2021 USDA EXPLANATORY NOTES – AGRICULTURAL RESEARCH SERVICE

AGENCY-WIDE

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 Production, Crop Production; Food Safety; Livestock Protection, Crop Protection; Human Nutrition; and Environmental Stewardship – are described under the "Status of Program" section.

ARS' Headquarters Offices are located in the Washington, D.C. metropolitan area. The agency's research is organized under 15 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, 2019, there were 4,914 permanent, full-time employees including 573 in the Headquarters offices and 4,341 in field offices.

Completed OIG Reports

ID	Date	Title	Result
02601-0001-24	10/3/2019	ARS' Animal Welfare Act Controls to Prevent Mistreatment of Animals Used For Researching Parasitic Diseases	OIG did not make any recommendations.
50401-0016-11	11/15/2018	U.S. Department of Agriculture's Consolidated Balance Sheet for Fiscal Year 2018	OIG recommended that the OCFO develop an Unliquidated Obligations Aging report in FMMI that reconciles to the general ledger.
50501-0017-12	10/3/2018	Security Over Select USDA Agencies' Networks and Systems	OIG found that the Department did not fully implement federally-mandated controls.
50501-0018-12	10/17/2018	U.S. Department of Agriculture, Office of the Chief Information Officer, Fiscal Year 2018 Federal Information Security Modernization Act	OIG recommended that the Department continue its progress by issuing critical policy and completing actions on the 20 outstanding recommendations from the 2009-17 FISMA review.
50501-0020-12	7/3/2019	Improper Usage of USDA's Information Technology Resources	OIG recommended development/implementation of a process for ensuring all parties are notified of incidents; staff offices need to monitor incidents, and ensure contractors are held accountable.
50501-0021-12	8/5/2019	Data Encryption Controls Over Personally Identifiable Information on USDA Information Technology Systems Review	OIG found that the Department/ agencies did not fully implement federally-mandated controls.
50503-0002-12	11/5/2019	U.S. Department of Agriculture, Office of the Chief Information Officer, Fiscal Year 2019 Federal Information Security Modernization Act	OIG recommended that the Department review and identify the full population and last review date of all IT policies and procedures, revise as needed and disseminate to employees.

In Progress OIG Reports

ID	Title	Result
50401-0018-11	U.S. Department of Agriculture's Consolidated Balance Sheet for Fiscal Year 2019	Audit began 2/19/2019
50501-0022-12	Security Over Select USDA Agencies Networks and Systems	Audit began 7/31/2019
50503-0002-12	U.S. Department of Agriculture, Office of the Chief Information Officer, Fiscal Year 2019 Federal Information Security Modernization Act	Audit began 8/13/2019

Completed GAO Reports

ID	Date	Title	Result
GAO-18-422	9/20/2018	Biological Select Agents and Toxins: Actions Needed to Improve Management of DOD's Biosafety and Biosecurity Program	ARS is evaluating GAO recommendations.
GAO-19-24	11/15/2018	Agent Orange - Actions Needed to Improve Accuracy and Communication of Information on Testing and Storage Locations	ARS is evaluating GAO recommendations.
GAO-19-47	6/3/2019	Renewable Fuel Standard: Information on Likely Program Effects on Gasoline Prices and Greenhouse Gas Emissions	ARS is evaluating GAO recommendations.
GAO-19-103	3/12/2019	Foot-and-Mouth Disease: USDA's Efforts to Prepare for a Potential Outbreak Could Be Strengthened	ARS is evaluating GAO recommendations.
GAO-19-265	4/4/2019	Scientific Integrity Policies: Additional Actions Could Strengthen Integrity of Federal Research	ARS is evaluating GAO recommendations.
GAO-19-407	9/9/2019	Date Labels on Packaged Foods: USDA and FDA Could Take Additional Steps to Reduce Consumer Confusion	ARS is evaluating GAO recommendations.
GAO-19-466	7/31/2019	Foreign Assistance: Federal Monitoring and Evaluation Guidelines Incorporate Most But Not All Leading Practices	ARS is evaluating GAO recommendations.
GAO-19-629	9/24/2019	Animal Use in Research: Federal Agencies Should Assess and Report on their Efforts to Develop and Promote Alternatives	ARS is evaluating GAO recommendations.
GAO-20-128SP	11/12/2019	Irrigated Agriculture: Technologies, Practices,	ARS is evaluating GAO

		and Implications for Water Scarcity	recommendations.
GAO-20-81	11/21/2019	Federal Research: Additional Actions Needed to Improve Public Access to Research Results	ARS is evaluating GAO recommendations.

In-Progress GAO Reports

ID	Title	Result
101434	USDA's Regional Climate Hubs	Audit began 2/3/2017
101732	Federal Grants Workforce Training	Audit began 8/31/2017
102299	Information Technology Cloud Computing	Audit began 10/13/2017
102509	Federal Preparedness for Responding to Antimicrobial-Resistant Pathogens	Audit began 2/14/2018
102599	Network for Manufacturing Innovation Program	Audit began 4/23/2018
102947	Transfer of National Bio- and Agro-Defense Facility Operations	Audit began 8/8/2018

LEAD-OFF TABULAR STATEMENT

ACCOUNT 1: SALARIES AND EXPENSES

Item	Amount
2020 Appropriations.....	$1,414,366,000
Change in Appropriation.....	-46,396,000
2021 Budget Request……	**$1,367,970,000**

ACCOUNT 2: BUDGET AND FACILITIES

Item	Amount
2020 Appropriations.....	$192,700,000
Change in Appropriation.....	-142,700,00
2021 Budget Request.....	**$50,000,000**

AVAILABLE FUNDS AND STAFF YEARS

Item	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
Salaries and Expenses:								
Discretionary Appropriations	$1,202,766	5,572	$1,303,266	5,361	$1,414,366	5,649	$1,367,970	5,673
Buildings and Facilities:								
Discretionary Appropriations	162,600	-	381,200	-	192,700	-	50,000	-
Rescission	-	-	-	-	-	-	-	-
Transfers In	60	-	60	-	-	-	-	-
Transfers Out	-350	-	-	-	-	-	-	-
Adjusted Appropriation	1,365,076	5,572	1,673,926	5,361	1,607,066	5,649	1,417,970	5,673
Balance Available, SOY	231,119	-	379,417	-	759,507	-	295,733	-
Other Adjustments (Net)	14,648	-	10,788	-	-	-	-	-
Total Available	1,610,843	5,572	2,074,731	5,361	2,366,573	5,649	1,713,703	5,673
Lapsing Balances	-2,437	-	-3,494	-	-	-	-	-
Balance Available, EOY	-379,417	-	-759,507	-	-295,733	-	-216,217	-
Obligations	1,228,989	5,572	1,311,730	5,361	2,070,840	5,649	1,497,486	5,673
Ob. Under Other USDA Appr.:								
Agricultural Marketing Service, AMS	131	-	135	1	135	1	135	1
Animal & Plant Health Inspection Service, APHIS	26,046	82	28,465	107	28,465	107	28,465	107
Economic Research Service, ERS	3,409	11	3,871	15	3,871	15	3,871	15
Farm Service Agency, FSA	260	1	176	1	176	1	176	1
Food & Nutrition Services, FNS	312	1	391	1	391	1	391	1
Food Safety & Inspection Service, FSIS	3,905	12	4,294	16	4,294	16	4,294	16
Foreign Agricultural Service, FAS	603	2	987	4	987	4	987	4
Forest Service, FS	813	3	844	3	844	3	844	3
Hazardous Waste	5,540	17	1,445	5	1,445	5	1,445	5
National Agricultural Statistics Service, NASS	4,277	14	9,731	36	9,731	36	9,731	36
National Institute of Food and Agriculture, NIFA	15,774	50	20,176	76	20,176	76	20,176	76
Natural Resources Conservation Service, NRCS	5,295	17	4,761	18	4,761	18	4,761	18
Office of Secretary, OSEC	502	2	-	-	-	-	-	-
Office of the Chief Economist, OCE	1,407	4	171	1	171	1	171	1
Office of the Chief Information Officer	-	-	132	1	132	1	132	1
Quarters and Subsistence	130	-	-	-	-	-	-	-
Revocable Permits & Easements	549	2	995	4	995	4	995	4
Risk Management Agency	120	-	-	-	-	-	-	-
Sale of Animals & Personal Property (Proceeds)	12,867	41	12,665	47	12,665	47	12,665	47
Misc., Other USDA Funds	430	1	389	1	389	1	389	1
Total, Other USDA	82,370	260	89,628	336	89,628	336	89,628	336
Total, Agriculture Appropriations	1,311,359	5,832	1,401,358	5,697	2,160,468	5,992	1,587,114	6,016

