659	112,441	659	111,678	659	-14,113	(4)	-58	97,565	601
Livestock Protection	92,626	436	94,151	434	93,664	434	-4,582	(5)	-20	89,082	414
Crop Protection	194,496	1,017	197,599	1,014	196,578	1,014	-41,091	(6)	-180	155,487	834
Human Nutrition	86,874	235	87,380	235	86,787	235	-42,282	(7)	-179	44,505	56
Environmental Stewardship	202,730	1,222	217,112	1,218	215,991	1,218	-21,508	(8)	-104	194,483	1,114
National Agricultural Library	23,292	92	25,409	92	23,629	92	-2,000	(9)	-	21,629	92
Repair and Maintenance	20,144	-	20,144	-	20,007	-	-		-	20,007	-
National Bio-Agro Defense Facility	•						+52,600	(10)	+24	52,600	24
Decentralized GSA and											
DHS Security Payments	5,115	-	-	-	-	-	-		-		
Subtotal	1,141,982	5,970	1,170,340	5,952	1,162,288	5,952	-143,297		-839	1,018,991	5,113
Supplemental Obligations:											
Funds included for											
Homeland Security	(37,923)	-	(40,107)	-	(40,107)	-	(50,403)		-	(90,510)	-
Misc. Fees/Supplementals	2,468	-	32	-	30,123	-	-		-	-	-
Subtotal	2,468	-	32	-	30,123	-	-30,123		-	-	-
Total Obligations	1,144,450	5,970	1,170,372	5,952	1,192,411	5,952	-173,420		-839	1,018,991	5,113
Recoveries, Other (Net)	-	-	-	-	-	-	-		-	-	-
Lapsing Balances	7,331	-	742	-	-	-	-		-	-	-
Bal. Available, EOY	14,889	-	30,123	-	-	-	-		-	-	-
Total Available	1,166,670	5,970	1,201,237	5,952	1,192,411	5,952	-173,420		-839	1,018,991	5,113
Transfers In	-102	-	-90	-	-	-	-		-	-	-
Transfers Out	-	-	-	-	-	-	-		-	-	-
Bal. Available, SOY	-13.680	-	-14.889	0	-30.123	0	+30.123		-	-	-
Other Adjustments (Net)	-9,063	-	-16,023	0	-	0	-		-	-	-
Total Appropriation	1,143,825	5,970	1,170,235	5,952	1,162,288	5,952	-143,297		-839	1,018,991	5,113
Staff Years:											
Direct		5,970		5,952		5,952			-839		5,113
Other		617		531		531			-		531

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

Other Total, Staff Year Estimate

6,483

6,483

-839

5,644

6,587

Justification of Increases and Decreases

The President's 2019 Budget requests for ARS' Salaries and Expenses account \$1,018,991,000, a decrease of \$143,297,000 and 863 positions (FTEs) from the agency's 2018 annualized continuing resolution budget level. The ARS Budget proposes to transfer operational responsibility for the National Bio- and Agro-Defense Facility (NBAF), in Manhattan, Kansas from the Department of Homeland Security to USDA in 2019. The request includes \$42,000,000 for operations costs in 2019 and \$10,600,000 for program transition/equipment. Once construction is complete, USDA would operate the NBAF and use the facility to study diseases that threaten the animal agricultural industry and public health. The 2019 Budget also includes program reductions from ongoing research projects. These reductions will include the closure of 20 ARS laboratories/locations/worksites. 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 program and operating activities in order to make the agency more efficient and effective. In 2017, ARS implemented the new Student and Outreach Database (SOD) to capture this data in a "one-stop-shop." Data collected from SOD is serving all data reporting requirements regarding students and outreach activities for the agency, eliminating the multiple data calls and hours of extra work, as well as adding new capabilities for data analysis. 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.

New Products/Product Quality/Value Added

(1) <u>A decrease of \$35,730,000 and 154 staff years for New Products/Product Quality/Value Added research</u> (\$100,854,000 and 656 staff years available in 2018).

ARS' New Products/Product Quality/Value Added research program is directed toward: Improving 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.

Continuing New Products/Product Quality/Value Added base funding is essential for ARS to carry out its research mission and responsibilities. Base funding supports ARS' program goals of increasing the economic viability and competitiveness of U.S. agriculture by maintaining and/or enhancing the quality of harvested agricultural commodities; and expanding domestic and global market opportunities through the development of value-added food and nonfood technologies and products including energy and fuels. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' New Products/Product Quality/Value Added research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports many of USDA's Strategic Goals, particularly: Promote American Agricultural Products and Exports. The research also directly supports many of the Research, Education, and Economics (REE) Action Plan Goals.

A funding change is requested for the following items:

a) <u>A decrease of \$35,363,000 from ongoing research projects to support higher priority research</u>.

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 2019 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. This includes:

- IL, Peoria Coordinated Analysis of Soybean Breeding Germplasm (-\$185,000)
- IL, Peoria Industrial Monomers and Polymers from Plant Oils (-\$1,247,000)
- IL, Peoria Replacement of Petroleum Products Utilizing Off-Season Rotational Crops (-\$1,561,000)
- IL, Peoria Technologies for Improving Process Efficiencies in Biomass Refineries (-\$1,495,000)
- IL, Peoria Biochemical Technologies to Enable the Commercial Production of Biofuels from Lignocellulosic Biomass (-\$1,165,000)
- IL, Peoria Develop Technologies for Production of Platform Chemicals and Advanced Biofuels from Lignocellulosic Feedstocks (-\$1,424,000)
- IL, Peoria New Biobased Products and Improved Biochemical Processes for the Biorefining Industry (-\$1,720,000)
- IL, Peoria Technologies for Producing Renewable Bioproducts (-\$1,364,000)
- IL, Peoria Technologies for Producing Biobased Chemicals (-\$1,594,000)
- IL, Peoria Improved Utilization of Proteinaceous Crop Co-Products (-\$1,071,000)
- IL, Peoria Improving Quality, Stability, and Functionality of Oils and Bioactive Lipids (-\$1,198,000)
- IL, Peoria Conversion of Polysaccharides and Other Bio-based Materials to High-Value, Commercial Products (-\$1,564,000)
- 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 Improved Utilization of Low-Value Oilseed Press Cakes and Pulses for Health-Promoting Food Ingredients and Biobased Products (-\$1,038,000)
- IL, Peoria Innovative Processing Technologies for Creating Functional Food Ingredients with Health Benefits from Food Grains, their Processing Products, and By-Products (-\$982,000)
- IL, Peoria Renewable Biobased Particles (-\$1,826,000)
- IL, Peoria Value-Added Bio-oil Products and Processes (-\$1,561,000)
- 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 (-\$2,491,000)
- MS, Stoneville Cotton Ginning Research to Improve Processing Efficiency and Product Quality in the Saw-Ginning of Picker-Harvested Cotton (-\$1,965,000)
- ND, Fargo Improving Potato Nutritional and Market Quality by Identifying and Manipulating Physiological and Molecular Processes Controlling Tuber Wound-Healing and Sprout Growth (-\$640,000)
- PA, Wyndmoor Improving the Quality of Animal Hides, Reducing Environmental Impacts of Hide Production, and Developing Value-Added Products from Wool (-\$1,436,000)
- PA, Wyndmoor Effect of Processing of Milk on Bioactive Compounds in Fresh High-Moisture Cheeses (-\$1,176,000)
- PA, Wyndmoor Bioactive Food Ingredients for Safe and Health-Promoting Functional Foods (-\$1,093,000)
- b) <u>A decrease of \$367,000 for the transfer of the Office of Pest Management Policy from ARS to the Department's</u> Office of Chief Economist.

Livestock Production

(2) <u>A decrease of \$15,157,000 and 67 staff years for Livestock Production research (\$88,758,000 and 415 staff years available in 2018)</u>.

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.

Continuing Livestock Production base funding is essential for ARS to carry out its research mission and responsibilities. Base funding supports ARS' program goal of providing scientific information and biotechnologies which will ensure an abundant supply of competitively priced animal and aquaculture products. This includes: developing genome analysis tools; identifying economically important genetic traits; preserving agricultural animal genetic resources; improving the efficiency of nutrient utilization and conversion of feeds and forages to animal products; enhancing reproductive performance; and improving aquaculture production systems. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Livestock Production research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports many of USDA's Strategic Goals, particularly: Maximize the Ability of American Agricultural Producers to Prosper by Feeding and Clothing the World. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following items:

a) A decrease of \$14,914,000 from ongoing research projects to support higher priority research.

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 2019 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. This includes:

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 (-\$322,000)
- 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)
- MD, Beltsville Alternatives to Antibiotics: Developing Novel Strategies to Improve Animal Welfare and Production Efficiency in Swine and Dairy (-\$1,022,000)
- MS, Stoneville Biophotonics The Application of Novel Imaging Methodologies to Livestock Production Research (-\$699,000)
- MT, Miles City Alleviating Rate Limiting Factors that Compromise Beef Production Efficiency (-\$2,429,000)
- OR, Corvallis Developing Methods to Improve Survival and Maximize Productivity and Sustainability of Pacific Shellfish Aquaculture (-\$367,000)
- OR, Corvallis Determine Genetic Diversity and Develop Tools for Genetic Improvement of Oyster Stocks for the Pacific Northwest (-\$364,000)

WV, Leetown - Aquaculture Systems - Rainbow Trout – Univ. of CT (-\$441,000)
WV, Leetown - Aquaculture Research - Coldwater Aquaculture (-\$1,759,000)
WI, Madison - Reducing Impacts of Disease on Salmonid Aquaculture Production (-\$1,480,000)

b) <u>A decrease of \$243,000 for the transfer of the Office of Pest Management Policy from ARS to the Department's</u> Office of Chief Economist.

Crop Production

(3) <u>A decrease of \$19,434,000 and 101 staff years for Crop Production research (\$224,342,000 and 1,229 staff years available in 2018</u>).

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 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.

Continuing Crop Production base funding is essential for ARS to carry out its research mission and responsibilities. Base funding supports ARS' program goals of protecting, expanding, and enhancing the Nation's crop genetic resources; increasing scientific knowledge of crop genes, genomes, and biological systems; and delivering technologies that improve the production efficiency, quality, health, and value of the Nation's crops. This includes: developing and maintaining genome databases and informatics tools; managing plant and microbial genetic resources; assessing systematic relationships; enhancing and releasing improved genetic resources and varieties; improving bee health; developing integrative strategies for managing pests, soil, water, nutrient and environmental factors for optimal yield; and determining the biological processes that improve crop productivity. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Crop Production research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. This research supports many of USDA's Strategic Goals, particularly: Maximize the Ability of American Agricultural Producers to Prosper by Feeding and Clothing the World. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following items:

a) <u>A decrease of \$19,025,000 from ongoing research projects to support higher priority research</u>.

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 2019 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. This includes:

CA, Albany - Signaling Pathways Regulating Plant Architecture (-\$516,000)

- CA, Davis Improvement of Postharvest Performance of Ornamentals Using Molecular Genetic Approaches (-\$289,000)
- FL, Miami Conservation, Genetic Analyses, and Utilization of Subtropical/Tropical Fruit Crops, Sugarcane, and Miscanthus Genetic Resources (-\$1,225,000)
- FL, Miami Genetic Characterization, Genetic Improvement, and Best Horticultural Management Practices for Subtropical/Tropical Ornamental Germplasm (-\$1,168,000)
- FL, Miami Genetic Improvement of Cacao Through Genomics-Assisted Breeding (-\$1,376,000)
- GA, Tifton Developing Genomic Approaches to Improve Resistance to Diseases and Aflatoxin Contamination in Peanut and Corn (-\$158,000)
- HI, Hilo Tropical Crops Research (-\$401,000)
- IL, Peoria Genomic Analyses and Management of Agricultural and Industrial Microbial Genetic Resources and Associated Information (-\$670,000)
- IA, Ames Bioinformatics Institute for Model Plants (-\$593,000)
- IA, Ames Michael Fields Agricultural Institute (-\$172,000)
- 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)
- LA, Houma The Effects of Water-Driven Processes on Sugarcane Production Systems and Associated Ecosystem Services in Louisiana (-\$305,000)
- MD, Beltsville Molecular Approaches to Enhance Plant Nutrient Content, Shelf-Life and Stress Tolerance (-\$485,000)
- MD, Beltsville Cocoa, Coffee, and Alternative Crops Research (-\$494,000)
- MD, Beltsville Staffing and Operation for National Clonal Repositories for Plant Germplasm (-\$52,000)
- MD, Beltsville Information Transfer Genetic Resources (-\$48,000)
- MD, Beltsville Evaluation of Germplasm of Horticultural and Sugarcrops (-\$278,000)
- MD, Beltsville Sustainable Production Systems for Cacao (-\$857,000)
- MN, Morris Enhancing Cropping System Sustainability Through New Crops and Management Strategies (-\$651,000)
- MS, Stoneville Kenaf & Medicinal Plants (-\$489,000)
- MS, Stoneville Agricultural Genomics (-\$699,000)
- MO, Columbia Functional Genomics for Evaluating Genes and Gene Regulatory Networks of Soybean Quality Traits (-\$313,000)
- MO, Columbia Mid-West/Mid-South Irrigation (-\$52,000)
- OH, Wooster Greenhouse and Hydroponics (-\$222,000)
- OR, Corvallis Reducing the Impact of Diseases on Hop Production (-\$717,000)
- OR, Corvallis Hops (-\$85,000)
- OR, Corvallis Multi-Objective Optimization of a Profitable and Environmentally Sustainable Agriculture to Produce Food and Fiber in a Changing Climate (-\$1,578,000)
- SD, Brookings Soil and Crop Management for Enhanced Soil Health, Resilient Cropping Systems, and Sustainable Agriculture in the Northern Great Plains (-\$428,000)
- TX, Lubbock Managing and Modeling Deficit Irrigation and Limited Rainfall for Crop Production in Semi-Arid Regions (-\$1,608,000)
- WA, Pullman Cultural Practices and Cropping Systems for Economically Viable and Environmentally Sound Oilseed Production in Dryland of Columbia Plateau (-\$378,000)
- WI, Madison Reducing Impacts of Disease on Salmonid Aquaculture Production (-\$460,000)
- b) <u>A decrease of \$409,000 for the transfer of the Office of Pest Management Policy from ARS to the Department's</u> Office of Chief Economist.

Food Safety

(4) <u>A decrease of \$14,113,000 and 58 staff years for Food Safety research (\$111,678,000 and 659 staff years available in 2018</u>).

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 Research, Education, and Economics agencies, as well as with the Food Safety and Inspection Service, Animal and Plant Health Inspection Service (APHIS), Food and Drug Administration, Centers for Disease Control and Prevention (CDC), Department of Homeland Security (DHS), and the Environmental Protection Agency (EPA). The agency also collaborates in international research programs to address and resolve global food safety issues. Specific research efforts are directed toward developing new technologies that assist ARS stakeholders and customers, including regulatory agencies, industry, and commodity and consumer organizations in detecting, identifying, and controlling foodborne diseases that affect human health.

Continuing Food Safety base funding is essential for ARS to carry out its research mission and responsibilities. Base funding supports ARS' program goal of protecting food from pathogens, toxins, and chemical contamination during production, processing, and preparation. This includes: developing and evaluating technologies for the detection and characterization of microbial contaminants; developing new intervention and control strategies for the reduction of foodborne pathogens; and developing and evaluating detection methods for the reduction and control of veterinary drugs, chemical residues, heavy metals, organic pollutants, and biological toxins derived from bacteria, fungi, and plants. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Food Safety research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports many of USDA's Strategic Goals, particularly: Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following item:

a) A decrease of \$14,113,000 from ongoing research projects to support higher priority research.