Item	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
Other Federal Funds:								
Agency for International Development	4,928	16	4,445	17	4,445	17	4,445	17
Department of Defense, DOD	5,259	17	2,162	8	2,162	8	2,162	8
Department of Energy, DOE	1,264	4	982	4	982	4	982	4
Department of Health & Human Services, DHHS	26,031	82	3,878	15	3,878	15	3,878	15
Department of Homeland Security, DHS	1,234	4	2,771	10	2,771	10	2,771	10
Department of State, DOS	213	1	997	4	997	4	997	4
Department of the Interior, DOI	2,197	7	2,888	11	2,888	11	2,888	11
Department of Treasury, DOT	142	-	-	-	-	-	-	-
Environmental Protection Agency, EPA	404	1	362	1	362	1	362	1
Federal Emergency Management Agency, FEMA	316	1	316	1	316	1	316	1
National Aeronautics & Space Administration, NASA	1,184	4	1,134	4	1,134	4	1,134	4
United State Geological Survey	-	-	304	1	304	1	304	1
Misc., Other Federal Funds	4	-	44	-	44	-	44	-
Total, Other Federal	43,176	137	20,282	76	20,282	76	20,282	76
Non-Federal Funds:								
Arizona State University	-	-	151	1	151	1	151	1
Arizona, University of	122	-	153	1	153	1	153	1
Arkansas, University of	210	1	383	1	383	1	383	1
Binational Agricultural Research & Development (BARD)	172	1	257	1	257	1	257	1
California, State of	1,051	3	1,662	6	1,662	6	1,662	6
California Strawberry Commission	101	-	-	-	-	-	-	-
California, University of	706	2	1,485	6	1,485	6	1,485	6
California Walnut Board & Commission	302	1	411	2	411	2	411	2
Center for Produce Safety	-	-	309	1	309	1	309	1
Citrus Research & Development Foundation	915	3	743	3	743	3	743	3
Citrus Research Board	1,124	4	947	4	947	4	947	4
Colorado State University	316	1	151	1	151	1	151	1
Commodity Credit Corporation	-	-	153	1	153	1	153	1
Cornell University	968	3	615	2	615	2	615	2
Cotton Incorporated	1,174	4	991	4	991	4	991	4
Delaware, University of	-	-	104	-	104	-	104	-
Florida, State of	450	1	522	2	522	2	522	2
Florida, University of	623	2	638	2	638	2	638	2
Georgia, University of	274	1	158	1	158	1	158	1
Idaho State University	195	1	120	-	120	-	120	-
Idaho, University of	121	-	126	1	126	1	126	1
Illinois, University of	506	2	650	2	650	2	650	2
Iowa State University	367	1	314	1	314	1	314	1

Item	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
Kansas State University	605	2	832	3	832	3	832	3
Maine, University of	555	2	411	2	411	2	411	2
Maryland, University	103	-	-	-	-	-	-	-
Massachusetts, Univ of	-	-	101	-	101	-	101	-
Michigan State University	1,064	3	1,369	5	1,369	5	1,369	5
Minnesota, Univ of	-	-	311	1	311	1	311	1
Mississippi Soybean Promotion	148	-	125	1	125	1	125	1
Missouri Soybean Merchandising Council	143	1	-	-	-	-	-	-
Monell Chemical Senses Center	-	-	248	1	248	1	248	1
National Ecological Observatory Network (NEON)	744	2	-	-	-	-	-	-
Nebraska, University of	361	1	358	1	358	1	358	1
New Mexico Consortium	124	-	-	-	-	-	-	-
New Mexico State University	-	-	457	2	457	2	457	2
Noble Foundation	130	-	-	-	-	-	-	-
North Carolina State University	535	2	658	2	658	2	658	2
North Carolina University	-	-	107	-	107	-	107	-
North Dakota State University	-	-	121	1	121	1	121	1
Ohio State University	703	2	562	2	562	2	562	2
Oklahoma State University	116	-	-	-	-	-	-	-
Oklahoma, University of	-	-	124	1	124	1	124	1
Oregon State University	222	1	156	1	156	1	156	1
Pennsylvania State University	305	1	234	1	234	1	234	1
Purdue University	146	-	-	-	-	-	-	-
Rutgers University	271	1	104	-	104	-	104	-
Saint Louis University	121	-	184	1	184	1	184	1
South Dakota State University	253	1	222	1	222	1	222	1
South Florida Water Management District	925	3	950	4	950	4	950	4
Texas A&M University (TAMU)	150	1	184	1	184	1	184	1
United Soybean Board	3,444	11	2,076	8	2,076	8	2,076	8
U.S. Highbush Blueberry Council	170	1	-	-	-	-	-	-
Utah State University	343	1	134	1	134	1	134	1
Vermont, University of	-	-	176	1	176	1	176	1
Virginia Institute of Marine Science	110	-	-	-	-	-	-	-
Washington, State of	163	1	619	2	619	2	619	2
Washington State University	249	1	193	1	193	1	193	1
Misc., Non-Federal Funds	2,363	7	2,303	9	2,303	9	2,303	9
Total, Non-Federal	24,263	76	24,359	91	24,359	91	24,359	91
Miscellaneous Contributed Funds	23,316	97	22,909	84	22,909	84	22,909	84
Total, ARS	1,402,114	6,142	1,468,908	5,948	2,228,018	6,236	1,654,664	6,260

PERMANENT POSITIONS BY GRADE AND STAFF YEAR

Item	2018 Actual			2019 Actual			2020 Enacted			2021 Budget		
	D.C.	Field	Total	D.C.	Field	Total	D.C.	Field	Total	D.C.	Field	Total
SES	12	17	29	11	20	31	11	20	31	11	20	31
GS-15	46	708	754	50	699	749	53	742	795	53	746	799
GS-14	52	465	517	72	440	512	76	467	543	76	469	545
GS-13	123	283	406	162	289	451	172	307	479	173	308	481
GS-12	134	267	401	154	224	378	163	238	401	164	239	403
GS-11	41	496	537	87	445	532	92	472	564	92	474	566
GS-10	1	1	2	-	-	-	-	-	-	-	-	-
GS-9	37	942	979	78	901	979	76	956	1,032	76	961	1,037
GS-8	12	274	286	12	245	257	13	260	273	13	261	274
GS-7	34	499	533	36	459	495	38	474	512	38	476	514
GS-6	9	136	145	9	159	168	10	187	197	10	188	198
GS-5	4	94	98	9	96	105	10	106	116	10	106	116
GS-4	4	17	21	3	20	23	3	26	29	3	26	29
GS-3	-	10	10	3	7	10	3	8	11	3	8	11
GS-2	-	4	4	-	5	5	-	5	5	-	5	5
GS-1	-	3	3	-	2	2	-	2	2	-	2	2
Other Graded	4	-	4	5	-	5	5	-	5	5	-	5
Ungraded	-	414	414	-	397	397	-	397	397	-	397	397
Total Permanent	513	4,630	5,143	691	4,408	5,099	725	4,667	5,392	727	4,686	5,413
Unfilled, EOY	75	83	158	118	67	185	129	61	190	129	58	187
Total Perm. FT EOY	438	4,547	4,985	573	4,341	4,914	596	4,606	5,202	598	4,628	5,226
Staff Year Est	471	5,671	6,142	595	5,353	5,948	625	5,618	6,236	627	5,640	6,260

SIZE, COMPOSITION, AND ANNUAL COSTS OF VEHICLE FLEET

The 2021 Budget Estimates proposes one planned replacements of owned passenger motor vehicles. Passenger motor vehicles are defined as sedans and stations wagons.

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 reviews 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. Vehicle replacement is based on program management, vehicle mileage/age, and funding. By

Federal regulation, minimum replacement standards for passenger vehicles are six years or 60,000 miles, and for light trucks are six years or 60,000 miles.

The composition of the ARS fleet is primarily light duty trucks, which includes sport utility vehicles, vans, and pick-up trucks. These multi-purpose type vehicles enable research personnel to move equipment and transport personnel. Past practices have allowed ARS to decrease the number of passenger vehicles by relying on multi-purpose type vehicles. ARS will continue to review its fleet for opportunities to reduce vehicles longer required for the mission, realign vehicles where it is necessary without affecting the mission and control operating costs. The agency continues to review inventory information to accurately classify the fleet.

Fiscal Year	Sedans and Station Wagons	Lt. Trucks, SUVs, and Vans (4x2)	Lt. Trucks, SUVs, and Vans (4x4)	Medium Duty Vehicles	Ambu-lances	Buses	Heavy Duty Vehicles	Total Vehicles	Annual Operating Costs
2018	205	1,075	942	722	-	3	163	3,110	$4,628
Change	-45	-154	-86	-56	-	-1	-11	-353	+1
2019	160	921	856	666	-	2	152	2,757	4,629
Change	-	+10	-	-	-	-	-	+10	+154
2020	160	931	856	666	-	2	152	2,767	4,783
Change	-	-	-	-	-	-	-	-	+143
2021	160	931	856	666	-	2	152	2,767	4,926

*Vehicle count includes those owned by agency and leased from commercial sources or GSA.

SHARED FUNDING PROJECTS

Item	2018 Actual	2019 Actual	2020 Enacted	2021 Budget
Working Capital Fund:				
Administration:				
HR Enterprise System Management	$129	$136	$157	$164
Integrated Procurement Systems	1,752	1,827	1,977	1,978
Mail and Reproduction Services	952	747	815	844
Material Management Service Center	141	228	365	358
Procurement Operations Division	33	29	27	19
Subtotal	3,007	2,967	3,341	3,363
Communications:				
Creative Media & Broadcast Center	298	310	364	188
Finance and Management				
Financial Shared Services	5,417	5,440	5,507	5,745
Internal Control Support Services	147	113	126	104
National Finance Center	2,285	2,041	1,863	1,775
Subtotal	7,849	7,594	7,496	7,624
Information Technology:				
Client Experience Center	3,583	4,778	13,151	13,389
Department Administration Information Technology Office	-	-	47	47
Digital Infrastructure Services Center	1,122	998	1,633	1,586
Enterprise Network Services	1,836	3,980	5,537	5,726
Subtotal	6,541	9,756	20,368	20,748
Correspondence Management	107	390	393	421
Total, Working Capital Fund	17,802	21,018	31,962	32,344
Department-Wide Shared Cost Programs:				
Advisory Committee Liaison Services	3	3	4	4
Agency Partnership Outreach	484	481	479	479
Honor Awards	1	1	1	1
Human Resources Self-Service Dashboard	38	37	36	-
Human Resources Transformation	57	-	-	-
Medical Services	31	72	47	-
Office of Customer Experience	124	162	182	182
People's Garden	31	-	-	-
Personnel and Document Security	102	93	93	93
Physical Security	-	-	359	260
Security Detail	287	270	283	283
Security Operations	673	657	356	389
TARGET Center	85	77	71	71
USDA Enterprise Data Analytics Services	-	-	331	331
Virtual University	65	-	-	-
Total, Department-Wide Reimbursable Programs	1,981	1,853	2,242	2,093
E-Gov:				
Budget Formulation and Execution Line of Business	7	7	7	7
Enterprise Human Resources Integration	139	139	-	-
Financial Management Line of Business	5	5	5	5
Human Resources Line of Business	19	19	19	19
Integrated Acquisition Environment	194	209	141	141
Total, E-Gov	364	379	172	172
Agency Total	20,148	23,250	34,376	34,609

ACCOUNT 1: SALARIES AND EXPENSES

LEAD-OFF TABULAR STATEMENT

Item	Amount
2020 Appropriations	$1,414,366,000
Change in Appropriation	-46,396,000
2021 Budget Request	**$1,367,970,000**

APPROPRIATIONS LANGUAGE

The appropriations language follows (new language underscored; deleted matter enclosed in brackets):

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, $1,367,970,000 [$1,414,366,000 of which $13,100,000, to remain available until expended, shall be used to carry out the science program for transition and equipment purchases for 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 $1,800,000, 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.

Change Description

The first change (line 5 of paragraph 1) deletes the 2020 National Bio and Agro-Defense set-aside.

PROJECT STATEMENT

Item	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget Request	SY	Change from 2020 Enacted	SY
Discretionary Appropriations										
Salaries and Expenses	$1,202,766	5,572	$1,292,666	5,361	$1,401,266	5,649	$1,367,970	5,673	(1) $-33,296	24
National Bio and Agro-Defense Facility (Transition and Equipment Purchases).....	0	-	10,600	-	13,100	-	0	-	(2) -13,100	-
Direct Appropriation.....	1,202,766	5,572	1,303,266	5,361	1,414,366	5,649	1,367,970	5,673	-46,396	24
Transfers In:										
Congressional Relations	60	-	60	-	-	-	-	-	-	-
Subtotal, Transfers In.....	60	-	60	-	-	-	-	-	-	-
Total, Discretionary Funding	**1,202,826**	**5,572**	**1,303,326**	**5,361**	**1,414,366**	**5,649**	**1,367,970**	**5,673**	**-46,396**	**24**
Carryover from Prior Years:										
Balance Available, SOY.....	30,123	-	44,254	-	62,500	-	-	-	-	-
Subtotal Carryover.....	30,123	-	44,254	-	62,500	-	-	-	-	-
Transfers Out:										
IT Modernization.....	-350	-	-	-	-	-	-	-	-	-
Recoveries, Other (Net).....	14.648	-	10,788	-	-	-	-	-	-	-
Total Available	**1,247,247**	**5,572**	**1,358,368**	**5,361**	**1,476,866**	**5,649**	**1,367,970**	**5,673**	**-108,896**	**24**
Lapsing Balances.....	-2,437	-	-3,494	-	-	-	-	-	-	-
Balances, Available End of Year	-44,254	-	-62,500	-	-	-	-	-	-	-
Total Obligations	**$1,200,556**	**5,572**	**$1,292,374**	**5,361**	**$1,476,866**	**5,649**	**$1,367,970**	**5,673**	**-$108,896**	**24**
Staff Years:										
Direct.....		5,572		5,361		5,649		5,673		24
Other		570		587		587		587		-
Total, Staff Year Estimate		**6,142**		**5,948**		**6,236**		**6,260**		**24**

Agricultural Research Service
Salaries and Expenses
(Dollars in Thousands)