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 2019 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. This includes:

AR, Booneville - Agroforestry (-\$111,000)

- GA, Athens Genomic and Proteomic Approaches for the Characterization of Foodborne Pathogens in Poultry (-\$1,116,000)
- GA, Tifton Developing Genomic Approaches to Improve Resistance to Diseases and Aflatoxin Contamination in Peanut and Corn (-\$269,000)
- IL, Peoria Identification and Validation of Insect and Disease Resistance Mechanisms to Reduce Mycotoxin Production in Midwest Corn (-\$735,000)
- IL, Peoria Novel Methods for Controlling Trichothecene Contamination of Grain and Improving the Climate Resilience of Food Safety and Security Programs (-\$2,830,000)

IL, Peoria - Improved Analytical Technologies for Detection of Foodborne Toxins and their Metabolites (-\$1,194,000)

- IL, Peoria Genomic and Metabolomic Approaches for Detection and Control of Fusarium, Fumonisins and Other Mycotoxins on Corn (-\$2,574,000)
- KY, Bowling Green Waste Management (-\$243,000)
- MD, Beltsville Environmental and Plant Factors that Influence Trace Element Bioavailability in Food Crops (-\$705,000)
- MS, Stoneville Center for Food Safety & Postharvest Technology (-\$985,000)

PA, Wyndmoor - Food Safety Engineering (-\$1,688,000)

- PA, Wyndmoor The Role of Genotype in the Development and Validation of Growth Models and Intervention Technologies for Pathogenic Non-Shiga Toxigenic Escherichia coli Found in Foods (-\$1,390,000)
- PA, Wyndmoor Bioactive Food Ingredients for Safe and Health-Promoting Functional Foods (-\$273,000)

Livestock Protection

(5) <u>A decrease of \$4,582,000 and 20 staff years for Livestock Protection research (\$93,664,000 and 434 staff years available in 2018)</u>.

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.

Continuing Livestock Protection base funding is essential for ARS to carry out its research mission and responsibilities. Base funding supports ARS' program goal of preventing and controlling pests and animal diseases that pose a threat to agriculture, public health, and the well-being of Americans. This includes: identifying genes involved in animals with disease-resistant phenotypes; improving our understanding of microbial pathogenesis, transmission, and immune responses to develop countermeasures to prevent and control animal diseases; analyzing microbial genomes to better understand host-pathogen interactions; developing new vaccines to prevent disease in aquaculture species; developing new methods to minimize tick bites; identifying measures to restrict the cattle fever tick; developing methods to control stable flies, horn flies, and house flies and their impact on livestock; supporting the screwworm eradication program; and developing control methods for U.S. vectors of Rift Valley fever. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Livestock Protection research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports many of USDA's Strategic Goals, particularly: Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following items:

a) A decrease of \$4,240,000 from ongoing research projects to support higher priority research.

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 2019 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. This includes:

MD, Beltsville - Emerging Animal Diseases that Exist Offshore (-\$199,000)

MD, Beltsville - Develop Alternatives to Antibiotics for Priority Diseases in Animal Agriculture (-\$500,000)

MD, Beltsville - Microbial Ecology of Antimicrobial Resistance (-\$500,000)

MS, Oxford - Green Biopesticides: Identification (-\$333,000)

- MS, Stoneville Red Imported Fire Ants MS State Univ. (-\$215,000)
- MS, Stoneville Red Imported Fire Ants Univ. of MS (-\$501,000)

MS, Stoneville - Products for Invasive Ant Control (-\$1,992,000)

b) <u>A decrease of \$342,000 for the transfer of the Office of Pest Management Policy from ARS to the Department's</u> Office of Chief Economist.

Crop Protection

(6) <u>A decrease of \$41,091,000 and 180 staff years for Crop Protection research (\$196,578,000 and 1,014 staff years available in 2018</u>).

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

Continuing Crop Protection base funding is essential for ARS to carry out its mission and responsibilities. Base funding supports ARS' program goals of protecting our Nation's crops from arthropods, plant pathogens, nematodes, and weeds; and developing economical alternatives to methyl bromide. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Crop Protection research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports many of USDA's Strategic Goals, particularly: Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following items:

a) <u>A decrease of \$40,373,000 from ongoing research projects to support higher priority research</u>.

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 2019 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. This includes:

CA, Salinas - Minor Use Pesticide Testing on Vegetables and Sugar Crops (-\$222,000)

- FL, Gainesville Biological Control and Ag. Research (-\$48,000)
- FL, Miami Methyl Bromide Replacement: Mitigation of the Invasive Pest Threat from the American Tropics and Subtropics (-\$1,317,000)
- GA, Tifton Host Plant Resistance and Other Management Strategies for Nematodes in Cotton and Peanut (-\$655,000)
- GA, Tifton Integrating Biological and Genetic Control Tactics to Manage Invasive Insects Pests (-\$679,000)
- GA, Tifton Magnitude of the Residue Analyses in Minor Crops from Experimental Applications of Pesticides (-\$725,000)

- GA- Tifton Nematode, Disease, Weed, and Mite Control on Minor Food Crops and Ornamentals (-\$243,000)
- GA, Tifton Integrated Management and Ecology of Weed Populations in the Southeastern Field Crops (-\$708,000)
- GA, Tifton Ecology and Biologically-Based Management Systems for Insect Pests in Agricultural Landscapes in the Southeastern Region (-\$1,016,000)
- 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 Minor Crop Pest Control (-\$186,000)
- HI, Hilo Papaya Ringspot (-\$196,000)
- HI, Hilo Fruit Fly Eradication (-\$151,000)
- IL, Peoria Use of Microorganisms to Manage Weeds and Insect Pests in Turf and Agricultural Systems (-\$461,000)
- 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, Peoria Development of New Production Methodologies for Biocontrol Agents and Fastidious Microbes to Improve Plant Disease Management (-\$1,066,000)
- IL, Urbana Minor Use Weed Management (-\$15,000)
- IN, Lafayette Oat Virus (-\$65,000)

LA, Houma - Integrated Weed and Insect Pest Management Systems for Sustainable Sugarcane Production (-\$731,000)

- LA, Houma Sugarcane Improvement through Effective Disease Management and Resistance Development (-\$393,000)
- MD, Beltsville Minor Use Pesticides Umbrella Project (-\$336,000)
- MD, Beltsville Area-Wide Management of Agricultural Pests (-\$5,246,000)
- MD, Beltsville Potato Research (-\$1,342,000)
- MD, Beltsville Fusarium Head Blight of Wheat and Barley (-\$6,590,000)
- MD, Beltsville Floriculture and Nursery Research Initiative (-\$2,681,000)
- MD, Beltsville Small Fruit and Nursery Research (-\$1,071,000)
- MD, Beltsville National Plant Diseases Recovery System (-\$1,384,000)
- MD, Beltsville Wheat Stripe Rust Initiative (-\$200,000)
- MD, Beltsville Coordination Activities for Research to Register Minor Use of Pesticides (-\$306,000)
- MD, Beltsville Biologically-Based Technologies for Control of Soil-Borne Pathogens of Vegetables and Ornamentals (-\$750,000)
- MD, Beltsville Development of Novel Strategies for Disease Management in Solanaceous Crops (-\$1,211,000)
- MS, Stoneville Bioherbicidal Control of Invasive Weeds with Indigenous Plant Pathogens (-\$335,000)
- MS, Stoneville Alternative Approaches to Tarnished Plant Bug Control (-\$648,000)
- MS, Stoneville Cropping Systems Research (-\$120,000)
- MS, Stoneville Cotton Genomics and Breeding (-\$272,000)
- MO, Columbia Insect Biotechnology Products for Pest Control and Emerging Needs in Agriculture (-\$1,735,000)
- NY, Ithaca Pear Thrips (Knapweed) (-\$39,000)
- NY, Ithaca Golden Nematode (-\$207,000)
- ND, Fargo Novel Weed Management Solutions: Understanding Weed-Crop Interactions in Northern Climates (-\$1,550,000)
- OH, Wooster Minor Use Pesticide-Food/Ornamentals (-\$230,000)
- OR, Corvallis Disease Modeling and Genetic Approaches to Enhance Wheat and Grass Seed Crop Biosecurity (-\$625,000)
- 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)
- TX, College Station Identification of Resistance in Sorghum to Fungal Pathogens and Characterization of Pathogen Population Structure (-\$241,000)
- WA, Wapato Residue Analysis of Minor Use Pesticides (-\$601,000)
- WA, Wapato Field Testing of Minor Use Pesticides (-\$184,000)

b) <u>A decrease of \$718,000 for the transfer of the Office of Pest Management Policy from ARS to the Department's</u> Office of Chief Economist.

Human Nutrition

(7) <u>A decrease of \$42,282,000 and 179 staff years for Human Nutrition research (\$86,787,000 and 235 staff years available in 2018)</u>.

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.

Continuing Human Nutrition base funding is essential for ARS to carry out its mission and responsibilities. Base funding supports ARS' program goal of enabling Americas to make health promoting, science-based dietary choices. This includes: determining food consumption and dietary patterns of Americans; updating U.S. food composition data; enhancing the health promoting quality of the food supply; developing and evaluating strategies to prevent obesity and related diseases; and understanding the mechanisms by which nutrition promotes healthy development. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Human Nutrition research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports many of USDA's Strategic Goals, particularly: Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following item:

a) A decrease of \$42,282,000 from ongoing research projects to support higher priority research.

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 2019 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. This includes:

AR, Little Rock - Impact of Early Dietary Factors on Child Development and Health (-\$8,374,000)

MD, Beltsville - Healthy Eating and Lifestyle for Total Health (HEALTH) (-\$3,626,000)

MA, Boston - Immunity, Inflammation, and Nutrition in Aging (-\$1,600,000)

MA, Boston - Sarcopenia, Nutrition, and Physical Activity (-\$1,177,000)

MA, Boston - Nutrients, Aging, and Musculoskeletal Function (-\$1,641,000)

MA, Boston - One Carbon Nutrients and Metabolism (-\$625,000)

MA, Boston - Plant Components and Aging (-\$1,169,000)

MA, Boston - Cardiovascular Nutrition and Health (-\$1,397,000)

MA, Boston - Vision, Aging, and Nutrition (-\$914,000)

MA, Boston - Cancer Prevention via Diet (-\$1,355,000)

MA, Boston - Rural Aging Study (-\$186,000)

- MA, Boston Nutritional Epidemiology (-\$666,000)
- MA, Boston Energy Regulation and Obesity (-\$2,136,000)
- MA, Boston Genomics, Nutrition, and Health (-\$1,215,000)
- MA, Boston Nutrition, Brain, and Aging (-\$1,811,000)
- TX, Houston Nutritional Metabolism in Mothers, Infants, and Children (-\$2,902,000)
- 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)
- TX, Houston Molecular, Cellular, and Regulatory Aspects of Nutrition during Development (-\$2,737,000)

Environmental Stewardship

(8) <u>A decrease of \$21,508,000 and 104 staff years for Environmental Stewardship research (\$215,991,000 and 1,218 staff years available in 2018)</u>.

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.

Continuing Environmental Stewardship base funding is essential for ARS to carry out its mission and responsibilities. Base funding supports ARS program goals of providing integrated, effective, and safe water resources; improving the quality of atmosphere and soil resources and understanding the effects of climate change; effectively and safely managing the use of manure and other industrial byproducts that maximize their potential benefits while protecting the environment and human and animal health; and developing and transferring economically viable and environmentally sustainable production and conservation practices, technologies, plant materials, and integrated management strategies that conserve and enhance the Nation's natural resources. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

ARS' Environmental Stewardship research program is carried out at numerous locations where agency scientists frequently collaborate with researchers from other Federal/State governments, academia, and private industry. Their research supports USDA's FY 2016 Interagency Climate Change initiatives and priorities, and many of the Department's Strategic Goals, particularly: Strengthen the Stewardship of Private Lands through Technology and Research. The research also directly supports many of the REE Action Plan Goals.

A funding change is requested for the following items:

a) <u>A decrease of \$20,719,000 from ongoing research projects to support higher priority research</u>.

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 2019 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. This includes:

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)
- KY, Bowling Green Waste Management (-\$472,000)
- KY, Lexington Improved Forage Livestock Production (-\$360,000)
- LA, Houma The Effects of Water-Driven Processes on Sugarcane Production Systems and Associated Ecosystem Services in Louisiana (-\$711,000)
- ME, Orono Improved Crop Production Systems for the Northeast (-\$1,031,000)
- MD, Beltsville Regulation of Gene Expression in Alfalfa Development and Stress Tolerance (-\$424,000)
- MD, Beltsville Global Change Research (-\$125,000)
- MD, Beltsville Combined Water Quality Initiative (-\$96,000)
- MD, Beltsville Air Quality Associated with Agricultural Operations (SDL) (-\$628,000)
- MN, Morris Stewardship of Upper Midwest Soil and Air Resources through Regionally Adapted Management Practices (-\$2,160,000)
- MS, Oxford Acoustics (-\$784,000)
- MO, Columbia Mid-West/Mid-South Irrigation (-\$120,000)
- 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)
- OR, Corvallis Improvement of Biotic and Abiotic Stress Tolerance in Cool Season Grasses (-\$1,105,000)
- 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 TX A&M Univ. (-\$538,000)
- TX, Bushland Ogallala Aquifer TX Tech Univ. (-\$269,000)
- TX, Bushland Ogallala Aquifer KS State Univ. (-\$601,000)
- TX, Bushland Ogallala Aquifer West TX A&M Univ. (-\$113,000)
- TX, College Station Improved Forage and Alternative Use Grasses for the Southern U.S. (-\$266,000)
- TX, Lubbock Improving the Productivity and Climatic Resilience of Agricultural Production Systems in Semiarid and Arid Ecosystems (-\$1,109,000
- TX, Lubbock Managing and Modeling Deficit Irrigation and Limited Rainfall for Crop Production in Semi-Arid Regions (-\$689,000)
- b) <u>A decrease of \$789,000 for the transfer of the Office of Pest Management Policy from ARS to the Department's</u> <u>Office of Chief Economist.</u>

Library and Information Services

(9) A decrease of \$2,000,000 for Library and Information Services (\$23,629,000 and 92 staff years available in 2018).

The National Agricultural Library (NAL) is the largest and most accessible agricultural research library in the world. It provides services directly to the staff of USDA and to the public, primarily via its web site, http://www.nal.usda.gov. NAL was created with the USDA in 1862 and was named a national library in 1962 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 our Nation's agricultural heritage, the provider of world class information, and a wellspring for generating new fundamental knowledge and advancing scientific discovery. It is a priceless national resource that, through it services, programs, information products, and web-based tools and technologies, serves anyone who needs agricultural information. The Library's vision is "advancing access to global information for agriculture."

Continuing Library and Information Services base funding is essential for NAL to carry out its mission and responsibilities. Base funding supports ARS' goal of ensuring the provision and access of agricultural information for USDA, the Nation, and the global agricultural community. This includes: delivering unified, easy to use, convenient 24/7 digital services; improving information delivery; extending AGRICultural OnLine Access (AGRICOLA); conserving rare and at-risk items; extending partnerships with USDA and other Federal agencies to develop targeted information services; and marketing NAL services to specific audiences. In addition to the activities and functions specifically described in the budget request, current year and budget year base funds will be used to carry out activities and functions consistent with the full range of authorities and activities delegated to the agency.

A funding change is requested for the following item:

- a) <u>A decrease of \$2,000,000 from ongoing programs and operations to help finance and support the</u> <u>Administration's budget priorities</u>. This includes:
- MD, Beltsville Ag. Law Partnership (-\$2,000,000)

New National Bio- and Agro-Defense Facility

(10) <u>An increase of \$52,600,000 and 24 staff years for Operations and Maintenance, and Program Transition/New</u> Equipment for the National Bio- and Agro-Defense Facility.

The National Bio- and Agro-Defense Facility (NBAF), located in Manhattan, Kansas, will be a state-of-the-art biocontainment facility for the study of foreign, emerging, and zoonotic animal diseases that pose a threat to United States animal agriculture and public health. The facility will serve as a "One Health" national and international resource, offering capabilities for training, research and development, surveillance, prevention, and response to emerging infectious diseases. NBAF is envisioned as a replacement and enhancement of the Plum Island Animal Disease Center (PIADC) capability. Specifically, NBAF will provide the first U.S large animal biosafety level-4 (BSL-4) facilities to house livestock infected with zoonotic agents within the highest biocontainment envelope, a critical capability that is currently lacking in the U.S. NBAF will also house a Biologics Development Module that will provide small scale production of standardized biological reagents needed for basic and applied research, and biological test materials for supporting proof-of-concept studies and early phase veterinary medical countermeasures development.

NBAF will continue the half century long tradition of foreign and emerging animal disease research first initiated by ARS at PIADC in 1954. As such, NBAF will support the ARS biodefense research program, as well as the work of the Animal and Plant Health Inspection Service (APHIS), which is dedicated to the defense of animal agriculture against the threat of biological agents with the potential of significant economic harm and public health consequences.

The Administration envisions that USDA, rather than the Department of Homeland Security (DHS), will ultimately own and operate the NBAF facility. In accordance with this direction, the two Departments are finalizing a detailed action plan prior to FY 2019 to ensure a successful transition of the facility ownership and operations to USDA. While the Departments prepare the transfer of ownership and operations of NBAF, DHS will complete the construction of NBAF and decommission PIADC. USDA's budget request for FY 2019 reflects planning and startup costs for the transfer of ownership and operational responsibilities of NBAF. Both APHIS and ARS will share responsibilities as well as funding once they determine the specific breakout of responsibilities.