Funding Detail	2018 Actual B.A.	2019 Actual B.A.	2020 Enacted B.A.	2021 Budget Request B.A.
Salaries and Expenses				
New Product Quality/Value Added	$101,336	$101,512	$117,512	$109,955
Livestock Production	93,937	102,700	114,200	106,981
Crop Production	241,479	258,348	282,748	280,170
Food Safety	112,441	113,844	113,844	110,458
Livestock Protection	95,113	101,808	116,808	120,704
Crop Protection	201,521	206,686	217,186	194,464
Human Nutrition	87,980	90,510	92,510	89,656
Environmental Stewardship	219,024	225,323	231,523	229,102
National Agricultural Library	25,791	25,791	28,791	25,079
National Bio and Agro-Defense Facility (Operations and Maintenance)	4,000	46,000	66,000	81,257
Repair and Maintenance	20,144	20,144	20,144	20,144
Total, Salaries and Expenses	**1,202,766**	**1,292,666**	**1,401,266**	**1,367,970**

JUSTIFICATIONS OF INCREASES/DECREASES

Salaries and Expenses

(1) ARS is requesting $1,367,970,000 in FY 2021 for its Salaries and Expenses account, a decrease of $33,296,000 from the FY 2020 Enacted level. The FY 2021 Budget includes an increase of $35,000,000 for new initiatives in precision agriculture related to labor-saving automation and data management/tool development; artificial intelligence innovations for agricultural production; long-term agroecosystems research; and managing excess water and controlling erosion. There is also an increase of $23,000,000 for operations/maintenance, and research program improvements required for the new National Bio and Agro-Defense Facility (NBAF), which replaces the outdated and inadequate Plum Island Animal Disease Center (PIADC). NBAF, which is scheduled to attain full operational capability by December 2022, will be a state-of-the-art biocontainment facility for the study of foreign, emerging, and zoonotic animal diseases that pose a threat to U.S. animal agriculture and to public health. In addition, the Budget includes $17,704,000 for increases for pay costs, performance awards, and the Federal Employees Retirement System. Offsetting the increases are $109,000,000 in decreases for the: (a) elimination of ongoing extramural research projects and selected intramural research projects ($74,000,000); and (b) redirection (elimination) of lower priority research projects to fund higher priority research projects ($35,000,000).

New Products/Product Quality/Value Added

(1) A decrease of $7,557,000 and no staff year increase for New Products/Product Quality/Value Added research ($117,512,000 and 599 staff years available in 2020).

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

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $705,000 for pay costs ($323,000 for annualization of the 2020 pay increase and $382,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $509,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $642,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture – Labor-Saving Automation of which $1,000,000 is for ARS' New Products/Product Quality/Value Added Program.

U.S. agriculture is undergoing a transformation at many levels. Markets are now global and competition for the U.S. and global markets is intense. Globalization has increased the threat of costly foreign disease and invasive pests, including citrus greening, which is carried by the Asian citrus psyllid, and African swine fever. The U.S. is also in a severe labor shortage. Crops are going unharvested. Producers are working longer hours, postponing retirement, and continuing to work in their fields. Therefore, new labor-saving automated technologies are needed that can measure, analyze, and advise producers how to enhance crop and animal productivity and health; that can harvest more rapidly and gently than humans; and that guard 24/7 against crop and animal pathogens and pests and weeds. New labor-saving technologies are needed to address the labor gap and to modernize the most productive agricultural system in the world. The goal of the Precision Agriculture--Automation initiative, is to develop new labor-saving technologies.

Automation will strengthen and accelerate the development of new autonomous platforms and support technologies for the production and management of crop production, and for related research. Critical support programs and partners include ARS' Breeding Insight Platform (BIP), ARS' Ag Data Commons, and ARS' SCINet (Scientific Computing Initiative).

As a result of this funding, ARS will:

- Enhance the profitability and sustainability of upland cotton, cottonseed, and agricultural byproducts through: improvements in automated pre- and post-harvest processing, new equipment and system innovations for pickers and strippers, and new technologies for detecting and removing contaminants in seed cotton during ginning.
- Use new, efficient, cost-effective robotic and 'imaging' systems for nondestructive quality assessment, grading, harvesting, and tracking of fruits/vegetables incorporating artificial intelligence and advanced data analytics.

E) A redirection of $1,000,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in precision agriculture related to labor-saving automation. Funding from the following research projects is proposed for redirection:

- Michigan, East Lansing - Nondestructive Quality Assessment and Grading of Fruits and Vegetables (-$500,000)

- Texas, Lubbock - Enhancing the Profitability and Sustainability of Upland Cotton, Cottonseed, and Agricultural Byproducts Through Improvements in Pre- and Post-Harvest Processing (-$500,000)

F) A decrease of $9,413,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- Beltsville, Maryland - Enhancing Fruit and Vegetable Nutritional Quality with Improved Phenolics Contents (-$98,000)
- Maryland, Beltsville - Forest Products Research (-$3,500,000)
- Mississippi, Oxford - Natural Products (-$2,575,000)
- Pennsylvania, Wyndmoor - Effect of Processing of Milk on Bioactive Compounds in Fresh High-Moisture Cheeses (-$1,176,000)
- North Dakota, Fargo - Improving Potato Nutritional and Market Quality by Identifying and Manipulating Physiological and Molecular Processes Controlling Tuber Wound-Healing and Sprout Growth (-$640,000)
- Illinois, Peoria - Develop Technologies for Production of Platform Chemicals and Advanced Biofuels from Lignocellulosic Feedstocks (-$1,424,000

Livestock Production

(2) A decrease of $7,219,000 and no staff year decrease for Livestock Production research ($114,200,000 and 383 staff years available in 2020).

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 wellbeing 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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $476,000 for pay costs ($218,000 for annualization of the 2020 pay increase and $258,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $344,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $434,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture—Labor-Saving Automation of which $1,800,000 is for ARS' Livestock Production Program.

Automation is key to the future of U.S. cattle production. The trend today is larger, more intensive animal operations. As the number of animals increases, and the ratio of animals to workers likewise increases, the challenges of maximizing productivity, ensuring animal health

and welfare, and mitigating environmental impacts can be addressed, in part, by continuous automated measurement of key traits of individual animals, combined with machine learning models, and decision support tools for producers. Thus, critical production issues including environmental stress, early disease detection, estrus detection, behavior management, and greenhouse gas production can be managed.

Automation will strengthen and accelerate the development of new autonomous platforms and support technologies for the production and management of dairy and beef cattle production, and for related research. Critical support programs and partners include ARS' Breeding Insight Platform (BIP), ARS' Ag Data Commons, and ARS' SCINet.

If this initiative is not funded, economic development, workforce development, and quality of life for producers will be compromised due to delayed access to innovation and technology, or the U.S. will become dependent on Japan, China, or Europe for the latest technologies. Lower cost international producers will increase their share of U.S. markets.

As a result of this funding, ARS will:

- Alleviate rate limiting factors that compromise beef production efficiency. Automate precision measures of cattle range utilization and methane production.
- Develop forage characteristics/utilization that improve efficiency of growth, performance, nutrient use, and environmental impacts of dairy production. Automate precision feeding of dairy cattle.
- Improve nutrient management/efficiency of beef cattle. Automate precision measures of cattle feed efficiency, heat stress, methane production, and the onset of livestock disease.
- Use animal genetics and diversified forage systems to improve efficiency/sustainability of livestock production systems in the Southern Great Plains. Automate precision measures of cattle and their interactions with the environment related to sustainability.

E) <u>The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture—Data Management and Tool Development of which $1,167,000 is for ARS' Livestock Production Program.</u>

A primary limitation in using more sustainable agricultural production practices and conservation strategies is the challenge of choosing the most appropriate management option for a particular time and place. This choice should be influenced by climate and soil, so fitting production practices into a precision framework is knowledge intensive. Farmers make these decisions based on data which is often incomplete, ambiguous, or inaccessible when needed. With investments in data science, decision support tools can be developed to help producers leverage broadband connectivity to manage production efficiency, weather associated risks, and market variability using intensive automated data collection from their own farms and ranches in real time.

This coordinated research effort on developing decision tools for precision agricultural management will enable small- and medium-scale producers to participate in advances in site

specific best management practices optimized in real time to maximize the output from advanced animal genetics. For example, producers will be able to use sensors in their own barns to know when individual animals need attention.

As a result of this funding ARS will:

- Develop decision support tools that use precision geospatial and sensor data that enable effective use of cover crops to enhance crop production systems, minimize nutrient loss, and reduce wind/water erosion.
- Enable precision animal management for production issues, such as animal traceability, environmental stress, and disease detection by developing a data-driven, systems biology approach that enhances nutritional efficiency, sustainability, and animal health in beef and lamb production systems.
- Use animal genetics and diversified forage systems to improve efficiency/sustainability of livestock production systems in the Southern Great Plains.
- Alleviate rate limiting factors that compromise beef production efficiency.

F) A redirection of $2,967,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in precision agriculture related to labor-saving automation and data management/tool development. Funding from the following research projects is proposed for redirection:

- Montana, Miles City - Alleviating Rate Limiting Factors That Compromise Beef Production Efficiency (-$734,000)
- Nebraska, Clay Center - Developing a Systems Biology Approach to Enhance Efficiency and Sustainability of Beef and Lamb Production (-$500,000)
- Nebraska, Clay Center - Improve Nutrient Management and Efficiency of Beef Cattle and Swine (-$500,000)
- Oklahoma, El Reno - Use of Animal Genetics and Diversified Forage Systems to Improve Efficiency and Sustainability of Livestock Production Systems in The Southern Great Plains (-$733,000)
- Wisconsin, Madison - Forage Characteristics and Utilization That Improve Efficiency of Growth, Performance, Nutrient Use, And Environmental Impacts of Dairy Production (-$500,000)

G) A decrease of $8,473,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects

for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- Idaho, Aberdeen - Aquaculture Systems - Rainbow Trout - Univ of ID (-$321,000)
- Kentucky, Lexington - Improved Forage Livestock Production (-$899,000)
- Maryland, Beltsville - Bovine Genetics (-$216,000)
- Mississippi, Stoneville - Aquaculture Research National Warmwater Aquaculture Center (Catfish Health) (-$1,093,000)
- Mississippi, Stoneville - Aquaculture Warmwater Aquaculture (-$2,553,000)
- Mississippi, Stoneville - Biotechnology Research to Improve Crops and Livestock (-$671,000)
- Oregon, Corvallis - Genetic Improvement of Oyster Stocks for The Pacific Northwest (-$63,000)
- West Virginia, Leetown - Aquaculture Research - Coldwater Aquaculture (-$1,741,000)
- West Virginia, Leetown - Aquaculture Systems - Rainbow Trout - Univ of CT (-$436,000)
- Wisconsin, Madison - Great Lakes Aquaculture Research (-$480,000)

Crop Production

(3) A decrease of $2,578,000 and no staff year decrease for Crop Production research ($282,748,000 and 1,138 staff years available in 2020).

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

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $1,360,000 for pay costs ($622,000 for annualization of the 2020 pay increase and $738,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $985,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $1,239,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture—Labor-Saving Automation of which $5,000,000 is for ARS' Crop Production Program.

Currently, the harvesting of tree fruit crops (grapes, apples, apricots, peaches, pears, plums, and more) and small fruits (blackberries, blueberries, raspberries, strawberries, and tomatoes), and vegetables (lettuce, greens, celery, and more), rely primarily on manual labor. The domestic labor shortage and increased labor costs are hindering the profitability and competitiveness of U.S. specialty crop industries. Thus, the development of innovative, autonomous production monitoring, measuring, analyzing, and harvesting technologies, coupled with automated infield sorting and quality assessment technologies, will help address the labor shortage and

production cost issues as well as reduce postharvest loss and handling costs, and benefit research.

Automation will strengthen and accelerate the development of new autonomous platforms and support technologies for the production and management of specialty crop production, and for related research. Critical support programs and partners include ARS' Breeding Insight Platform (BIP), ARS' Ag Data Commons, and ARS' SCINet.

As a result of this funding, ARS will provide:

- Computational analysis of specialty crop traits and performance in the field; and phenotyping data analysis.
- Improved pest control application technologies for sustainable crop protection. Improved ARS intelligent sprayer system design for the control of pests, diseases, and weeds for the field/greenhouse to further reduce labor costs, pesticide consumption, and promote human safety.
- Integrated orchard management/automation for deciduous tree fruit crops. Computer vision and machine learning systems for analyzing plant architecture and fruit growth/shape.
- Molecular genetic and proximal sensing analyses of abiotic stress response and oil production pathways in cotton, oilseeds, and other industrial and biofuel crops. Automated trait analysis, low cost robotic systems development data processing, and data analytics pipeline.
- Aerial application technology for sustainable crop production. New knowledge on unmanned aerial spray application systems. Develop remote sensing data acquisition and analysis methods to determine site-specific crop and pest conditions, and guide the precision application of crop production inputs and pest management products.
- Application technologies to improve the effectiveness of chemical and biological crop protection materials. Dual function field imaging and spray application UAV development; rapid detection of conventional and herbicide resistant weeds; rapid detection of herbicide drift.

E) A redirection of $5,000,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in precision agriculture related to labor-saving automation. Funding from the following research projects is proposed for redirection:

- Arizona, Maricopa - Molecular Genetic and Proximal Sensing Analyses of Abiotic Stress Response and Oil Production Pathways in Cotton, Oilseeds, and Other Industrial and Biofuel Crops (-$500,000)
- Mississippi, Stoneville - Application Technologies to Improve the Effectiveness of Chemical and Biological Crop Protection Materials (-$500,000)

- New York, Ithaca - Improving Crop Efficiency Using Genomic Diversity and Computational Modeling (-$1,500,000)
- New York, Ithaca - Mapping Crop Genome Functions for Biology-Enabled Germplasm Improvement (-$1,000,000)
- Ohio, Wooster - Improved Pest Control Application Technologies for Sustainable Crop Protection (-$500,000)
- Texas, College Station - Aerial Application Technology for Sustainable Crop Production (-$500,000)
- West Virginia, Kearneysville - Integrated Orchard Management and Automation for Deciduous Tree Fruit Crops (Bridge Project) (-$500,000)

F) A decrease of $6,162,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- California, Davis - Improvement of Postharvest Performance of Ornamentals Using Molecular Genetic Approaches (-$289,000)
- Hawaii, Hilo - Tropical Crops Research (-$396,000)
- Iowa, Ames - Bioinformatics Institute for Model Plants (-$917,000)
- Iowa, Ames - Michael Fields Agricultural Institute (-$170,000)
- Maryland, Beltsville - Molecular Understanding of the Nexus Between Plant Bioregulators, Stress Tolerance, and Nutrient Content in Plants (-$485,000)
- Maryland, Beltsville - Cocoa, Coffee, and Alternative Crops Research (-$494,000)
- Maryland, Beltsville - Evaluation of Germplasm of Horticultural and Sugarcrops (-$278,000)
- Maryland, Beltsville - Information Transfer - Genetic Resources (-$48,000)
- Maryland, Beltsville - Staffing and Operation for National Clonal Repositories for Plant Germplasm (-$52,000)
- Mississippi, Stoneville - Agricultural Genomics (-$694,000)
- Mississippi, Stoneville - Kenaf & Medicinal Plants (-$467,000)
- Mississippi, Poplarville - Woody Ornamentals (-$832,000)
- Missouri, Columbia - Mid-West/Mid-South Irrigation (-$52,000)
- Missouri, Columbia - Soybean Seed Quality Improvement through Translational Genomics (-$313,000)
- Ohio, Wooster - Greenhouse and Hydroponics (-$215,000)
- Wisconsin, Madison - Pollinators and Gene Flow (-$460,000)

Food Safety

(4) A decrease of $3,386,000 and no staff year decrease for Food Safety research ($113,844,000 and 659 staff years available in 2020).