Need for Change

Homeland Security Presidential Directive 9 (HSPD-9) identified the need for "safe, secure, and state-of-the-art agriculture biocontainment laboratories to research and develop diagnostic capabilities for foreign animal and zoonotic diseases." Although PIADC currently performs much of this research, at present there are no facilities in the U.S that have adequate containment, security, equipment, and infrastructure to meet the requirements identified in HSPD-9. Furthermore, current facilities have inadequate space resulting in a backlog of experiments and the inability to expand the existing research program to address problems of high national priority. Importantly, the

scope and depth of the existing scientific program is insufficient to meet the needs of action government agencies responsible for foreign animal disease prevention, management, and recovery. There are major gaps in the existing ARS biodefense research program at PIADC. The current scientific program covers:

- Only Foot and Mouth Disease (FMD), Classical and African Swine Fever diseases, and does not have the capacity to conduct research on other priority diseases such as *Peste des Petits* ruminants, contagious bovine pleuropneumonia, Swine vesicular disease, African horse sickness, and Lumpy skin disease.
- Lacks research or has inadequate resources to address vector-borne animal diseases, such as Heartwater, Vesicular Stomatitis, Theileriosis, Tsetse-transmitted Trypanosomiasis, Epizootic hemorrhagic disease, Venezuelan Equine Encephalitis, and West Nile Virus.
- Lacks any research on zoonotic diseases (i.e., diseases transmitted from animals to people) such as Ebola Virus (EBOV) disease, Middle Eastern Respiratory Syndrome (MERS), Non tse-tse transmitted animal trypanosomiasis, Congo crimean haemorrhagic fever, and Nipah Virus.

NBAF will for the first time provide the U.S with the capacity to implement an expanded comprehensive biodefense research program to protect the U.S against dangerous foreign animal diseases that pose the greatest threat to animal agriculture and public health. Animal health experts define a foreign animal disease as an important transmissible livestock disease believed to be absent from the U.S and its territories that has the potential to be a significant health or economic impact if it enters the country. Priority diseases include but are not limited to FMD, Avian Influenza, virulent Newcastle disease, Rift Valley Fever, Classical swine fever, African swine fever, Japanese encephalitis, Vesicular Stomatitis, Exotic Bluetongue, *Peste des Petits* ruminants, and Lumpy skin disease. An outbreak of FMD, for example, would have a significant economic impact on the entire U.S. agriculture enterprise, as well as agricultural exports: \$12.8 billion a year or \$128 billion over 10 years, with a possible impact in California alone being \$2.3 to \$69 billion over 10 years.

An additional key component of the expanded scientific program at NBAF will be to address the threat of emerging infectious diseases:

- Recent incursions of infectious diseases have had significant effects on domestic public health and agriculture and demonstrate our vulnerability to newly emerging and re-emerging pathogens, e.g., porcine epidemic diarrhea virus (PEDV), highly pathogenic avian influenza (HPAI), EBOV, MERS, and the Zika Virus.
- Changes in socio-economic, environmental, and/or ecological circumstances are recognized as contributing to the emergence of disease.
- It is estimated that over 75 percent of all emerging human pathogens are either vector-borne or zoonotic; zoonotic pathogens are twice as likely to be associated with an emerging disease as non-zoonotic pathogens.
- There are an estimated 320,000 unknown viruses that infect mammals that have not yet been identified and/or characterized.
- Emerging diseases that affect public health and livestock are occurring with greater frequency, arise in the U.S., and there is a shortage in countermeasures to address them.

NBAF's role in addressing these exigent threats could best be considered through the concept of "One Health," or the recognition "that the health of humans is connected to the health of animals and the environment." Given the facility's capabilities and interagency mission, the NBAF will be uniquely positioned to serve a major role and make significant contributions to the "One Health" collaborative approach to address the myriad of emerging infectious diseases that cross the wildlife, human, and domestic animal interface that threaten our Nation.

Means to Achieve Change

ARS and APHIS are seeking to increase their annual recurring research and diagnostic operations budgets for the transfer of PIADC operations to the NBAF. The BSL-4 facility would increase laboratory capacity to study foreign animal diseases and emerging diseases with high consequence to animal and public health.

- Operations and Maintenance (\$42,000,000). The research and laboratory equipment, machinery, building infrastructure, and supporting utilities of the new facilities (NBAF) will be inspected and maintained.
- One Time Costs for Program Transition, and Equipment Transfer/Purchase (\$10,600,000). From PIADC, ARS will transition its research program to NBAF, as well as transfer/purchase new research equipment to

replace the equipment confined to high containment laboratories at the PIADC that cannot be decontaminated and transferred to NBAF.

Outcomes

The NBAF will provide:

- New solutions to prevent economic losses from foreign animal diseases in agricultural and wildlife species.
- Effective countermeasures to prevent and eliminate the threat of zoonotic diseases in agricultural and wildlife species.
- Scientific information to establish on-farm practices that will maximize "biosecurity" to protect farms from naturally or intentionally introduced pathogens that threaten food security, farm productivity, and the trade and export of agricultural products.
- Experimental animal disease models that will serve the veterinary and public health research communities to significantly shorten the timelines for developing breakthrough medicines and disease prevention tools.
- Integrated predictive modeling capability for emerging and/or intentionally released infectious diseases of animals and the collection of data to support these models.
- Novel detection systems and broad spectrum vaccines and biotherapeutics to counter the threat of emerging diseases or engineered biological weapons.
- Novel countermeasures against the natural or intentional introduction of agricultural threats, including new methods for detection, prevention, and characterization of high-consequence agents.

Collaborators

This initiative requires contributions from ARS scientists working within the Animal Health National Program. External partners include but are not limited to: Kansas State University; Iowa State University; Mississippi State University; University of Connecticut; APHIS; DHS; Animal Health Institute; Global Foot-and-Mouth Research Alliance; Global African Swine Fever Research Alliance; STAR-IDAZ (International Collaboration on Research on Animal and Emerging Zoonotic Diseases); PROCINORTE; CaribVET; United States Animal Health Association (USAHA); American Association of Veterinary Medical Colleges (AAVMC); and the American Veterinary Medical Association (AVMA).

(11) Repair and Maintenance

Sustained support for repairs and maintenance of ARS' laboratories and facilities (\$20,007,000 available in 2018).

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. The funding level can only address ARS' highest priorities.

(12) 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

Georgia, Tifton Crop Protection and Management Research Unit 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 Oregon, Corvallis Forage Seed and Cereal Research Unit South Dakota, Brookings * Integrated Cropping System Research Texas, Houston * Children's Nutrition Research Center Texas, Lubbock

Wind Erosion and Water Conservation Research Unit Wisconsin, Milwaukee (Worksite) Aquaculture Production

* Denotes Entire Location Closure

State/Territory	2016 Ac	ctual	2017 Ac	tual	2018 Esti	mate	2019 President's Budget	
	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
ALABAMA, Auburn	6,821	38	6,394	41	6,398	41	6,398	41
ARIZONA								
Maricopa	10,511	67	9,691	65	9,735	65	9,735	65
Tucson	6,400	48	6,951	51	6,377	51	6,377	51
Total	16,911	115	16,642	116	16,112	116	16,111	116
ARKANSAS								
Booneville	4,178	18	3,888	20	3,902	20	2,902	19
Fayetteville	1,979	10	2,015	10	1,849	10	1,849	10
Jonesboro	1,366	6	1,306	7	1,415	7	1,415	7
Little Rock	7,442	-	7,395	-	7,707	-	-	-
Stuttgart	7,482	59	7,656	62	7,834	62	4,588	33
Total	22,447	93	22,260	99	22,707	99	10,754	69
CALIFORNIA								
Albany	38,939	205	40,240	206	38,000	206	37,535	202
Davis	12,332	88	13,695	90	11,594	90	11,333	86
Parlier	10,746	82	11,046	86	11,243	86	11,243	86
Riverside	5,169	33	5,188	33	5,129	33	5,129	33
Salinas	7,810	43	7,203	42	8,296	42	8,096	40
Total	74,996	451	77,372	457	74,262	457	73,336	447
COLORADO								
Akron	1,973	18	1,779	17	1,967	17	-	-
Fort Collins	15,464	117	18,147	140	18,375	140	18,375	140
Total	17,437	135	19,926	157	20,342	157	18,375	140
DELAWARE, Newark	1,938	13	2,075	15	1,987	15	1,987	15
DISTRICT OF COLUMBIA								
National Arboretum	11,325	62	10,303	56	11,678	56	11,678	56
Headquarters								
Federal								
Administration	110,851	502	123,476	510	87,553	510	87,553	350
Total	122,176	564	133,779	566	99,231	566	99,231	406
FLORIDA								
Canal Point	2,893	25	2,908	27	2,916	27	2,916	27
Fort Lauderdale	2,390	30	2,391	30	2,429	30	2,429	30
Fort Pierce	14,480	120	14,166	120	13,282	120	13,282	120
Gainesville	11,689	98	11,424	92	11,832	92	11,788	90
Miami	4,586	32	4,431	30	4,547	30	-	-
Total	36,038	305	35,320	299	35,006	299	30,414	267

State/Territory	2016 Ac	ctual	2017 Ac	tual	2018 Esti	mate	2019 President'	s Budget
-	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
GEORGIA								
Athens	25,913	141	29,020	145	27,634	145	26,629	137
Byron	3,497	33	3,695	33	3,534	33	3,534	33
Dawson	3,459	29	3,380	26	3,689	26	3,689	26
Griffin	2,390	19	2,283	16	2,394	16	2,394	16
Tifton	11,549	79	10,655	83	10,092	83	6,085	54
Total	46,808	301	49,033	303	47,343	303	42,331	266
HAWAII, Hilo	9,507	58	10,220	60	9,296	60	8,170	60
IDAHO								
Aberdeen	6,545	48	6,141	44	6,053	44	5,763	42
Boise	2,338	20	3,681	20	2,858	20	2,858	20
Dubois	2,103	14	1,923	14	2,127	14	-	-
Kimberly	4,439	39	4,427	35	4,241	35	4,241	35
Total	15,425	121	16,172	113	15,279	113	12,862	97
ILLINOIS								
Peoria	32,241	207	31,488	206	32,443	206	2,132	4
Urbana	5,566	38	5,556	37	5,524	37	5,511	37
Total	37,807	245	37,044	243	37,967	243	7,642	41
INDIANA, W. Lafayette	6,797	53	7,280	52	7,486	52	7,427	52
IOWA, Ames	53,403	362	53,433	354	53,988	354	53,300	352
KANSAS, Manhattan	14,804	85	15,704	84	16,451	84	69,051	108
KENTUCKY								
Bowling Green	2,688	14	2,792	15	2,603	15	1,960	13
Lexington	2,617	13	2,596	12	2,686	12	1,877	10
Total	5,305	27	5,388	27	5,289	27	3,837	23
LOUISIANA								
Baton Rouge	2,691	22	2,525	20	3,066	20	3,066	20
Houma	4,041	45	4,078	45	3,931	45	-	-
New Orleans	20,677	132	20,171	127	20,640	127	20,640	127
Total	27,409	199	26,774	192	27,637	192	23,706	147
MAINE, Orono	2,657	15	2,552	17	2,245	17	1,316	13
MARYLAND								
Beltsville	118,431	637	119,963	617	118,143	617	84,699	581
National Ag Library	23,292	84	25,409	81	23,039	81	23,039	81
Frederick	5,923	37	6,087	33	6,055	33	6,055	33
Total	147,646	758	151,459	731	147,237	731	113,793	695
MASSACHUSETTS, Boston	15,774	9	15,169	8	14,892	8	-	-
MICHIGAN, East Lansing	1,679	22	1,684	10	1,484	10	1,484	10

State/Territory	2016 Ac	ctual	2017 Ac	tual	2018 Esti	mate	2019 President's Budget	
-	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
MINNESOTA								
Morris	2,822	25	2,715	23	2,512	23	-	-
St. Paul	7,228	51	7,120	49	6,632	49	6,632	49
Total	10,050	76	9,835	72	9,144	72	6,632	49
MISSISSIPPI								
Mississippi State	8,960	69	10,336	63	10,083	63	10,083	63
Oxford	13,930	80	14,986	75	15,251	75	11,940	69
Poplarville	5,806	32	5,724	32	5,857	32	5,857	32
Stoneville	39,374	240	42,926	243	43,320	243	35,293	210
Total	68,070	421	73,972	413	74,511	413	63,174	374
MISSOURI, Columbia	9,203	72	9,351	67	9,259	67	7,262	52
MONTANA								
Miles City	3,569	24	3,475	22	3,730	22	-	-
Sidney	5,308	43	5,085	43	5,235	43	5,235	43
Total	8,877	67	8,560	65	8,965	65	5,235	43
NEBRASKA								
Clay Center	23,313	120	22,293	117	22,597	117	22,597	117
Lincoln	5,764	54	5,630	51	5,573	51	5,573	51
Total	29,077	174	27,923	168	28,170	168	28,170	168
NEVADA, Reno	2,362	16	2,333	18	2,259	18	2,259	18
NEW MEXICO, Las Cruces	7,110	51	7,578	53	7,354	53	7,354	53
NEW YORK								
Geneva	3,955	33	4,404	33	3,867	33	3,867	33
Greenport	4,297	25	3,979	20	4,102	20	4,102	20
Ithaca	12,209	50	13,784	56	12,563	56	12,342	56
Total	20,461	108	22,167	109	20,532	109	20,311	109
NORTH CAROLINA, Raleigh	9,650	64	10,933	64	10,605	64	10,605	64
NORTH DAKOTA								
Fargo	15,532	97	16,601	98	15,873	98	13,902	92
Grand Forks	9,511	42	9,257	46	9,210	46	9,210	46
Mandan	5,032	34	3,735	32	4,138	32	4,138	32
Total	30,075	173	29,593	176	29,221	176	27,250	170

State/Territory	2016 Actual		2017 Ac	tual	2018 Estimate		2019 President's Budget	
-	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
OHIO								
Columbus	1,541	15	1,670	15	1,444	15	1,444	15
Wooster	5,623	45	6,135	43	5,335	43	4,928	41
Total	7,164	60	7,805	58	6,779	58	6,372	56
OKLAHOMA								
El Reno	6,855	47	6,864	52	6,829	52	6,829	52
Stillwater	4,016	28	5,046	28	3,624	28	3,624	28
Woodward	2,316	16	2,231	16	2,204	16	-	-
Total	13,187	91	14,141	96	12,657	96	10,453	80
OREGON								
Burns	2,288	20	3,183	21	3,483	21	3,483	21
Corvallis	13,280	96	13,847	90	11,782	90	7,299	52
Pendleton	2,140	17	2,025	18	1,887	18	1,887	18
Total	17,708	133	19,055	129	17,152	129	12,670	91
PENNSYLVANIA								
University Park	5,736	40	5,739	39	5,817	39	5,817	39
Wyndmoor	31,344	165	30,789	164	31,311	164	24,961	139
Total	37,080	205	36,528	203	37,128	203	30,778	178
SOUTH CAROLINA								
Charleston	4,696	38	4,669	39	4,558	39	4,406	39
Florence	3,961	26	3,846	27	3,892	27	3,892	27
Total	8,657	64	8,515	66	8,450	66	8,299	66
SOUTH DAKOTA, Brookings	2,983	25	2,843	23	2,954	23	-	-
TEXAS								
Bushland	6,246	40	6,355	39	6,404	39	5,035	39
College Station	13,724	85	14,849	78	13,036	78	12,580	72
Houston	15,025	7	13,717	6	13,432	6	-	-
Kerrville	5,969	38	6,056	37	6,175	37	6,175	37
Lubbock	9.202	88	9.352	80	9.634	80	6,568	56
Temple	4.145	31	4.565	31	4.628	31	4,628	31
Total	54,311	289	54,894	271	53,309	271	34,987	235
UTAH, Logan	9,790	74	8,988	70	9,655	70	9,655	70
WASHINGTON								
Pullman	21,156	123	20,959	127	19,680	127	19,339	124
Wapato	6,440	50	6,200	46	5,845	46	5,138	41
Wenatchee	2,028	20	2,032	19	2,022	19	2,022	19
Total	29,624	193	29,191	192	27,547	192	26,499	184

State/Territory	2016 Ac	tual	2017 Ac	2017 Actual		mate	2019 President's Budget		
-	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	
WEST VIRGINIA									
Kearneysville	7,775	61	7,076	53	7,034	53	7,034	53	
Leetown	7,802	34	7,602	33	7,537	33	5,557	33	
Total	15,577	95	14,678	86	14,571	86	12,591	86	
WISCONSIN, Madison	17,985	106	18,852	104	19,034	104	17,288	97	
WYOMING, Cheyenne	3,129	23	-	-	-	-	-	-	
PUERTO RICO, Mayaguez	3,213	36	3,489	35	3,137	35	3,137	35	
OTHER COUNTRIES									
France, Montpellier	3,361	2	3,833	1	3,137	1	3,137	1	
Extramural and Funds Administered from									
Headquarters-Held Funds	21,828	-	19,491	-	94,233	-	43,338	-	
Repair & Maintenance									
of Facilities	20,133	-	20,144	-	20,007	-	20,007	-	
Obligations	1,144,450	6,587	1,170,372	6,483	1,192,411	6,483	1,018,991	5,644	
Lapsing Balances	7,331	-	742	-	-	-	-	-	
Bal. Available, EOY	14,889	-	30,123	-	-	-	-	-	
Total Available	1,166,670	6,587	1,201,237	6,483	1,192,411	6,483	1,018,991	5,644	

Classification by Objects (Dollars in thousands)

		2016 Actual	2017 Actual	2018 Estimate	2019 President's Budget
Personn	el Compensation:				0
Wash	ington D.C	\$42,921	\$43,336	\$43,336	\$37,209
Field.	-	438,111	446,177	446,177	383,095
11	Total personnel compensation	481,032	489,513	489,513	420,304
12	Personal benefits	170,001	172,950	173,343	148,836
13.0	Benefits for former personnel	393	393	-	-
	Total, personnel comp. and benefits	651,426	662,856	662,856	569,140
Other O	bjects:				
21.0	Travel and transportation of persons	11,837	10,399	22,622	11,346
22.0	Transportation of things	334	577	759	631
23.1	Rental payments to GSA	4,726	4,760	4,839	4,872
23.2	Rental payments to others	620	530	522	580
23.3	Communications, utilities, and misc. charges	45,415	42,947	42,108	46,059
24.0	Printing and reproduction	2,054	394	388	431
25.1	Advisory and assistance services	970	1,321	1,300	1,446
25.2	Other services from non-Federal sources	16,613	23,615	23,571	25,838
25.3	Other purchases of goods and services				
	from Federal sources	4,184	5,076	4,995	5,554
25.4	Operation and maintenance of facilities	42,731	43,035	43,821	47,086
25.5	Research and development contracts	199,073	211,541	208,172	127,685
25.6	Medical care	289	291	287	319
25.7	Operation and maintenance of equipment	18,468	18,902	31,004	20,680
25.8	Subsistence and support of persons	1	4	4	4
26.0	Supplies and materials	75,149	64,372	66,682	70,233
31.0	Equipment	49,794	55,042	54,165	60,052
32.0	Land and structures	7,487	7,499	7,379	8,204
41.0	Grants, subsidies, and contributions	13,279	17,211	16,937	18,831
	Total, Other Objects	493,024	507,516	529,555	449,851
99.9	Total, new obligations	1,144,450	1,170,372	1,192,411	1,018,991
DHS Bı	uilding Security payments (included in 25.3)	\$139	\$140	\$134	\$137
Position	Data:				
Avera	ge Salary (dollars), ES Position	\$144,995	\$168,812	\$168,812	\$166,491
Avera	ge Salary (dollars), GS Position	\$68,490	\$70,502	\$70,502	\$69,533
Avera	ge Grade, GS Position	10.6	10.7	10.7	10.7

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 2017 accomplishments and current activities, including the National Agricultural Library, are detailed below.

<u>Program Evaluations</u>. In 2017, ARS conducted retrospective reviews of its Human Nutrition; and Pasture, Forage, and Rangeland Systems 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:

<u>Guayule rubber tires: establishing a U.S. rubber production industry</u>. Developing guayule rubber for use in modern tires is critical for supplementing the ever growing need for rubber worldwide, and in particular, for developing a U.S. natural rubber production industry. With funding from the National Institute for Food and Agriculture, ARS led a five year collaborative research effort, to domesticate and develop a commercial guayule farming system in Maricopa, Arizona, and to refine rubber biotechnology and chemistry for converting the plant into rubber at commercial scale in Albany, California. In collaboration with university partners and rubber and tire industry leaders, ARS produced breakthroughs in guayule rubber processing, stabilization and performance that allowed passenger tires to be produced with 100 percent guayule rubber. The tires, developed by an industry partner, passed both the specified testing by the U.S. Department of Transportation and the more stringent internal industry testing. Seventy-five percent guayule rubber tires with exceptional wear and performance are available commercially at a price comparable to high performance tires.

<u>Milk: an edible-packaging film</u>. Packaging is a critical part of modern food technology because of the increased consumer interest in consumption of processed, pre-packaged foods. The challenge for the food industry, however, is to develop packaging that has the correct utility, while being consumer and environmental friendly. Most foods are wrapped in petroleum-based plastic packaging, which is not only poor at preventing spoilage, but is also non-biodegradable and creates a lot of waste. Recently, ARS researchers in Wyndmoor, Pennsylvania, developed a milk based edible film from casein, a milk protein, that can be used to wrap fresh foods to preserve quality; that create pouches that dissolve in hot water; or that coat breakfast cereals to keep them crispy in milk. This edible milk-protein film is being tested by Lipton Soup Co. for potential use in production of its various food products.

<u>Crispy, healthy fruit and vegetable snack drying system is commercialized</u>. Currently the hot air drying of fruit and vegetables is an important U.S. industry worth \$50 billion annually, but is also the third largest industrial energy user in California. As a solution to substantially reduce energy usage and improve dried produce appearance and flavor, ARS scientists in Albany, California, with the support of the California Energy Commission developed a two stage, infrared blanching and hot air drying system. The project demonstrated the novel drying system technology in producing healthy crispy snacks from carrots, kale, bell peppers, squashes, pears, and apples at a commercial scale. This demonstration showed the benefits of the new technology, both in a 75 percent energy savings and a reduction in environmental pollution, while providing new healthy snacks with desirable texture and flavor at an

affordable cost. This technology was recently licensed by a private company to produce healthy snacks, while saving energy and water.

<u>Environmentally friendly BBQ "starter" charcoal</u>. Millions of consumers use lighter fluid to light charcoal for cooking, thereby contributing to the level of volatile organic compounds in the air around residential neighborhoods. ARS scientists in Albany, California, developed a porous charcoal material from plant waste using plant starch to bind biochar powder from walnut and almond hulls into quick igniting "starter" charcoal briquettes that can be easily lit without lighter fluid. This patented technology will help consumers comply with regional air districts' recommendations to reduce air polluting activities when air alerts are issued.

<u>"Liberty" switchgrass produces high yields of bioethanol</u>. An established field of "Liberty" switchgrass, an ARS cultivar, was grown on marginal, non-food cropping land in central Wisconsin in 2014 and 2015 and processed into bioethanol, yielding 3,510 to 4,960 liters per hectare. By comparison, corn grown on nearby high quality food cropping land produced 5,300 liters per hectare of bioethanol. "Liberty," the newest ARS cultivar bred for biomass production of bioethanol, has far exceeded the yield of other popular switchgrass cultivars (Summer and Kanlow). This is the first study of field-to-fermentation integration and the first study using "Liberty" switchgrass. These findings help establish "Liberty" switchgrass as a viable industrial crop.

<u>Newly discovered yeast increases biomass conversion yield</u>. *Yarrowia* yeast strains are critical for the bioconversion of lignocellulosic biomass into diverse lipids for potential conversion to biodiesel; food and healthcare applications; organic acids; and recently, as protein rich feed supplements for the animal and aquaculture industries. ARS scientists in Peoria, Illinois, screened 45 types of *Yarrowia* from the ARS culture collection. Those different strains of *Yarrowia* were evaluated in a harsh, dilute acid, switchgrass media for growth robustness, and breadth of sugars and lipids produced. The top producing strain accumulated more than three times the quantity of lipids than the strain that is commonly used in commercial bioconversion systems. This more robust strain offers a new and better option for conversion of biomass into lipid biofuels and other bioproducts.

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:

<u>An improved reference genome assembly for cattle and swine</u>. Reference genomes that accurately represent all the genes and regulatory sequences in their correct order and orientation can be used by breeders to develop improved livestock breeds with desirable traits. The reference genome for cattle was published in 2009 and had many inaccuracies and deficiencies, as does the reference genome for pigs, which was published in 2012. To improve the cattle genome sequence, ARS researchers in Clay Center, Nebraska, collaborated with researchers at the University of California, Davis; the University of Missouri, Columbia; the University of Maryland; the National Human Genome Research Institute; and ARS researchers in Beltsville, Maryland to generate an improved cattle reference assembly 100 times more continuous (a key measure of accuracy and quality) than the existing cattle reference. This new reference assembly more accurately represents the genes related to immune functions, which are notoriously difficult to assemble. For swine, ARS researchers in Clay Center worked in a collaboration led by the Roslin Institute in Scotland and collaborators at two U.S. universities and three genome industry partners to develop

an improved reference assembly for swine 200 times more continuous than the existing reference, and a second assembly of a crossbred pig that is 100 times more continuous than the original reference. The new assemblies of the original cow and pig are now the accepted reference genomes for cattle and swine. The alternate crossbred pig assembly is being used to investigate genome structure and function in commercial pig populations. These improved genomes will facilitate progress on genomic selection in beef cattle and swine.

Identifying genetic variations that may affect important livestock traits. One of the key aims of livestock genetics and genomics research is to discover and use the genetic variants underlying economically important traits such as reproductive performance, feed efficiency, disease resistance/susceptibility, and product quality. However most critical variants are not known. ARS scientists in Clay Center, Nebraska, sequenced the genomes of 72 influential sires and dams of the research location's swine herd, identified approximately 22 million variants, and submitted them to public databases. By aligning these sequences to the pig genome, researchers found that about 139,000 of these variants were expected to alter or disrupt proteins coded by genes in the genome, or were likely to regulate protein production. Because these variants are likely to alter proteins, they are most likely to have a significant effect on various traits of interest to livestock producers. Five hundred and sixty-five variants were classified as high impact, loss-of-function (LOF) mutations, meaning they render the protein inoperable. These LOF variants, along with functional variants likely to influence various reproductive traits, were included in a commercially available genotyping microarray. This information is expected to improve breeding efforts to enhance production traits.

The value of more prolific sheep breeds in a rangeland setting. The number of lambs produced by U.S. ewes every year does not currently meet market demand for weaned lambs. Researchers in Dubois, Idaho, in collaboration with ARS scientists in Clay Center, Nebraska, and researchers at Virginia Tech University in Blacksburg, Virginia, and Montana State University in Bozeman, Montana, assessed the use of more prolific sheep breeds to increase the number and weight of lambs weaned in range production systems. Researchers demonstrated that using more prolific breeds, such as Polypay and Romanov-cross, in a rangeland setting yielded more lambs and higher lamb weight yields than using traditional wool type breeds. The more prolific breeds produced lower quality wools and lighter fleeces than wool type breeds, but the higher total lamb weight compensated for reduced returns from wool sales. Results are being used by the U.S. sheep industry to guide producers in selecting breeds and genetics that will increase lambing rates in rangeland production systems.

<u>Maps of bovine DNA methylation in cattle</u>. DNA methylation is a biological process that affects gene expression and plays important roles in cattle development and various diseases. Methylation varies across tissues within an animal and is one way the same genetic code within all cells can cause differences across different organs within an organism. Data is needed to more fully describe methylation in various cattle tissues. ARS scientists in Beltsville, Maryland, evaluated methylation distributed throughout the bovine genome in 10 different bovine tissues and detected hundreds of differentially methylated regions in which methylation is thought to control gene expression. Additional analyses revealed that the degree of methylation was correlated with the expression of nearby genes in those tissues. This research provided a baseline dataset and essential information for DNA methylation, and gene expression profiles of cattle that will help understand DNA sequence regions that affect gene expression.

Use of the animal germplasm collection to restore lost genetic resources. ARS has a large and important collection of animal genetic resources. The stored collection has been used to regenerate or analyze important lost animal genetic resources. For example, Purdue University acquired pig germplasm samples from the stored collection to reconstitute a research line of pigs that was no longer available. The reestablished line had traits known to affect meat quality and were used in a project that garnered substantial funding, generated more than 10 scientific articles, and prompted Virginia Tech University to establish a second research population of this pig line. In another example, the Angus Association obtained a stored semen sample from a prominent bull and determined that the bull was free of a lethal mutation, which meant more than 29,000 other cattle did not have to be genotyped, saving the Association approximately \$2 million. In a final example, collaborative research between ARS scientists in Fort Collins, Colorado, and researchers at Pennsylvania State University, determined there were only two different Y chromosomes (which determines whether an animal is male) in the current U.S. Holstein population (our major milk producing breed) and that there were two additional Y chromosomes in semen stored in the collection that were not identified in the present Holstein population. ARS and Pennsylvania State University scientists worked with industry to produce bull calves with these two lost Y chromosomes from the collection as a first step to reintroducing them to increase genetic diversity. These examples demonstrate the value of ARS' germplasm collection to the U.S. livestock sector as a tool for industry and researchers to use in their efforts to solve a range of livestock industry problems.

<u>Fast growing rainbow trout</u>. Rapid growth rate is one of the most important economic traits in rainbow trout that can be improved through selective breeding. ARS researchers in Leetown, West Virginia, selectively bred a pedigreed, commercial scale rainbow trout population to market weight for five generations. Compared to the control line, body weight in the growth selected line increased by approximately 12 percent per generation through 13 months of age, resulting in a line that grows approximately 60 percent faster to and beyond standard market weight. The improvement in growth over contemporary commercial lines was consistent when fish were reared in different environments. This genetically improved and highly characterized population has been released for commercial propagation.

<u>Breeding for disease resistance in Nile tilapia</u>. Worldwide tilapia aquaculture is valued at about \$8 billion. The U.S. aquaculture industry produces nearly 30 million pounds of tilapia per year. However, production is hindered by two bacteria, *Streptococcus iniae* and *Streptococcus agalactiae*, which are responsible for around \$1 billion in annual worldwide losses. ARS scientists in Auburn, Alabama, collaborated with industry partners and verified that tilapia resistance to *S. iniae* infection is heritable, and that selective breeding of superior individuals produced increased disease resistance in subsequent generations. They also demonstrated that resistance to *S. agalactiae* was also heritable. Tilapia industry breeding programs now select for resistance to the two *Streptococcus* sp., as well as selecting for increased harvest weights and reduced disease risks in rapidly growing fish. The improved tilapia are being sold throughout the Americas and abroad. Based on current production statistics and available models, the improved tilapia on an average size farm provide \$0.6 million in additional revenue. This research helps U.S. fish farmers, and paves the way globally for reducing antibiotic use leading to safer products entering the United States.

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 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:

<u>Resistance identified for new types of wheat stem rust</u>. Wheat, a staple crop for billions of people, had a farm gate value of about \$10 billion in the United States in 2015. For centuries, wheat production has been threatened by a highly virulent microbe, wheat stem rust, which is able to rapidly change into new dangerous types. New and highly virulent races of the wheat stem rust pathogen, known as Ug99, have arisen in Africa and are a severe threat to U.S. and world wheat production. To protect the U.S. wheat crop from Ug99, new research tools are needed to help wheat breeders identify new sources of genetic protection. ARS researchers in Aberdeen, Idaho, and St. Paul, Minnesota, discovered genetic markers that speed the selection for the resistance gene Sr28, which is effective against Ug99, from wheat breeding stocks. Additionally, a potentially new type of genetic resistance that acts at the adult wheat plant stage was identified and its location has been mapped on the wheat genome. These advancements are substantially aiding U.S. wheat breeders by providing them with new wheat varieties that are resistant to stem rusts.

<u>Sugarcane aphid resistant sorghum</u>. Sugarcane aphid has become a major pest in sorghum in the last few years. ARS scientists in Lubbock, Texas, developed two new lines of pollinator sorghum that showed significant tolerance to sugarcane aphid. These two new lines have been transferred to four seed companies and have been adopted in their breeding programs.

<u>Big Data toolbox</u>. While computer aided simulation may be useful in designing optimal breeding strategies, the complexity of simulation is a barrier for breeders to taking the first step in using the software. ARS researchers in Ithaca, New York, developed a simple and flexible computational software suite called the breeding scheme language which allows users to more easily simulate breeding options and estimates of benefit from selection under specific genetic criteria and options. This software will be useful for breeders to evaluate breeding schemes, and to choose an optimal breeding strategy among a number of possible ones. It also serves as a training platform for plant breeders.