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $783,000 for pay costs ($359,000 for annualization of the 2020 pay increase and $424,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $566,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $714,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture--Data Management and Tool Development of which $1,000,000 is for ARS' Food Safety Program.

A primary limitation in using more sustainable agricultural production practices and conservation strategies is the challenge of choosing the most appropriate management option for a particular time and place. This choice should be influenced by climate and soil, so fitting production practices into a precision framework is knowledge intensive. Farmers make these decisions based on data which is often incomplete, ambiguous, or inaccessible when needed. With investments in data science, decision support tools can be developed to help producers leverage broadband connectivity to manage production efficiency, weather associated risks, and market variability using intensive automated data collection from their own farms and ranches in real time.

This coordinated research effort on developing decision tools for precision agricultural management will enable small- and medium-scale producers to participate in advances in site specific best management practices optimized in real time to maximize the output from advanced plant genetics. For example, producers will be able to use sensors in their own fields to know when to irrigate or fertilize each crop variety.

As a result of this funding, ARS will:

- Develop/use precision sensing/imaging technologies to determine water safety and quality for agricultural commodities.

E) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture—Labor-Saving Automation of which $1,000,000 is for ARS' Food Safety Program.

The export of some commodities from the U.S. is formally dependent on the ability to eliminate any associated pests, weeds, and/or pathogens from them. Aspergillus and Fusarium are toxigenic fungi genera of major concern because they can contaminate export commodities including tree nuts, cotton, rice, sunflower, wheat, barley, and corn, and are expensive, time

consuming, and a challenge to detect in the field. This initiative will develop non-destructive imaging technology to detect fungal infection in agricultural products including corn and other grains.

As a result of this funding, ARS will:

- Develop sensing technologies for the detection/characterization of microbial, chemical, and biological contaminants. Develop and use non-destructive hyper-spectral imaging technology to determine in-field toxigenic fungal infection in agricultural products; use automation technology to rapidly detect fungal/mycotoxin contamination in the field.
- Use classical/molecular technologies for developing aflatoxin resistance in crops; develop and use non-destructive hyper-spectral imaging technology to determine in-field toxigenic fungal infection in agricultural products; use automation technology to rapidly detect fungal/mycotoxin contamination in the field.

F) A redirection of $2,000,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in precision agriculture related to labor-saving automation and data management/tool development. Funding from the following research projects is proposed for redirection:

- Louisiana, New Orleans - Use of Classical and Molecular Technologies for Developing Aflatoxin Resistance in Crops (-$500,000)
- Maryland, Beltsville - Sensing Technologies for the Detection and Characterization of Microbial, Chemical, and Biological Contaminants in Foods (-$500,000)
- Maryland, Beltsville - Design and Implementation of Monitoring and Modeling Methods to Evaluate Microbial Quality of Surface Water Sources Used for Irrigation (-$1,000,000)

G) A decrease of $5,449,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- Arkansas, Booneville -Agroforestry (-$107,000)
- Kentucky, Bowling Green - Waste Management (-$183,000)
- Louisiana, New Orleans -Hyperspectral Imaging Technique (-$456,000)
- Maryland, Beltsville - Developing Practices or Nutrient and Byproducts to Mitigate Climate Change, Improve Nutrient Utilization, And Reduce Effects on Environment (-$1,225,000)

- Maryland, Beltsville - Enhancing Fruit and Vegetable Nutritional Quality with Improved Phenolics Contents (-$885,000)
- Mississippi, Stoneville - Center for Food Safety & Postharvest Technology (-$974,000)
- Pennsylvania, Wyndmoor -Food Safety Engineering (-$1,619,000)

Livestock Protection

(5) An increase of $3,896,000 and 24 staff years for Livestock Protection research ($116,808,000 and 426 staff years available in 2020).

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $479,000 for pay costs ($219,000 for annualization of the 2020 pay increase and $260,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $346,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $436,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture -- Data Management and Tool Development of which $1,000,000 is for ARS' Livestock Protection Program.

A primary limitation in using more sustainable agricultural production practices and conservation strategies is the challenge of choosing the most appropriate management option for a particular time and place. This choice should be influenced by climate and soil, so fitting production practices into a precision framework is knowledge intensive. Farmers make these decisions based on data which is often incomplete, ambiguous, or inaccessible when needed. With investments in data science, decision support tools can be developed to help producers leverage broadband connectivity to manage production efficiency, weather associated risks, and market variability using intensive automated data collection from their own farms and ranches in real time.

This coordinated research effort on developing decision tools for precision agricultural management will enable small- and medium-scale producers to participate in advances in site specific best management practices optimized in real time to maximize the output from

advanced animal genetics. For example, producers will be able to use sensors in their own barns to know when individual animals need attention.

As a result of this funding, ARS will:

- Develop precision surveillance, detection, and control technologies to alleviate and control the spread of Haemaphysalis longicornis, an invasive tick reported in New Jersey in 2017 and now present in 11 States, and a growing livestock disease vector.

E) An increase of $8,000,000 and 24 staff years for the National Bio and Agro-Defense Facility—Research.

NBAF will provide larger and more technology sophisticated facilities for the study of foreign, emerging, and zoonotic animal diseases that pose a threat to U.S. animal agriculture and public health. This capacity will enable USDA/ARS to conduct research and diagnostics, and develop countermeasures for high consequence zoonotic livestock diseases. NBAF's dedicated specialized space will support the early development of veterinary medical countermeasures and their transfer to the pharmaceutical industry for their development, registration, stockpiling, and distribution. In order to fully realize the mission of NBAF, it is necessary to increase the current funding for high priority foreign, emerging, and zoonotic diseases.

As a result of this funding, ARS will:

- Enhance existing research programs and expertise in Foot-and-Mouth Disease, African Swine Fever, Japanese Encephalitis, and Rift Valley Fever.
- Initiate new research and expertise in zoonotic disease agents and new anthropod-borne diseases.
- Conduct research gap analyses and risk analyses for diseases of interest to ensure research alignment.

- As a result of this funding to establish and increase partnerships and innovation ($3,000,000). ARS will:
  - Establish and increase partnerships with academia, industry, and others to address critical needs related to foreign animal disease research.

F) A redirection of $1,000,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in precision agriculture related to and data management/tool development. Funding from the following research projects is proposed for redirection:

- Maryland, Beltsville - Prevention of Arthropod Bites (-$500,000)
- Texas, Kerrville - Cattle Fever Tick Control and Eradication (-$500,000)

G) A decrease of $5,365,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- Maryland, Beltsville – Melaleuca Control Research (-$508,000)
- Maryland, Beltsville - Microbial Ecology of Antimicrobial Resistance (-$500,000)
- Maryland, Beltsville - Emerging Animal Diseases that Exist Offshore (-$199,000)
- Maryland, Beltsville - Develop Alternatives to Antibiotics for Priority Diseases in Animal Agriculture (-$500,000)
- Mississippi, Stoneville - Products for Invasive Ant Control (-$2,708,000)
- Mississippi, Stoneville - Red Imported Fire Ants - Mississippi State University (-$213,000)
- Mississippi, Stoneville - Red Imported Fire Ants - University of Mississippi (-$496,000)
- Texas, College Station - Identification of Resistance in Sorghum to Fungal Pathogens and Characterization of Pathogen Population Structure (-$241,000)

Crop Protection

(6) A decrease of $22,722,000 and no staff year decrease for Crop Protection research ($217,186,000 and 933 staff years available in 2020).

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $1,091,000 for pay costs ($500,000 for annualization of the 2020 pay increase and $591,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $788,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $994,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture -- Data Management and Tool Development of which $1,000,000 is for ARS' Crop Protection Program.

A primary limitation in using more sustainable agricultural production practices and conservation strategies is the challenge of choosing the most appropriate management option for a particular time and place. This choice should be influenced by climate and soil, so fitting production practices into a precision framework is knowledge intensive. Farmers make these decisions based on data which is often incomplete, ambiguous, or inaccessible when needed. With investments in data science, decision support tools can be developed to help producers leverage broadband connectivity to manage production efficiency, weather associated risks, and market variability using intensive automated data collection from their own farms and ranches in real time.