<u>Strawberries perform better under low tunnels</u>. Strawberries are economically valuable to farmers, and are popular with consumers who expect availability all year long. However, in much of the United States, traditional strawberries produce fruit only three to four weeks each year. To produce strawberry fruit for several months, farmers need to use a repeat fruiting strawberry variety that fruits nearly all year long, and protect it from mid-summer outdoor conditions. ARS scientists in Beltsville, Maryland, compared the performance of repeat fruiting strawberries under two different production systems (raised beds with and without low tunnels) to determine the effect of day length, brightness, soil moisture, humidity, and temperature on strawberry yield. They found that higher temperatures under low tunnels, especially in early spring and late fall, resulted in a much longer harvest season. Strawberry yield increased as light increased, and with temperatures up to about 28°C, above which yields dropped. Further evaluations showed that yields were more strongly associated with soil temperatures than air temperatures. This new discovery will be useful to strawberry growers are rapidly adopting the low tunnel production system.

<u>Optimum production systems for two new alternative oilseed crops</u>. ARS research has been critical in the domestication and establishment of *Camelina* and pennycress as new oilseed crops. Although ARS has published information on effective crop production systems that include these crops, optimum seeding methods for best stand establishments have not been determined. ARS researchers in Morris, Minnesota, developed better methods for timing and planting both crops that can lead to improved plant establishment, and potentially higher seed and oil yields. Much of the research information developed on *Camelina*, including using winter varieties in dual cropping systems, was summarized in an ARS produced growers guide, and published in two different review articles in collaboration with universities. In addition to providing new alternative crops for growers, this research offers producers a way to teach themselves how to grow *Camelina* and pennycress for maximum economic benefit.

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, Department of Homeland Security, 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 resistance in meats from animals produced with and without antibiotics. Meats produced from animals raised without antibiotics are perceived to harbor lower levels of antimicrobial resistance than meats from animals produced with no restrictions on antimicrobial use (conventional). ARS researchers in Clay Center, Nebraska, measured the prevalence and concentrations of antimicrobial resistant bacteria and the levels of 10 antimicrobial resistance genes in ground beef and pork chops from animals raised without antibiotics or by conventional methods. The researchers found that generally the levels of antimicrobial resistance were similar between the meats from animals raised either way. These results demonstrate that conventional beef and pork

products do not pose a greater risk of exposure to antimicrobial resistance than products from animals raised without antibiotics.

<u>Rapid residue screening test developed</u>. Zilpaterol is an FDA approved beta-agonist feed additive that increases feed efficiency, improves growth rate, and produces lean meat in livestock. Several major U.S. trading partners do not allow the import of meat from animals fed zilpaterol, and in the United States zilpaterol is illegal to use in some food animal species. ARS researchers in Fargo, North Dakota, developed a sensitive, selective, inexpensive, and rapid test to determine whether animals have been exposed to zilpaterol. The assay, which is similar to an over-the-ounter pregnancy test, can be used on-site with minimal training, with results in about 10 minutes. The accuracy and sensitivity of the assay was verified in tissues and urine from animals exposed to zilpaterol. This simple and inexpensive assay could be used to determine accidental, illegal, or purposeful zilpaterol exposure.

<u>FDA and industry use ARS research to develop food safety practices.</u> Fresh produce processors traditionally have used a specific free chlorine level (one part per million) as the control limit, and a re-wash as the corrective action solutions in hazard analysis and critical control points (HACCP) programs. ARS researchers in Beltsville, Maryland, determined that the industry standard control limit chlorine concentration does not prevent pathogen cross contamination, and that rewashing of contaminated product is an ineffective corrective action. The research clearly documented significant risk factors associated with generally considered safe operating practices. Follow up studies further demonstrated that a minimum of 10 ppm free chlorine was required to effectively prevent pathogen cross-contamination during washing. Recommendations have been adopted by leading processors, and incorporated in the interagency and industry taskforce whitepaper entitled, "Guidelines to Validate Control of Cross Contamination during Washing of Fresh-Cut Leafy Vegetables."

<u>The Environmental Protection Agency registers biopesticides for aflatoxin management</u>. Biopesticides based on atoxigenic strains of *Aspergillus flavus* have become the most widely used intervention for preventing aflatoxin contamination. However, these biopesticides must be approved by and registered with regulatory authorities, and each target crop and each atoxigenic genotype require additional regulatory action. Thousands of atoxigenic genotypes of *A. flavus* exist with broad adaptation, but regulatory approval for use in commercial products has only been granted for a few genotypes. ARS researchers in Tucson, Arizona, addressed this through direct interactions with regulatory authorities, field and laboratory experimentation, and collaborations with the Arizona Cotton Research and Protection Council, the University of California, the International Institute of Tropical Agriculture, commodity groups, and several national governments. The result is new and expanded registrations of biopesticides for preventing aflatoxin contamination, including approval for new target crops (figs and almonds), additional *A. flavus* genotypes, and less restrictive handling requirements. Full registrations for the United States, Senegal, and Burkina Faso were added to existing registrations in the United States (partial), Kenya, and Nigeria.

<u>Vaccination with live attenuated vaccine significantly reduces Salmonella levels in turkeys</u>. ARS researchers in Ames, Iowa, created a Salmonella vaccine with genetic mutations in the bacterial genome that limits Salmonella serotype specific immunity and induces an immune response that would be cross protective against diverse Salmonella serotypes. The researchers have previously shown the effective reduction of Salmonella disease, colonization, and fecal shedding in vaccinated swine. To highlight utility of the vaccine, researchers also tested the vaccine in turkeys that showed a reduction in systemic and intestinal colonization of vaccinated turkeys following challenge with multi-drug resistant Salmonella Heidelberg. Preharvest control of Salmonella in food producing animals can protect animal health, limit antibiotic usage, decrease environmental contamination, reduce Salmonella carriage into the human food chain, and diminish the cost of meat product recalls to producers. The results highlight the utility of the ARS designed vaccine for enhancing preharvest control of Salmonella.

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:

<u>Protecting livestock producers from the threat of foot-and-mouth disease</u>. Foot-and-mouth disease (FMD), a highly contagious disease that affects cattle, pigs, and small ruminants, is considered to be a major global threat to animal agriculture. Although FMD was eradicated from the United States in 1929, its reintroduction could result in billions of dollars in annual lost revenue to U.S. livestock producers. FMD diagnostics and vaccines have been used to control the disease, significant gaps remain in the availability of effective veterinary medical countermeasures suited for use in the United States. ARS scientists working at the Plum Island Animal Disease Center in Orient Point, New York, have made significant breakthroughs in developing better veterinary countermeasures to detect, prevent, and control FMD should an incursion ever happen in the United States. The first breakthrough is a vaccine platform called the "leaderless" FMDLL3B3D vaccine. The attenuated vaccine has a portion of the viral sequence known as the leader deleted (hence, leaderless). When injected, this vaccine stimulates the same immune response that is stimulated after vaccination with inactivated FMD vaccines made with virulent wild type virus strains. Unlike current FMD vaccine platforms, the FMDLL3B3D vaccine strains are fully attenuated, and they can be produced safely in the United States without the risk of causing a devastating FMD outbreak if they escape from a manufacturing facility.

<u>Development of foot-and-mouth disease diagnostic tests</u>. In the event of an outbreak of FMD, it is important to be able to determine which animals have been infected and which have been vaccinated. In developing the leaderless FMDLL3B3D vaccine virus platform, ARS scientists genetically engineered the platform with two markers so that vaccinated animals can be differentiated from infected animals. This ability would be critical during FMD outbreaks for differentiating infected animals from vaccinated animals (DIVA). This FMD vaccine is now in the advanced development phase with a commercial partner, and distribution is expected to begin within two years. With the availability of these DIVA markers, a consortium of academic, industry, and Federal agencies, including ARS, has developed a novel companion diagnostic test for the FMDLL3B3D vaccine. This is the first licensed FMD diagnostic kit approved for manufacturing on the U.S. mainland. The FMDLL3B3D vaccine together with its companion diagnostic test kit will provide animal health first responders with important new methods for mitigating the potentially catastrophic economic effect of an FMD outbreak.

Early warning strategies for outbreaks of vector-borne animal diseases. Vesicular stomatitis virus (VSV) is an animal pathogen spread by insects, and is one of the most common vesicular diseases affecting horses, cattle, and pigs throughout the Americas. There is currently limited understanding of the cause of VSV outbreaks, although VSV has occurred in the United States every decade since 1916. The disease is complex, with ecological, environmental, climatic, and time factors that may contribute to disease outbreaks. Having a better understanding of the cause and progression of VSV could provide a research model for predicting animal disease outbreaks spread by insects and other arthropods. ARS scientists from Colorado, Kansas, New Mexico, New York, and Wyoming collaborated to develop early warning strategies for VSV. Coupling Big Data model integration with human and machine learning, ARS scientists evaluated the relative importance of a large and diverse suite of variables to patterns in VSV disease outbreaks. Their findings showed a sequence of early indicators accompanied by the presence of important disease transmitting insects. Before this analysis, little information was available about the different roles insects and environmental factors played in disease outbreaks. These findings about the role of latitude, elevation, and long-term precipitation in disease outbreaks will allow livestock producers or horse owners to monitor local conditions for determining the likelihood that VSV could occur in any month of the year.

<u>Swine to human transmission of methicillin resistant *Staphylococcus aureus*</u>. *Staphylococcus aureus* is a common bacteria generally found in the nose and throat of humans and animals. It can also be a devastating human pathogen that has the ability to acquire resistance to antibiotics resulting in, for example, methicillin resistant *S. aureus*

(MRSA). Swine can carry strains of MRSA that do not cause disease in swine, but it is unclear whether livestock associated (LA)-MRSA is a risk for humans. ARS scientists in Ames, Iowa, investigated the genetic mechanisms of antimicrobial resistance among swine LA-MRSA and human clinical MRSA isolates and found that swine LA-MRSA isolates exhibited resistance to fewer antibiotics than MRSA isolates from humans who have had no swine contact. Furthermore, differences in the antimicrobial resistance genes between swine LA-MRSA and human clinical MRSA isolates suggest there are distinct populations of MRSA in swine and humans, antibiotic resistance is more prevalent in human strains, swine to human transmission is infrequent, and LA-MRSA may not be a common zoonotic threat.

A new research tool for tick transmitted diseases that eliminates the need for using animals in testing. Ticks are serious pests because they transmit a range of diseases to humans and animals. Laboratory methods to enhance large scale preparations of purified pathogens from ticks that transmit disease are paramount to advance research of tick transmitted diseases such as bovine anaplasmosis, bovine babesiosis, Lyme disease, and Heartwater. But these methods require the use of live host animals to "feed" the ticks and propagate these pathogens. ARS scientists in Pullman, Washington, designed and developed a novel continuous flow laboratory tick feeding system that facilitates isolating pure infectious tick borne pathogens and eliminates the traditional method of using animals to isolate pathogen cultures. Ticks feed on a silicone membrane that covers blood that is being circulated at a constant temperature which mimics a live animal. The laboratory tick feeding system will be a useful method in processes to develop live vaccines for tick borne diseases and for conducting studies to understand pathogen tick vector interactions and the tick mammalian host interface. This new laboratory method not only improves pathogen isolation, but will provide a framework for following the three Rs for ethical use of animals in research (i.e., replacement, reduction, and refinement) in studying tick transmitted diseases.

Improving the accuracy of diagnostic tests for bovine babesiosis. Bovine babesiosis (also known as cattle tick fever) is caused by the protozoan parasites *Babesia bovis* and *B. bigemina*. Babesia parasites can be transmitted by ticks to cattle of any age, and can result in 90 percent mortality in newly infected adults. Babesiosis was a significant problem in the southern United States until eradication of the tick vector in the 1940s. The United States imports one million head of cattle annually from Mexico, where babesiosis and cattle fever ticks are present. The recent discovery of acaricide (i.e., a pesticide) resistant tick populations capable of transmitting *Babesia* species and the reemergence and spread of cattle fever ticks by wildlife on the Texas-Mexico border is increasing the risk that bovine babesiosis will be reintroduced to the United States. ARS scientists in Pullman, Washington, have improved diagnostic testing methods to determine the infection prevalence of bovine babesiosis on the U.S.-Mexico border. This improved test was fully developed in collaboration with a commercial partner and is now available for use.

<u>Publication of the cattle fever tick genome sequence</u>. The cattle fever tick *Rhipicephalus microplus* transmits the disease cattle fever (Babesiosis) to cattle. The genome of the cattle fever tick, which contains more than twice the amount of DNA as the human genome, is difficult to sequence. ARS scientists in Kerrville, Texas, worked with researchers at Murdoch University's Centre for Comparative Genomics, Murdoch, Australia, and published the genome sequence for this cattle fever tick. They identified genes associated with cattle fever pathogen maintenance, the cattle host immune response, pesticide resistance, tick feeding, and others. This new comprehensive sequence information is facilitating tick vaccine research and pesticide resistance monitoring which will help protect cattle health.

<u>Finding a virus that is a natural enemy of fire ants</u>. Fire ants inflict serious and sometimes fatal bites to animals and humans, and they cause billions of dollars of crop damage. *Solenopsis invicta* virus 4 (SINV-4) belongs to a new virus family, *Polycipiviridae*, and viruses within this family appear to infect only ant species. ARS scientists in Gainesville, Florida, discovered SINV-4 in South American fire ant populations and determined that this virus is also present in U.S. fire ant populations. Because it is known to infect only ant species, SINV-4 may be a good biocontrol agent for controlling invasive ants, including fire ants. This research is useful to the pest control industry and industries that are harmed by this pest.

<u>Developing transgenic male only screwworm strain</u>. Screwworms burrow into the skin of live animals and inflict serious wounds while they feed on the tissue. ARS researchers in Kerrville, Texas, worked with researchers at North Carolina State University and the Panama-U.S. Commission for the Eradication and Prevention of Cattle Screwworm (COPEG) to complete a critical step in bioengineering a transgenic male only strain of screwworms to mate with females in the wild. The genetically engineered male only strains were transferred to the Methods and Development section of COPEG for further evaluation in field trials scheduled for the coming year. The ability to produce a colony consisting only of males is expected to decrease production costs and biological waste by

approximately 50 percent. In related research, ARS researchers in Lincoln, Nebraska, and Kerrville, Texas, identified four volatile attractants that influence female egg laying. These results are expected to support the development of products that will increase the average number of eggs produced for creating sterile screwworm males. It will be particularly important for producing the male only strain because fewer fertile females will be produced which will reduce production costs.

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:

<u>Cloning of a durum wheat stem rust resistance gene</u>. Wheat provides a substantial proportion of the calories and proteins consumed by humans, and additional increases in wheat production are necessary to feed a growing population. Reducing yield losses caused by pathogens can contribute to production increases. ARS scientists in St. Paul, Minnesota, report the identification and development of perfect markers for Sr13, a gene from durum wheat that confers resistance to the new virulent races of the stem rust pathogen that appeared in Africa at the beginning of this century, including Ug99. Two phenotypic alleles, Sr13a and Sr13b, were identified as having effectiveness in controlling stem rust pathogen races. The perfect markers developed for Sr13 and knowledge of allelic differences will allow U.S. durum wheat breeders to more effectively develop Ug99-resistant cultivars. In addition, Sr13 can be a useful component of transgenic cassettes that include multiple resistance genes.

<u>Bee mite identification using the internet</u>. Bees play a crucial role in U.S. agriculture as pollinators of many important crops. Some mites that live on bees are parasitic to their hosts, spreading viruses that contribute to colony collapse, whereas other mites have little detrimental effect on their bee hosts. ARS scientists in Beltsville, Maryland, along with researchers at the University of Michigan and the Animal and Plant Health Inspection Service, designed an interactive, web-based tool for identifying mites found on bees. The searchable image gallery contains more than 850 mite images with an emphasis on mites associated with honey bees, mason bees, bumble bees, and other important pollinators in temperate regions, and stingless bees and large carpenter bees in the tropics. This interactive internet site is useful to beekeepers, scientists, extension agents, and quarantine officers throughout the world who need to distinguish harmless mites from those that might harm bees or bee colonies.

<u>Genetic mapping of the location imparting resistance to root knot nematode in cotton</u>. The root knot nematode is found throughout the Cotton Belt, and crop rotation with non-host crops can provide short-term nematode suppression. But growers prefer to raise plants that have nematode resistance rather than rotate their crops which is usually a challenge to implement. Chromosome 14 holds one of the two known genetic locations that imparts resistance to root knot nematode in cotton. But this genetic location has been only sparsely mapped, and genetic markers were not linked closely enough to the gene location to effectively select them. ARS researchers in Tifton, Georgia, collaborated with University of Georgia scientists, to create new molecular markers that are more closely linked to the gene location, and demonstrated that the resistance gene(s) are confined to a much smaller segment of DNA than had been previously identified. Additionally, the researchers used the cotton genome of *Gossypium raimondii*, a precursor of modern cotton, to identify 20 genes in the newly delineated region that could be involved in nematode resistance. The improved markers allow better pinpointing of their precise location, and breeding programs are now developing resistant germplasm with the markers. Identification of these potentially resistance genes advances researchers closer to the goal of identifying the specific resistance genes and their function.

Discovery of new environmentally friendly mosquito repellent. Mosquitoes are responsible for spreading such diseases as yellow fever, Zika, and chikungunya to humans, thus, the development of new, environmentally friendly repellents is a high priority, particularly for the protection of U.S. troops deployed overseas in areas where these diseases are readily spreading. However, significant health and environmental risks are encountered in the use of effective mosquito control strategies that are pesticide based. ARS researchers in College Station, Texas, along with collaborators at Texas A&M University and the University of Paris-Saclay, identified a class of "neuropeptide" hormone in the legs and mouth parts of mosquitoes involved in taste perception. A novel version of the neuropeptide hormone was developed that deters, and/or repels mosquitoes from feeding, resulting in an immediate "fly-away," "walk-away," and/or "jump away" behavior. The work, funded by a joint USDA/Department of Defense program, and published in the Proceedings of the National Academy of Sciences of the United States, represents a major breakthrough that might find practical use as a completely new and effective mosquito repellant.

Impact of various pesticide classes on honey bee survival. Information regarding the impact of direct sprays and residues from different pesticide classes on honey bee populations is needed to understand which classes may pose the greatest risks. ARS scientists in Stoneville, Mississippi, tested the toxicity of imidacloprid, a commonly used agricultural pesticide, mixed with seven different pesticide classes on honey bees through direct sprays and residues. The scientists determined that that residue levels of seven pesticides in pollens/hives may not adversely affect honey bees, but long-term exclusive ingestion of the maximal residue levels of some of the insecticides may induce substantial bee mortality. Rotating pesticide chemistries and proper selection of pesticide mixtures can alleviate toxicity risks to honey bees.

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:

Whole grain replacement of refined grains improves calorie balance. Dietary recommendations, including Dietary Guidelines for Americans, suggest replacing refined grains with whole grains, but the evidence for this is not consistent. ARS-supported scientists in Boston, Massachusetts, studied 81 older volunteers who were given meals for 6 weeks that were designed to maintain body weight containing either 0 or 7 ounces of whole grain foods daily. Whole grain intake led to a 92 calorie/day net energy loss compared with refined grain intake. There were modest beneficial changes in some of the large-intestinal bacteria and two types of immune cells in the bloodstream as a result of this diet. These data strengthen the recommendation from the Departments of Agriculture and Health and Human Services that at least half of a person's grain servings should come from whole grain foods.

Improved nutrient intake recommendations for infants, young children, and lactating women. It is important to know the concentration of nutrients in human milk because it is recommended as the sole source of nutrition for infants during the first 6 months of life. Additionally, it is the basis for setting nutrient intake recommendations for infants, nursing women, and young children. Unfortunately, the reported nutritional values for human breast milk are few and inconsistent across studies due to differences in methods and timing of milk collection and maternal nutritional status. ARS researchers in Davis, California, have developed and validated more efficient methods for measuring nutrients in human milk that has spawned a new study to obtain reference values for nutrients and other milk components in four countries. The studies have shown that poor maternal nutritional status and/or dietary quality results in low concentrations of many nutrients in milk, and that various ways of improving a mother's

micronutrient status can increase the micronutrient concentrations in milk. This research will be useful for improving nutrient intake recommendations for infants, lactating women, and young children, and for informing global public health policy about the need for maternal or infant supplementation during lactation.

<u>The glycemic index is highly variable and not a reliable dietary guide</u>. The glycemic index (GI) was developed to identify how specific carbohydrate-rich foods influence blood sugar levels in the hours after consumption. Glycemic load (GL) incorporates both the GI and quantity of food to adjust for serving size. These measurements did not consider how blood sugar levels are affected when carbohydrate-containing foods are eaten in combination with other nutrients such as fat or protein. ARS-funded researchers in Boston, Massachusetts, found that adding protein to a person's diet resulted in a healthier, significant decrease in measured GI and GL, whereas adding carbohydrate, fat, or fiber had little effect on these values. These data indicate significant variability in meal GI and GL determinations results from the consumption of different food combinations and caution against using these values for dietary guidance.

<u>High folate intake is linked with nerve damage risk in older adults with a common gene variant</u>. One in six Americans carries two copies of a genetic variant in the gene for a vitamin B12 transport protein. In a study of more than 170 older adults, ARS-supported scientists in Boston, Massachusetts, collaborated with colleagues from Boston University and Pfizer, Inc., and found that individuals with the gene variant were three times more likely to have a type of nerve damage called peripheral neuropathy. Subjects with the variant who consumed more than twice the recommended amount of folate were seven times more likely to develop peripheral neuropathy. These results strongly suggest that older people should exercise caution in taking folic acid supplements and limit their folate intake to no more than the recommended amount.

Environmental Stewardship

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:

Remote sensing toolkit improves water resource management with first ever daily delivery of crop water use data. Accurately measuring crop water use (evapotranspiration or ET) at appropriate temporal and spatial scales is important for effectively managing agricultural water use. To address this need, ARS scientists in Beltsville, Maryland, developed and distributed a novel ET mapping toolkit that combines remote sensing data from a range of satellite platforms into daily crop water use estimates at an unprecedented 30 meter spatial resolution. Because of its significant resolution advantages, the toolkit has already been used to address many water resource issues in agriculture: studying groundwater depletion via irrigation in Central Wisconsin; assessing the impact of expanding agricultural drainage on regional hydrology in the Corn Belt; improving water use in managed forest plantations; calibrating hydrologic/water quality models for the Chesapeake Bay Watershed; making irrigation management decision in vineyards; assessing consumption for the U.S. Water Census and California's new Sustainable

Groundwater Management Act; and delivering drought and water information for the Near East North African region. The toolkit will also be used to generate ET and water stress products for NASA's ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) mission. Using this ET mapping tool in these projects has greatly expanded monitoring and has optimized water use and availability across a broad range of agricultural systems.

Improving nitrate removal using saturated buffers with tile drainage. Streamside vegetation buffers are a proven practice for removing nitrate from both overland flow and shallow groundwater before it can enter surface waters. But in landscapes with tile pipe drainage, most of the subsurface flow travels from farm fields through tile pipes, leaving little opportunity for this nitrate removal process. ARS scientists in Ames, Iowa, and university cooperators showed that re-routing a fraction of field tile drainage through riparian buffers can remove hundreds of pounds of nitrate before it enters nearby surface waters each year. This buffer system has been adopted by the Natural Resources Conservation Service (NRCS) and is now eligible for Environmental Quality Incentives Program funding across the Midwest. Research shows the practice could be installed along thousands of miles of rivers in Iowa alone and potentially remove millions of pounds of nitrate from U.S. surface waters.

Lowering the cost of removing phosphate from agricultural drainage waters. Filter treatment systems containing synthetic goethite (iron oxyhydroxide) could be a viable means of capturing phosphate and reducing nutrients in agricultural drainage, but goethite can be costly unless it can be regenerated for continual use. ARS scientists in Columbus, Ohio, conducted laboratory and field drainage phosphate removal tests on synthetic goethite, and afterwards regenerated the same material using a sodium hydroxide flush. Laboratory treatment tests showed that both the original and regenerated goethite removed greater than 98 percent of the phosphate in agricultural drainage waters. Field agricultural drainage water treatment tests showed that the original goethite removed 75 percent of the phosphate, while the regenerated synthetic goethite removed 34 percent. These results suggest that in field settings, regenerating synthetic goethite will probably require a two step procedure that uses a diluted acid wash to remove calcium phosphate precipitates followed by a sodium hydroxide flush to release any remaining adsorbed phosphate. Using refined regeneration process filter treatment systems containing synthetic goethite could be a cost-effective phosphate removal treatment for drainage water.

Improving access to and the usefulness of GRACEnet data for improved soil management. GRACEnet (the Greenhouse gas Reduction through Agricultural Carbon Enhancement Network) is a network of scientists and locations focused on improving agricultural management and improving the environmental footprint of agriculture. Specifically, GRACEnet activities support efforts to mitigate greenhouse gas (GHG) emissions associated with agricultural production through large scale studies that address how management strategies affect both soil carbon and GHG emissions. The GRACEnet community has expanded the network's role in these efforts by establishing new field/laboratory measurement protocols; refining a standardized Excel data entry template; developing and implementing software to perform data entry quality control; and introducing a web accessible GRACEnet database. The public portal of the data management system was further improved during 2017 and integrated with the Natural Resource and Genomics Data Systems server. The GRACEnet web portal now contains extensive data from 17 ARS locations with more than 450,000 total records, including 116,000 soil GHG emission measurements and 83,000 soil measurements. Furthermore, the data developed and housed by the GRACEnet project have been used to increase the accuracy of GHG emission estimates reported in the U.S. national GHG inventories, including the latest EPA inventory published in FY 2017. Additionally, project data have been used to develop scaling factors to quantify the GHG reductions for improved management practices. GRACEnet data are now being used to validate the underlying models used by the NRCS Carbon Online Management Evaluation Tool (COMET-Farm) decision support tool.

<u>Recovery of ammonia and production of highgrade phosphates from animal and municipal effluents</u>. New processes and technologies to recover and reuse nitrogen and phosphorus from wastes will help conserve valuable crop nutrient resources and mitigate their release into the environment. ARS researchers in Florence, South Carolina, developed a new technology that separates and recovers ammonia and phosphorus from liquid effluents. A U.S. patent application for this process was filed in 2016. The developed technology can recover 98 percent of the nitrogen, and when enhanced, the technology was able to reduce costs by 70 percent. ARS scientists combined the nitrogen recovery process with a novel phosphorus recovery process. The combined process produced phosphorus bio-minerals that were similar to the very high phosphate grade commercial fertilizers favored by the fertilizer industry. This process enabled 100 percent phosphorus recovery efficiencies. This technology has a number of wide ranging applications, including treating anaerobic digester effluents arising from swine operations, dairies operations, and even municipal waste water systems. The estimated potential value of implementing this nutrient

recovery system in dairy farms alone is about \$1.3 billion. This technology will dramatically support livestock producers, municipalities, industrialists, extension practitioners and other scientists interested in manure nutrient recovery technologies.

<u>Post-fire grazing does not harm plant recovery or plant communities</u>. After wildfires on western U.S. rangelands, natural resource agencies often prohibit grazing from one to three years, and ranchers who need to rent other pasture for their grazing livestock can incur annual costs exceeding \$54 million. ARS scientists in Miles City, Montana, in cooperation with U.S. Forest Service, found that post-fire plant production increased 56 percent the year a fire occurred. Where grazing occurred the second and third years after fire, the post-fire pastures yielded slightly more or had similar production as unburned sites. A companion study demonstrated that plant response to fire was similar whether sites were mowed or not mowed after fire. These combined results suggest it is not necessary to prohibit or delay grazing in northern mixed grass prairies after spring wildfires to be able to maintain plant productivity and species composition. These results were similar to recent research from the same laboratory indicating northern mixed prairie is resistant to grazing after summer fire. Natural resource agencies can use these findings to support grazing management decisions post-fire and reduce pasture costs for ranchers affected by wildfire.

Developing forage kochia for enhanced winter grazing. Winter feeding can account for up to 70 percent of annual livestock production costs in the western United States. These costs can be reduced by extended grazing into the fall and winter, but grasses that become dormant in the fall lack the protein needed by ruminants such as cattle. Forage kochia is a semi-shrub that has been seeded on rangelands for fall and winter forage. Previous research showed that the kochia cultivar "Immigrant" provided needed protein and reduced winter feed costs by 25 percent, but it has been limited by poor establishment and short stature. "Snowstorm" is a new forage kochia cultivar developed and released in 2012 by ARS scientists in Logan, Utah, that in field comparisons was 64 percent taller than "Immigrant," produced 68 percent more forage, and had increased protein and digestibility. "Snowstorm" has quickly become a popular selection for private and public rangeland seedings. For instance, the Bureau of Land Management's annual bid for reclamation plant materials included a significant portion of "Snowstorm" in the 2016 seed buy, purchasing 4,000 pounds valued at \$101,500.

<u>A soil and land management app debuts</u>. Smartphones are increasingly being used for quick and convenient access to information for improving farm management decisions and helping agricultural managers maximize the productivity, profitability, and sustainability of their production systems. ARS scientists in Las Cruces, New Mexico, with support from USAID, developed the Land-Potential Knowledge System (LandPKS) app for iOS and Android phones and tablets, which enables managers to rapidly collect and store soil and topographic information and monitor vegetation status for a given area. A new LandPKS algorithm can be used to identify soils based on user observations and provides a more precise and accurate tool for determining soil color using smartphone cameras. These tools, combined under a simple to use interface, help land managers develop information databases for identifying options that might improve risk management, productivity, economic returns, and environmental enhancement. The app is available for download at https://www.landpotential.org/.

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, <u>http://www.nal.usda.gov</u>. 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:

<u>Development of the Ag Data Commons</u>. The staff of the National Agricultural Library expanded the Ag Data Commons catalog for agricultural research datasets (https://data.nal.usda.gov). Improvements focused on multiple

platform upgrades for the enhancement of the Ag Data Commons DKAN distribution. The Ag Data Commons was successfully added to the USDA Enterprise Inventory with the support of ARS data steward and data architect from the USDA Office of the Chief Information Officer. Considerable effort was given to creating sustainable business models and strategic partnerships with senior program leadership within ARS and NIFA.

Implementation of the i5K Workspace. The USDA National Agricultural Library has implemented new tools, added new data, and performed updates to the i5K Workspace@NAL, a web resource for arthropod genome access and curation. New software suites include a GFF3 Toolkit package for the generation of Official Gene Sets (OGS). The software was used to generate three OGSs, and a manuscript describing the new tool was submitted to the journal *Methods in Molecular Biology*. Three new species and 30 new datasets were added to the Workspace. An analysis of the sequenced arthropod genomes found that 20 percent of all sequenced genomes are in the i5K Workspace@NAL--a good market penetration for a small unit.

<u>The LTAR data portal is functional</u>. Meteorological observations as part of the Long-Term Agro-ecosystem Research (LTAR) project exceeded 1.2 million individual readings. New sites were added and some sites expanded their data offerings by increasing the number of PhenoCam cameras being used to document weather and vegetation conditions at LTAR sites (now up to 45 PhenoCams at 13 LTAR sites). The geographic information systems (GIS) catalog now has more than 100 reusable metadata snippets for frequently used entries and 27 distinct keyword list thesauri, in addition to the National Agricultural Library Thesaurus (NALT). Each keyword is linked to its source thesauri. At present, the GIS server is hosting 113 data layers. A new tool was added to the GeoServer in response to customer feedback that allows the comparison of any two raster layers using a slider feature.

<u>Update on the Life Cycle Assessment Commons</u>. The NAL team and its partners were recognized by an industry association for their contributions to the field of Life Cycle Assessment (LCA). The memorandum of understanding (MOU) supporting this accomplishment, which formalizes the Federal LCA Commons, is moving through the approval process. The EPA and the Department of Energy have both signed the MOU. In support of its leadership in the field, the NAL team was called upon to conduct an expert review of the Australian life cycle inventory database on behalf of the United Nations Environmental Program (UNEP)/SETAC, and the UNEP Global Network of Interoperable Databases. This year, the team added the Federal Highway Administration as a new partner. The LCA team is making significant progress toward meeting the standards of a trusted repository, and providing reliable and long-term data stewardship for the LCA and Federal LCA Commons.

Implementing PubAg and expanding digital collections. NAL expanded its efforts to improve the technical development of PubAg and to build up the content of the service. In 2017, PubAg reached 1,707,868 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 internal NAL repository, PubMed Central, and the publisher. PubAg was migrated and modernized to a Blacklight platform with features added to improve the user experience, including an advanced search function and type ahead suggestions using ElasticSearch technology. Building on upgrades developed for PubAg, NAL has modified database, search, and user interface technology to support an upgrade to its digital collections scheduled for deployment in FY 2018. The National Agricultural Library's Digital Collections had nearly 14 million online page views of more than 30,000 historical documents and reports across 10 major collections in 2017. PubAg can be found at http://pubag.nal.usda.gov.