This coordinated research effort on developing decision tools for precision agricultural management will enable small- and medium-scale producers to participate in advances in site specific best management practices optimized in real time to maximize the output from

advanced plant genetics. For example, producers will be able to use sensors in their own fields to know when to irrigate or fertilize each crop variety.

As a result of this funding, ARS will:

- Develop precision pest, disease, and related vector detection and early warning technologies.

E) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture--Labor-Saving Automation of which $500,000 is for ARS' Crop Production Program.

Weed management represents the single largest pest management cost in agriculture. Many of the pressing weed issues in U.S. cropping systems are the result of increasing incidents of herbicide resistance, and the increasing costs and complexities of weed management. The development of autonomous systems for surveillance, detection, and elimination of weeds, including herbicide resistant weeds, is key to reducing production costs and preserving the efficacy of chemical control methods.

As a result of this funding to support new methods which are needed to manage weeds that will reduce the development of herbicide resistance and containing their spread when resistance does occur ($500,000), ARS will:

- Define plant-to-plant and plant-soil mechanisms and develop new systems. Integrate weed management through real-time field data systems, autonomous robots, and deep learning technologies.

F) A redirection of $1,500,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in precision agriculture related to labor-saving automation and data management/tool development. Funding from the following research projects is proposed for redirection:

- Maryland, Beltsville - Cover Crop-Based Weed Management: Defining Plant-Plant and Plant-Soil Mechanisms and Developing New Systems (-$500,000)
- Florida, Fort Pierce - Mitigating High Consequence Domestic, Exotic, And Emerging Diseases of Fruits, Vegetables, And Ornamentals (-$1,000,000)

G) A decrease of $25,595,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- California, Albany - Immunodiagnostics to Detect Prions and Other Important Animal Pathogens (-$1,718,000)
- Florida, Gainesville - Biological Control and Ag Research (-$49,000)
- Hawaii, Hilo - Fruit Fly Eradication (-$149,000)
- Hawaii, Hilo - Minor Crop Pest Control (-$184,000)
- Hawaii, Hilo - Papaya Ringspot (-$194,000)
- Hawaii, Hilo - U.S. Pacific Basin Ag Research -University of Hawaii (Hilo) (-$157,000)
- Hawaii, Hilo - U.S. Pacific Basin Ag Research -University of Hawaii (Manoa) (-$157,000)
- Indiana, West Lafayette -Oat Virus (-$65,000)
- Maryland, Beltsville -Area-Wide Management of Agricultural Pests (-$5,246,000)
- Maryland, Beltsville - Floriculture and Nursery Research Initiative (-$3,181,000)
- Maryland, Beltsville - Fusarium Head Blight of Wheat and Barley (-$6,965,000)
- Maryland, Beltsville - Minor Use Pesticides Umbrella Project (-$336,000)
- Maryland, Beltsville - National Plant Diseases Recovery System (-$1,383,000)
- Maryland, Beltsville - Potato Research (-$1,342,000)
- Maryland, Beltsville - Small Fruit and Nursery Research (-$1,071,000)
- Maryland, Beltsville - Wheat Stripe Rust Initiative (-$200,000)
- Mississippi, Stoneville - Cotton Genomics & Breeding (-$481,000)
- Mississippi, Stoneville - Cropping Systems Research (-$115,000)
- New York, Ithaca – Development of Tools, Models and Datasets for Genome-Enabled Studies of Bacterial Phytopathogens (-$667,000)
- New York, Ithaca - Golden Nematode (-$157,000)
- New York, Ithaca – Microbial and Arthropod Biological Control Agents for Management of Insect Pests of Greenhouse Crops and Trees (-$788,000)
- New York, Ithaca - Pear Thrips (Knapweed) (-$53,000)
- Oregon, Corvallis – Sudden Oak Death (-$937,000)

Human Nutrition

(7) A decrease of $2,854,000 and no staff year decrease for Human Nutrition research ($92,510,000 and 219 staff years available in 2020).

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $293,000 for pay costs ($134,000 for annualization of the 2020 pay increase and $159,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $212,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $267,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) A decrease of $3,626,000 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects

for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

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

Environmental Stewardship

(8) A decrease of $2,421,000 and no staff year increase for Environmental Stewardship research ($231,523,000 and 1,125 staff years available in 2020).

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. The research supports many of USDA's Strategic Goals.

The funding change is requested for the following items:

A) An increase of $1,327,000 for pay costs ($608,000 for annualization of the 2020 pay increase and $719,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $959,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $1,210,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) An increase of $5,000,000 and no staff year increase for Artificial Intelligence Innovations for Agricultural Production and Processing.

AI (artificial intelligence) research efforts are not new. Fundamental research in AI has been ongoing for decades. With improvements in the availability and speed of rural broadband, decreasing technology costs, increasing production costs (e.g., labor, water, and nutrients), increasing market competition, and more tech-savvy managers, there is an outstanding opportunity currently to leverage AI as a force multiplier in our management systems. Stakeholders are beginning to recognize this opportunity and are beginning to demand AI solutions. AI technologies such as Machine Learning create the possibility that an agricultural manager can optimize his/her production system, even customizing their management daily, hourly, or by the minute to fit the conditions of the day! By applying technologies that leverage AI, the farmer/rancher will realize improved efficiencies (e.g., yield, labor, pesticide and nutrient application, and water), higher quality products, decreased environmental impact, and increased profits/savings. Integrating AI research with precision agriculture and advanced mechanization technologies research is the key to creating agricultural industries that can feed the world tomorrow with fewer available resources than we have today.

This initiative will focus on creating an infrastructure whereby solutions driven research will enable AI derived solutions to agricultural challenges and AI powered decision support systems and tools for our customers and stakeholders. The effort will lead to opportunities for

collaboration between ARS and ERS on the economic impact and feasibility of the technologies, and among ARS, NRCS, and NIFA to operationalize adoption of the tools and technologies. The initial focus will be on creating a data and technology infrastructure that leverages AI in ARS research and tool development. The initiative will maintain a focus on advancing the fundamental science and application of AI in agriculture to ensure the technology continues to support future innovation and stakeholder needs. This initiative will include AI research for crops, animal production, agricultural processing, and natural resources. To meet this broad spectrum of target areas, the research initiative must be dynamic, flexible, and highly integrated. Because of this, the effort will need to be highly adaptable and modular or component driven research will be applied where possible to develop highly specific and sound solutions that can be integrated into a wide variety of AI products or assemblies. The effort will work to capitalize on gains made by the broader AI community and develop cutting edge applications and opportunities in the agriculture and natural resources space. The expertise of this initiative will be brought to bear across the ARS research enterprise to empower broad and diverse development of AI-driven tools and technologies that benefit every sector of agricultural production and sustainability. It will leverage existing expertise with AI research operations and infrastructure that enables the development of cutting-edge, data-driven agricultural solutions and management aids that are scalable for local to regional application by small and large farm and ranch operations. The following are a few examples of advancements that could be achieved with this initiative:

- Fruit specific harvesting – harvesting an apple, orange, or cotton boll when optimally ready for harvest, instead of current methods of harvesting based on field predicted average quality or ripeness.
- AI incorporated into small unmanned ground vehicles (UGV) to target and eliminate (non-chemical) individual non-beneficial insects.
- AI incorporated into UGVs for mechanical weeding.
- Virtual fencing for rangeland management.
- AI for early sickness or disease detection in livestock (including aquaculture).
- AI systems for feeding, watering, and medicating individual plants and animals.
- AI decision tools for comparing real time market value with producers' or ranchers' current crop or livestock dynamic performance metrics to maximize returns.
- AI decision tools for maximizing profits based on current market opportunities, by-product utilization, input costs, and near real time quality information on incoming based products (actual or model forecasted).
- AI systems focused on minimizing food and agricultural processing waste.