<u>NAL digital collections</u>. NAL staff digitized and created citation information for 19,741 items (690,304 pages), bringing the total number of digitized items to 135,397 (approximately six million pages). These items include historic USDA issued publications, nursery and seed trade catalogs, and topic specific content to support NAL online exhibits and information. NAL has also upgraded the metadata records for items in the Organic Roots, Historical Dietary Guidance, and the Animal Welfare Act collections. In addition, NAL continue contributing rare and historical titles to the Biodiversity Heritage Library. Until all mass digitized publications are migrated to NAL web services, public access is available at https://archive.org/details/usdanationalagriculturallibrary.

<u>DigiTop</u>. NAL and USDA partners licensed on behalf of USDA users a \$5.5 million portfolio of content consisting of full text and databases to support research and scientific discovery. DigiTop continued shifting subscription periods to make the service more resilient to the budgetary challenges and to ensure better continuity of access for researchers.

<u>Automated Indexing</u>. NAL continued improving full scale production--automated indexing/text analytics software to generate the AGRICOLA Index of agricultural literature. This application combines semantic analysis, machine

learning, and human constructed rules to automatically assign NAL Thesaurus subject terms to journal article citations. This metadata facilitates effective literature classification, management, search, and retrieval. NAL used the system to index 481,827 articles, an increase of 51,701 articles over FY 2016 production. NAL also migrated production from Luxid 6 to Luxid 7 application. Additionally, NAL begin migration to the next version of the Expert System software, called Cogito.

The estimates include appropriation language for this 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, \$99,600,000 to remain available until expended.]

Lead-Off Tabular Statement Current Law

Buildings and Facilities

Budget Estimate, 2019	-
2018 Annualized Continuing Resolution	\$98,924,000
Change in Appropriation	-98,924,000

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

Drogram	2016 A	ctual	2017 A	ctual	2018 Es	stimate	Inc. or	Dec.	2019 Pres	sident's
Flogram	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs
Buildings and Facilities										
Discretionary Appropriations	\$212,101	-	\$99,600	-	\$98,924	-	-\$98,924	-	-	-
Total Appropriation	212,101	-	99,600	-	98,924	-	-98,924	-	-	-
Rescission	-	-	-	-	-	-	-192,000	-	-\$192,000	-
Balance Available, SOY	44,055	-	248,665	-	200,996	-	-8,996	-	192,000	-
Recoveries, Other (Net)	28	-	-	-	-	-	-	-	-	-
Total Available	256,184	-	348,265	-	299,920	-	-299,920	-	-	-
Lapsing Balances	-	-	-	-	-	-	-	-	-	-
Bal. Available, EOY	-248,665	-	-200,996	-	-192,000	-	192,000	-	-	-
Total Obligations	7,519	-	147,269	-	107,920	-	-107,920	-	-	-

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

Due energy	2016 Actual		2017 A	2017 Actual		2018 Estimate		Inc. or Dec.		2019 President's	
Program	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	
Buildings and Facilities											
Discretionary Obligations:	\$7,519	-	\$147,269	-	\$107,920	-	-\$107,920	-	-	-	
Total Obligations	7,519	-	147,269	-	107,920	-	-107,920	-	-	-	
Bal. Available, EOY	248,665	-	200,996	-	192,000	-	-192,000			-	
Total Available	256,184	-	348,265	-	299,920	-	-299,920	-	-	-	
Rescission	-	-	-	-	-	-	+192,000	-	\$192,000	-	
Bal. Available, SOY	-44,055	-	-248,665	-	-200,996	-	+8,996		-192,000	-	
Recoveries, Other (Net)	-28	-	-	-	-	-	-	-	-	-	
Total Appropriation	212,101	-	99,600	-	98,924	-	-98,924	-	-	-	

Buildings and Facilities

Classification by Objects (Dollars in thousands)

				2019
	2016	2017	2018	President's
	Actual	Actual	Estimate	Budget
Other Objects:				
32.0 Land and structures	\$7,519	\$147,269	\$107,920	\$0
99.9 Total, new obligations	7,519	147,269	107,920	0

Status of Construction Projects as of December 2017

Status of research facilities authorized or funded in prior years and reported as uncompleted in the 2018 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 1st Quarter of 2018. Construction will be awarded in the 3rd Quarter of 2018 and completed in the 2nd Quarter of 2020.
California, Albany Western Regional Research Center (Research and Development Facility)	2000 Planning and Design 2001 Construction 2002 Construction 2009 ARRA 2015 Rescission Total	\$2,600,000 4,889,220 3,800,000 15,624,460 (\$166) 26,913,514	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.
California, Davis Center for Advanced Viticulture and Tree Crop Research	2004 Planning and Design 2005 Construction 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission Total	\$2,684,070 2,976,000 3,588,750 1,869,819 2,192,000 3,000,000 (\$16,062,114) 248,525	POR completed 2nd Quarter 2007. Lease agreement with University was not executed.
California, Salinas Agricultural Research Station	2004 Planning and Design 2005 Planning and Design 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission 2016 Design 2017 Construction Total	$\begin{array}{r} \$4,473,450\\ 2,976,000\\ 3,588,750\\ 1,869,819\\ 2,192,000\\ 3,654,000\\ (\$14,937,644)\\ 1,300,000\\ 30,200,000\\ 35,316,375\end{array}$	Design (100%) completed 2nd Quarter 2007. A design update was awarded in the 1st Quarter of 2017 and will be completed in the 3rd Quarter of 2018. Phase 1 construction will be awarded in the 4th Quarter of 2018.
Connecticut, Storrs Center of Excellence for Vaccine Research	2008 Planning and Design 2009 Design and Construction 2010 Construction 2011 Rescission Total	\$1,869,819 2,192,000 3,654,000 (\$7,221,296) 494,523	POR completed 4th Quarter 2010. Lease agreement was not executed.

		Amount of Funds	
Location and Purpose	Year	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 was completed in the 4th quarter of 2017.
Georgia, Athens Southeast Poultry Research Laboratory	1992 Planning1993 Construction2008 Planning and Design2009 Planning and Design2011 Rescission2015 Planning, Design, Const.2016 ConstructionTotal	\$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 of 2016. Design Build Construction Contract was awarded in the 4th Quarter of 2017. Total contract duration from notice to proceed to completion is expected to take 5½ years (all work to be completed by the 3rd Quarter of 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 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.

		Amount of Funds	
Location and Purpose	Year	Provided	Description
Illinois, Peoria National Center for Aquacultural Utilization Research (Central Wing)	2000 Construction Design 2002 Construction 2004 Construction 2005 Construction 2006 Construction 2008 Construction 2009 Construction 2009 ARRA 2015 Rescission Total	\$1,800,000 6,500,000 2,684,070 2,976,000 3,588,750 1,869,819 2,192,000 16,237,165 (\$142,565) 37,705,239	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.
Iowa, Ames National Centers for Animal Health	2001 Design and Construction 2002 Design and Construction 2002 Construction 2002 APHIS Transfers [Supplemental] [Other Transfers] 2002 Construction 2003 Construction 2003 Construction 2005 Construction 2006 Construction 2015 Rescission Total	\$8,980,200 40,000,000 50,000,000 15,753,000 [14,081,000] [1,672,000] 25,000,000 32,785,500 110,000,000 121,024,000 58,212,000 (\$1,108,686) 460,646,014	 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. Buildings 1 and 2 demolition are complete, but the site restoration will be completed in June 2018.
Iowa, Ames National Laboratory for Agricultural and the Environment	2016 Design and Construction	\$13,500,000	Design awarded 4th Quarter 2016 and bridging documents were 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.
Kentucky, Bowling Green Animal Waste Management Research Laboratory	2005 Planning and Design 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission Total	\$2,281,600 2,970,000 1,390,200 1,088,000 2,000,000 (\$5,880,338) 3,849,462	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 Headhouse/Greenhouse awarded 4th Quarter 2010 and completed 2nd Quarter 2012.
Kentucky, Lexington Forage Animal Research Laboratory	2005 Planning and Design 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission Total	\$2,976,000 3,960,000 2,085,300 1,632,000 2,000,000 (\$9,678,689) 2,974,611	POR is complete. Lease agreement terminated 2016. Design (100%) was completed 2nd Quarter 2011.

		Amount of Funds
Location and Purpose	Year	Provided
- • • • • • •	2004 PL : 1D :	¢1.242.025
Louisiana, Houma	2004 Planning and Design	\$1,342,035
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
Lectric New Orleans	1000 Plansing and Design	¢1 100 000
Louisiana, New Orleans	1998 Planning and Design	\$1,100,000
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
National Cold Water Marine	2002 Construction	3 000 000
Aquacultura Contar	2002 Construction	9,000,000
Aquaculture Cellier	2004 Design and Construction	2,684,070
	2004 Design and Construction	2,084,070
	2005 Design and Construction	2,976,000
	2006 Design and Construction	2,475,000
	2011 Rescission	(\$2,012,304)
	Total	20,707,591
Maryland Beltsville	1988 Design and Construction	\$5 750 000
Beltsville Agricultural Research	1989 Design and Construction	6 100 000
Center (BARC)	1990 Design and Construction	9 860 000
center, (britte)	1990 Design and Construction	15 000,000
	1997 Design and Construction	16,000,000
	1002 Design and Construction	12,547,000
	1995 Design and Construction	15,547,000
	1994 Design and Construction	2 060 000
	1995 Design and Construction	3,900,000
	1996 Design and Construction	8,000,000
	1997 Design and Construction	4,500,000
	1998 Design and Construction	5,200,000
	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

Description

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.

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.

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 when funds are made available.

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.

Location and Purpose	Year	Amount of Funds Provided	Description
Renovate Building 307	2010 Construction 2011 Rescission 2016 Design and Construction Total	3,000,000 (\$9,831,954) 37,100,000 205,762,274	A design update for Building 307 was awarded in the 4th Quarter of 2016 and completed in the 1st Quarter of 2018. Construction will be awarded in the 4th Quarter of 2018 and completed in the 2nd Ouarter of 2020.
Maryland, Beltsville National Agricultural Library	1998 Design and Construction 1999 Design and Construction 2001 Design and Construction 2002 Construction 2003 Design and Construction 2004 Design and Construction 2009 ARRA 2011 Rescission Total	\$2,500,000 1,200,000 1,766,106 1,800,000 1,490,250 894,690 6,357,422 (\$115,175) 15,893,293	Renovation of the NAL building continues. Completed projects include: replacement of the computer room HVAC and fire suppression systems; completion of chiller replacement and brick repairs of three building elevations; and 14th floor window replacements. Construction for the deteriorated building envelope, repair of brick facade, and replacement of the plumbing system awarded 1st Quarter 2010 using ARRA funding and completed 3rd Quarter 2012.
Maryland, Frederick (Fort Detrick) Foreign Disease-Weed Science Research Laboratory	2016 Design 2017 Construction Total	\$4,900,000 64,300,000 69,200,000	Design/Programming was awarded in the 4th Quarter of 2016 and will be completed in the 2nd Quarter of 2018. Construction will be awarded in 1st Quarter of 2019.
Michigan, East Lansing Avian Disease and Ocology Laboratory	1992 Planning 1993 Planning 1998 Planning and Design 2011 Rescission Total	\$250,000 212,000 1,800,000 (\$63,193) 2,198,807	Design (100%) for this multi-phased facility modernization is complete.
Mississippi, Lorman Biotechnology Laboratory Alcorn State University	2006 Planning and Design 2008 Planning and Design 2009 Construction 2010 Construction 2011 Rescission Total	\$1,980,000 1,390,200 1,176,000 (\$5,798,055) 248,145	A lease agreement with Alcorn State University for the new facility completed 4th Quarter 2009. POR completed 3rd Quarter 2008.
Mississippi, Poplarville Thad Cochran Southern Horticulture Laboratory	2002 Design 2003 Construction 2006 Supplemental 2011 Rescission Total	\$800,000 9,140,200 4,300,000 (\$9,178) 14,231,022	Construction of the Headhouse/Greenhouse awarded 4th Quarter 2007 and completed 1st Quarter 2008.
Mississippi, Starkville Poultry Science Research Facility	2005 Planning and Design 2006 Construction 2008 Construction 2009 Construction 2011 Rescission Total	\$2,976,000 4,950,000 1,390,200 3,177,000 (\$10,345,645) 2,147,555	Lease agreement is in place. Design (100%) completed 1st Quarter 2008.

		Amount of Funds	
Location and Purpose	Year	Provided	Description
Mississippi Stoneville	2004 Construction	\$4 831 326	Design (100%) completed. Construction of Phase 1 completed. Construction of mechanical
Jamie Whitten Delta States	2005 Construction	2 976 000	bestgi (100%) complete. Construction of mass the completed. Construction of international
Descende Conter	2009 Construction	2,770,000	electrical, and plumbing systems for phases 2 thru 5 (of 5 total) and repair of deteriorated building
Research Center	2008 Construction	2,780,400	envelope awarded 3rd Quarter 2010. Phase 2 and 3 completed 1st Quarter 2013, Phase 4 completed
	2009 ARRA	36,347,783	2nd Quarter 2015, and Phase 5 completed 2nd Quarter 2016.
	2010 Construction	4,000,000	
	2011 Rescission	(\$6,047,327)	
	2015 Rescission	(\$134)	
	Total	44,888,048	
		¢0.415.660	Decise (1000) accessible 1.44 Occaster 2000
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	
		2,001,000	
Montana, Bozeman	2005 Planning and Design	\$1,984,000	Lease agreement in place. Conceptual Design (35%) completed 3rd Ouarter 2008.
Animal Bioscience Facility	2006 Construction	3.960.000	
	2008 Construction	1 869 819	
	2009 Construction	2 192 000	
	2009 Construction	2,192,000	
	2010 Construction	(\$12,720,870)	
	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 (Ouarantine Lab)
Northern Plains Agricultural	1999 Construction	7 300 000	completed 4th Quarter 2008
Research Laboratory	2004 Design and Construction	2 505 132	compress in Quality 2000.
Research Eaboratory	2004 Design and Construction	(\$29,505)	
	2011 Rescission	(\$29,303)	
	Total	10,381,027	
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	
	Total	455,072	
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)	
	2011 INCSCISSIOII Tatal	(\$14,000,070)	
	rotai	1,889,362	

		Amount of Funds	
Location and Purpose	Year	Provided	Description
New York, Ithaca Crop-based Health Genomics	2004 Planning and Design 2005 Construction 2006 Construction 2011 Rescission Total	\$3,847,167 2,976,000 3,588,750 (\$7,314,491) 3,097,426	Design (100%) completed 2nd Quarter 2008.
Ohio, Toledo University of Toledo	2005 Planning and Design 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission Total	\$1,984,000 1,584,000 1,869,819 2,192,000 3,654,000 (\$9,356,845) 1,926,974	Design (100%) completed 1st Quarter 2010. Lease agreement in place.
Oklahoma, Woodward Southern Plains Range Research Center	2002 Planning and Design 2003 Construction 2005 Construction 2011 Rescission Total	\$1,500,000 7,948,000 2,976,000 (\$152,556) 12,271,444	Phases 1 and 2 of the three-phased construction project completed.
Pennsylvania, Wyndmoor Eastern Regional Research Center	1997 Construction1998 Construction1999 Construction2000 Construction2002 Design and Construction2009 ARRA2015 RescissionTotal	\$4,000,000 5,000,000 3,300,000 4,400,000 5,000,000 15,084,486 (\$2) 36,784,484	Modernization of the Center is being accomplished in nine phases, with construction of Phases 1 through 7 completed. Construction award for Phases 8 and 9 was made 4th Quarter 2010 with ARRA funding and completed 2nd Quarter 2012.
South Carolina, Charleston U.S. Vegetable Laboratory	 1988 Feasibility Study 1990 Planning and Construction 1994 Construction 1995 Construction 1996 Construction 1997 Construction 1998 Construction 2000 Construction 2000 Construction 2003 Design 2004 Construction 2005 Construction 2006 Construction 2011 Rescission Total 	\$50,000 1,135,000 909,000 5,544,000 3,000,000 4,824,000 1,000,000 *** 4,500,000 1,390,900 3,131,415 2,976,000 1,980,000 (\$517) 33,439,798	Construction of Phase 1 (laboratory) and Phase 2A (Headhouse) completed. Phase 2B (Greenhouse) construction awarded 2nd Quarter 2007 and completed 4th Quarter 2008.

***Reprogrammed from Horticultural Crop and Water Management Research Laboratory, Parlier, CA

		Amount of Funds	
Location and Purpose	Year	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 completed in the 4th Quarter of 2017. Construction solicitation on hold pending Congressional B&F Funding decisions for ARS.
Texas, Kerrville Knipling Bushland Lab	2008 Planning and Design 2009 Planning and Design	\$1,390,200 1,957,000	POR completed 2nd Quarter 2010 for a new site.
	2011 Rescission 2017 Planning and Design Total	(\$2,768,214) 3,700,000 4,278,986	In 2017, funding was appropriated for planning and design of a replacement laboratory and animal facilities at the the existing Kerrville location. The POR and Site Study will be awarded in the 2nd Ouarter of 2018.
Texas, Temple Grassland Soil & Water Research Lab	2017 Planning and Design	\$1,400,000	In 2017, funding was appropriated for planning and design of a laboratory modernization at Temple and repairs at the associated field site in Riesel,TX. The POR and Investigative Study was awarded in the 1st guarter of 2018.
Utah, Logan Agricultural Research Center	2008 Planning and Design 2009 Design and Construction 2010 Construction 2011 Rescission Total	\$5,560,800 4,351,000 4,527,000 (\$13,839,929) 598,871	Lease completed 3rd Quarter 2010. POR completed 4th Quarter 2010.
Washington, Pullman ARS Research Lab	2004 Planning and Design 2005 Construction 2006 Construction 2008 Construction 2009 Construction 2010 Construction 2011 Rescission Total	\$3,936,636 2,976,000 3,588,750 1,869,819 2,192,000 3,740,000 (\$17,240,830) 1,062,375	Lease agreement with University in place. Conceptual Design (35%) completed.
West Virginia, Kearneysville Appalachian Fruit Lab	2003 Planning and Design 2004 Construction 2005 Construction 2006 Construction 2008 Planning and Design 2009 Planning and Design 2010 Construction 2011 Rescission Total	\$471,913 1,789,380 3,608,896 2,024,550 1,529,220 783,000 2,000,000 (\$3,430,725) 8,776,234	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
West Virginia, Leetown National Center for Cool and Cold Water Aquaculture (Broodstock Facility)	2002 Design and Construction 2006 Construction 2011 Rescission Total	\$2,200,000 891,000 (\$4,717) \$3,086,283	Construction completed 3rd Quarter 2008.

Location and Purpose	Year	Provided	Description
Wisconsin, Marshfield Nutrient Management Laboratory	2003 Planning, Design and Construction 2004 Construction 2005 Construction 2006 Construction 2011 Rescission Total	\$2,980,500 3,668,229 4,860,800 7,920,000 (18,229) 19,411,300	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.
Wisconsin, Prairie du Sac Dairy Forage Agriculture Research Center	2008 Planning and Design 2009 Construction 2010 Construction 2011 Rescission Total	\$2,502,360 2,002,000 4,000,000 (7,675,381) 828,979	POR completed 3rd Quarter 2011

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 mission of the agency is to conduct research which develops solutions to agricultural problems of high national priority. ARS' research programs focus on New Products/Product Quality/Value Added; Livestock and Crop Production and Protection; Food Safety; Human Nutrition; and Environmental Stewardship.

ARS has four strategic goals and 12 performance measures related to its research programs. Its strategic goals and performance measures directly contribute to the Department's strategic goals and objectives particularly: Maximize the ability of American agricultural producers to prosper by feeding and clothing the world; promote American agricultural products and exports; strengthen the stewardship of private lands through technology and research; and provide all Americans access to a safe, nutritious and secure food supply.

Performance Measure:

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 Actual	2018 Target	2019 Target
• Described 5 new discoveries or developments significant for their scientific or applied value.	• Described 5 new discoveries or developments significant for their scientific or applied value.	• Describe 5 new discoveries or developments significant for their scientific or applied value.	• Identify 5 new scientific discoveries that provide scientific information contributing to solving problems of high national priority.
 Formed new partnerships and continued old partnerships with industry, universities, and other government agencies in order to promote production and marketing of new 	• Formed new partnerships and continued old partnerships with industry, universities, and other government agencies in order to	• Form new partnerships and continue old partnerships with industry, universities, and other government	• Establish strategic public and/or private partnerships that will enable the technology transfer of 4 ARS inventions.
methods for detection and identification of animal pathogens, arthropods that transmit pathogens, and arthropods that destroy property; including genetic markers, new	promote production and marketing of new methods for detection and identification of animal pathogens, arthropods that transmit pathogens, and arthropods that destroy	agencies in order to promote production and marketing of new methods for detection and identification of animal pathogens, arthropods that	• Identify 2 discoveries that will contribute to the development of new diagnostics for the detection of priority pest and infectious disease agents.
methods of detecting gene sequences or antibodies or proteins, and comprehensive guides to morphological identification.	property; including genetic markers, new methods of detecting gene sequences or antibodies or proteins, and comprehensive	transmit pathogens, and arthropods that destroy property; including genetic markers, new methods of detecting	• Identify 2 discoveries that will contribute to the development of veterinary medical countermeasures.
• Formed new partnerships and continued old partnerships with industry,	 guides to morphological identification. Formed new partnerships and continued old 	gene sequences or antibodies or proteins, and comprehensive guides to	• Form new partnerships and continue old partnerships with industry, universities, and other government agencies in order to

2016 Actual	2017 Actual	2018 Target	2019 Target
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.	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.	 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. 	promote production and marketing of inventions that protect animals from pathogens or manage arthropods that transmit pathogens or damage property.
Note: See the ARS 2017 "Annual Report on Science" at <u>https://www.ars.usda.gov/docs/plans-reports/</u> which provides a more comprehensive description of the agency's performance plan, including performance measures			

and indicators, and accomplishments.

Selected Past Accomplishments Toward the Achievement of the Key Outcome

- Developed foot-and-mouth disease diagnostic tests, and made significant breakthroughs in developing better veterinary countermeasures to detect, prevent, and control FMD.
- Developed early warning strategies for vesicular stomatitis virus, one of the most common vesicular diseases affecting horses, cattle, and pigs throughout the Americas.
- Developed a new research tool for tick transmitted diseases that eliminates the need for using animals in testing.
- Improved diagnostic testing methods to determine the infection prevalence of cattle tick fever (from one million cattle imported annually from Mexico) on the U.S.-Mexico border.
- Published the genome sequence of cattle fever tick.
- Discovered an effective biocontrol agent for controlling invasive ants, including fire ants that cause billions of dollars of crop damage and inflict serious bites to animals and humans.
- Completed a critical step in bioengineering a transgenic male only strain of screwworms to mate with females. This research may result in fewer fertile screwworm females, and decrease cattle production costs (with fewer incidents of screwworms inflicting serious wounds to cattle).
- Developed a comprehensive regional program to reduce the population of vectors insects and other arthropods that carry and transmit disease including the yellow fever mosquito that transmit Zika. The program combined traditional vector control, community engagement, and vector surveillance in reducing or eliminating mosquito populations.

Selected Accomplishments Expected at the FY 2019 Proposed Resource Level

- Identify 5 new scientific discoveries that provide scientific information contributing to solving problems of high national priority.
- Establish strategic public and/or private partnerships that will enable the technology transfer of 4 ARS inventions.
- Identify 2 discoveries that will contribute to the development of new diagnostics for the detection of priority pest and infectious disease agents.
- Identify 2 discoveries that will contribute to the development of veterinary medical countermeasures.

• 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.

Performance Measure:

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.

1			
2016 Actual	2017 Actual	2018 Target	2019 Target
• Bred superior new crops, varieties, and enhanced germplasm.	• Bred superior new crops, varieties, and enhanced germplasm.	• Breed superior new crops, varieties, and enhanced germplasm.	• Breed superior new crops, varieties, and enhanced germplasm.
• Devised innovative approaches to crop genetic improvement and trait analysis.	• Devised innovative approaches to crop genetic improvement and trait analysis.	 Devise innovative approaches to crop genetic improvement and trait analysis. 	• Devise innovative approaches to crop genetic improvement and trait analysis.
• Expanded crop genomic information resources and advanced bioinformatic capabilities.	• Expanded crop genomic information resources and advanced bioinformatic capabilities.	• Expand crop genomic information resources and advanced bioinformatic	• Expand crop genomic information resources and advanced bioinformatic capabilities.
• Conserved and encouraged the use of plant and microbial genetic resources and associated information.	• Conserved and encouraged the use of plant and microbial genetic resources and associated information.	 capabilities. Conserve and encourage the use of plant and microbial genetic resources 	• Conserve and encourage the use of plant and microbial genetic resources and associated information.
• Expanded fundamental knowledge of plant biological and molecular processes.	• Expanded fundamental knowledge of plant biological and molecular processes.	and associated information.Expand fundamental knowledge of plant	• Expand fundamental knowledge of plant biological and molecular processes.
• Developed more effective methods to enhance biotechnology for crop improvement.	• Developed more effective methods to enhance biotechnology for crop improvement.	 Develop more effective methods to 	• Develop more effective methods to enhance biotechnology for crop improvement.
• Developed crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.	• Developed crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency.	 enhance biotechnology for crop improvement. Develop crop production strategies to optimize crop genetic potential, mitigate losses due 	 Develop crop production strategies to optimize crop genetic potential, mitigate losses due to biotic and abiotic stresses, and increase production efficiency. Improve pollinator
• Improved pollinator health, bee systematics and germplasm lines, and	• Improved pollinator health, bee systematics and germplasm lines,	to biotic and abiotic stresses, and increase production	health, bee systematics and germplasm lines, and pollination.

2016 Actual	2017 Actual	2018 Target	2019 Target
pollination.	and pollination.	efficiency. Improve pollinator 	
		health, bee systematics and germplasm lines, and pollination.	
Note: See the ARS 2017 "Annual Report on Science" at <u>https://www.ars.usda.gov/docs/plans-reports/</u> which provides a more comprehensive description of the agency's performance plan, including performance measures and indicators, and accomplishments.			

Selected Past Accomplishments Toward the Achievement of the Key Outcome

- Discovered genetic markers that speed the selection for a resistance gene which is effective against Ug99, a highly virulent race of wheat stem rust.
- Developed two new lines of pollinator sorghum that has shown tolerance to the sugarcane aphid, a major pest in sorghum.
- Developed a simple and flexible computational software which enables plant breeders to more easily simulate breeding options and estimates.
- Developed new, more suitable potato varieties for the french fry industry (e.g., McDonald's restaurants).
- Released a soybean germplasm line with superior tolerance to high temperature stress. Commercial and public soybean breeders are now using the new soybean germplasm line in their breeding program.
- Developed better methods for timing and planting oilseed crops that lead to improved plant establishment and higher seed and oil yields.
- Developed a better method to cryopreserve honey bee spermatozoa, improving sperm quality and enabling semen shipment at room temperature before and after storage.

Selected Accomplishments Expected at the FY 2019 Proposed Resource Level

- 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.

Performance Measure:

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

2016 Actual 2017 Actual 201	18 Target 2019 Target
 Developed new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management. Developed new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management. Developed new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management. Developed new or improved knowledge to increase the effectiveness of agricultural water management. 	p new or ed guidelines, ogies, and/or dge to increase cctiveness of tural water ement.• Develop new or improved guidelines, technologies, and/or knowledge to increase the effectiveness of agricultural water management and improve drought
 Developed new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality. Developed new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality. Developed new or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water quality. Developed new or Developed new or 	 p new or ed guidelines, ogies, and/or dge to reduce and ntation from tural lands improve water Pevelop new or improved guidelines, technologies, and/or knowledge to reduce erosion and sedimentation from agricultural lands and/or improve water guality.
 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. Developed new of 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 Develop improved conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve Develop improve Develop improve Develop improve Develop conservation practices to better protect water resources, improve the overall effectiveness of USDA conservation programs, and/or improve Develop improve Develop subolicitors Develop improve D	 p new or ed knowledge, echnologies, nes, and/or vation practices r protect water es, improve rall 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.

Note: See the ARS 2017 "Annual Report on Science" at <u>https://www.ars.usda.gov/docs/plans-reports/</u> which provides a more comprehensive description of the agency's performance plan, including performance measures and indicators, and accomplishments.

Selected Past Accomplishments Toward the Achievement of the Key Outcome

- Developed a new remote sensing tool kit that improves water resource management. It has already been used in: studying groundwater depletion in Central Wisconsin; assessing the impact of agricultural drainage on regional hydrology in the Corn Belt; improving water use in managed forest plantations; delivering drought and water information for the Near East North African region; and in many other areas.
- Showed that re-routing field tile drainage through riparian buffers can remove hundreds of pounds of nitrate before it enters nearby surface waters. This buffer system has been adopted by NRCS.
- Conducted tests that demonstrated how phosphates can be removed more cost effectively from drainage waters.
- Developed for EPA and State departments of environmental quality a model/tool to assess flood-related environmental disasters.

Selected Accomplishments Expected at the FY 2019 Proposed Resource Level

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

Performance Measure:

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

2016 Actual	2017 Actual	2018 Target	2019 Target
• Surveyed, released data on and analyzed national food consumption patterns of Americans.	• Surveyed, released data on, and analyzed national food consump- tion patterns of Americans.	• Survey, release data on, and analyze national food consumption patterns of Americans.	• Collect and release data on national food consumption patterns of Americans and the chemical composition of those foods.
• Developed new methods, conducted food composition analyses, and compiled databases for known, emerging, and new classes of nutrients and branded food items.	• Developed new methods, conducted food composition analyses, and compiled databases for known, emerging, and new classes of nutrients and for branded food items.	• Develop new methods, conduct food composition analyses, and compile databases for known, emerging, and new classes of nutrients/ branded food items.	• Identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.
• Identified dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.	• Identified dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.	• Identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.	 Publish new findings on metabolic processes that are affected by nutrient intake. Determine the functions, bioavailability
• Determined the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.	• Determined the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.	• Determine the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.	interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.
• Published new findings on metabolic processes that are affected by nutrient intake.	• Published new findings on metabolic processes that are affected by nutrient intake.	• Publish new findings on metabolic processes affected by nutrient intake.	
• Discovered genetic or epigenetic factors	• Discovered genetic or epigenetic factors that	• Discover genetic or epigenetic factors that	

2016 Actual	2017 Actual	2018 Target	2019 Target	
that influence physiologic responses to diet or changes in gene expression in response to dietary intake.	influence physiologic responses to diet or changes in gene expression in response to dietary intake.	influence physiologic responses to diet or changes in gene expression in response to dietary intake.		
• Identified processes and methods whereby agriculture production influences the nutritional value of the food supply.	• Identified processes and methods whereby agriculture production influences the nutritional value of the food supply.	• Identify processes and methods whereby agriculture production influences the nutritional value of the food supply.		
Note: See the ARS 2017 "Annual Report on Science" at https://www.ars.usda.gov/docs/plans-reports/ which				

provides a more comprehensive description of the agency's performance plan, including performance measures and indicators, and accomplishments.

Selected Past Accomplishments Toward the Achievement of the Key Outcome

- Demonstrated that conventional beef and pork products do not pose a greater risk of exposure to antimicrobial resistance than products from animals raised without antibiotics.
- Developed a sensitive, selective, inexpensive, and rapid test to determine whether animals have been exposed to Zilpaterol (an FDA approved feed additive that increases feed efficiency, improves growth rate, and produces lean meat in livestock). Several major U.S. trading partners do not allow the import of meat from animals fed Zilpaterol, and in the U.S., Zilpaterol is illegal to use in some food animal species.
- Determined that the industry standard regarding chlorine concentration limits does not prevent pathogen crosscontamination, and that rewashing of contaminated product is an ineffective corrective action. ARS recommendations on preventing pathogen cross-contamination during washing vegetables has been adopted by breading processors.
- Created a vaccine that reduces *Salmonella* levels in turkeys. Preharvest control of *Salmonella* in food producing animals can protect animal health, limit antibiotic usage, decrease environmental contamination, reduce *Salmonella* carriage into the human food chain, and reduce the cost of meat product recalls to producers.

Selected Accomplishments Expected at the FY 2019 Proposed Resource Level

- Collect and release data on national food consumption patterns of Americans and the chemical composition of those foods.
- Identify dietary and lifestyle intervention strategies to prevent obesity and promote healthy food choices and eating behaviors.
- Publish new findings on metabolic processes that are affected by nutrient intake.
- Determine the functions, bioavailability, interactions, and requirements for known, emerging, and new classes of nutrients across the lifecycle.