Means to Achieve Change

- This integrated multi-disciplinary precision agriculture research effort will develop a suite of AI and machine learning tools ($5,000,000). ARS will provide:
  - Customers and stakeholders valuable decision support tools even in out-years.

- Agricultural producers, ranchers, and processors with these decision support tools to maximize production and minimize inputs and losses.

E) An increase of $5,000,000 and no staff year increase for Long-Term Agroecosystems Research.

The Long-Term Agroecosystem Research (LTAR) Network is a network of 18 sites across the country, representing most of the agricultural production regions of the U.S. LTAR is built upon a common experiment that evaluates a local "business as usual" production system against an "aspirational" system that includes improved, innovative technologies, and management practices--ones that are being explored and that have demonstrated some promise to increase regional production quality and quantity, as well as other sustainability outcomes, steadily increasing its impact in addressing long-term, systems level challenges associated with the sustainable intensification of U.S. agriculture. Across the Network, coordinated, site-based research is generating the knowledge needed to secure integrated solutions to complex problems and informing innovative, science-based policies for increased agricultural production, sustained profits, more vibrant rural economies, and enhanced ecosystem services from agricultural lands. One remaining hinderance is that some sites lack dedicated funding needed to support their network contributions and there is no dedicated network funding to support data coordination. Securing funding for the remaining locations and network data management will energize the entire network and increase the combined impact regionally and nationally. LTAR funding for all sites will empower a new era of network science at ARS to better address national agricultural research priorities and ensure open access to high quality, consistent and wide-ranging datasets that will attract external collaborators and the coupling of other Federal and non-Federal datasets, catalyzing opportunities to leverage Big Data science to solve agricultural challenges.

A formal measure of success of the LTAR research enterprise is a shift in agricultural management within each region from business as usual practices toward the aspirational, resulting in increased production efficiencies, reduced environmental impacts, improved food security, more resilient production systems, and improved support for rural communities. The decision support tools developed by the LTAR network will provide producers, ranchers, and processors an outstanding set of precision agricultural tools, especially if these rural customers have broadband access.

As a result of this funding, ARS will:

- Establish new project coordinating network-wide analyses, data science, data integration, data automation, and open access across the LTAR network.
- Establish efforts of the LTAR network at the Kellogg Biological Station.
- Establish the work of the California LTAR network site within the new water unit at Davis.
- Establish the work of the Lower Chesapeake Bay LTAR network site.
- Fully execute the Eastern Corn Belt LTAR site.

- Fully execute the Lower Mississippi River Basin LTAR site.

F) An increase of $5,000,000 and no staff year increase for Managing Excess Water and Controlling Erosion on Agricultural Landscapes.

Previous limitations in cloud storage, computational power, and spatial field data resulted in water availability, hydrology, and soil erosion datasets that are fragmented. Further, data rich, high resolution water availability and soil erosion models have limited scalability because of data consistency and availability. Multiple water flow and soil erosion models, each with their specific strength, can produce differing results. Such inconsistencies have often caused challenges for the NRCS and have confused land managers. Now is the time to leverage Big Data, modern computing technologies, and smartphone app capabilities to innovate next generation hydrology and soil erosion modeling and decision support tools. ARS proposes scaling up its hydrology and erosion modeling and tool development through multi-disciplinary research to develop a virtual Center of Excellence for Forecasting and Managing Flooding, Runoff, and Erosion. This will be a coordinated effort that results in precision instrumentation, integrated monitoring data, and a cloud-based platform for a suite of models and decision support tools that will aid NRCS and land managers in conserving scarce water and soil resources.

This initiative will be highly collaborative as NRCS routinely relies on ARS for erosion modeling, spillway design standards, and dam failure assessment. Additionally, there will be opportunities to collaborate with NIFA initiatives and ERS on the economic feasibility of the tools. Other Federal (Federal Emergency Management Agency, Army Corps of Engineers, and others) and State agencies have already expressed interest in collaborating.

This integrated, multi-disciplinary precision agriculture research effort will develop a network of models that will be used by local, State, and national agencies to forecast water availability and quantify soil erosion; conduct dam and levee risk assessments; and evaluate opportunities for aquifer recharge. Agricultural producers, ranchers, and processors will use these decision support tools to maximize production and minimize water needs and soil loss.

As a result of this funding, ARS will:

- Develop instrumentation and tools to improve water management, flood control, and aquifer recharge infrastructure that enhances the safety and sustainability of water resources, agricultural production systems, and rural communities.
- Develop next generation erosion prediction and mitigation tools to conserve agriculture soils, improve water quality, reduce sedimentation, and ensure sustainability of production systems and infrastructure.
- Develop precision instrumentation and management tools to control erosion by wind in croplands and rangelands.
- Conduct precision analytics for water and soil management to mitigate extreme weather.

G) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture -- Data Management and Tool Development of which $5,833,000 is for ARS' Environmental Stewardship Program.

A primary limitation in using more sustainable agricultural production practices and conservation strategies is the challenge of choosing the most appropriate management option for a particular time and place. This choice should be influenced by climate and soil, so fitting production practices into a precision framework is knowledge intensive. Farmers make these decisions based on data which is often incomplete, ambiguous, or inaccessible when needed. With investments in data science, decision support tools can be developed to help producers leverage broadband connectivity to manage production efficiency, weather associated risks, and market variability using intensive automated data collection from their own farms and ranches in real time.

This coordinated research effort on developing decision tools for precision agricultural management will enable small- and medium-scale producers to participate in advances in site specific best management practices optimized in real time to maximize the output from advanced plant and animal genetics. For example, producers will be able to use sensors in their own fields to know when to irrigate or fertilize each crop variety, or to use sensors in their own barns to know when individual animals need attention.

As a result of this funding, ARS will:

- Develop new precision tools that integrate sensors, images from multiple sources, and field measurements to enhance the sustainable management of field/specialty crops.
- Develop/deploy crop management tools that leverage sensor technologies integrating real-time weather data to predict nutrient losses, water movement and availability, and erosion events.
- Provide adaptive grazing management and decision support to enhance ecosystem services in the Western Great Plains.
- Research science and technologies for the sustainable management of Western rangeland systems.
- Use sensor and imaging technology to improve water use efficiency and quality, such as automated water sampling and treatment systems.
- Use precision agriculture to manage excess water, mitigate flood risk, and optimize storage for irrigation and aquifer recharge.

H) The President's FY 2021 Budget includes a total of $10,000,000 for Precision Agriculture-- Labor-Saving Automation of which $700,000 is for ARS' Environmental Stewardship Program.

Automation is key to the future of U.S. cattle production. The trend today is larger, more intensive animal operations. As the number of animals increases, and the ratio of animals to workers likewise increases, the challenges of maximizing productivity, ensuring animal health and welfare, and mitigating environmental impacts can be addressed, in part, by continuous automated measurement of key traits of individual animals, combined with machine learning

models, and decision support tools for producers. Thus, critical production issues including environmental stress, early disease detection, estrus detection, behavior management, and greenhouse gas production can be managed.

As a result of this funding, ARS will:

- Improve practices to conserve air quality, maintain animal productivity, and enhance use of manure and soil nutrients of cattle production systems for the Southern Great Plains. Precision automation for measures for nutrient management in cattle.
- Multi-functional farms/landscapes to enhance ecosystem services. Automation for precision measures of pasture feed efficiency for dairy cattle.

I) A redirection of $21,533,000 from current, ongoing research projects to support higher priority research initiatives.

The 2021 Budget recommends the redirection of selected ongoing research projects and resources in support of the agency's new program initiatives in artificial intelligence innovations for agricultural production; long-term agroecosystems research, managing excess water and controlling erosion; and precision agriculture related to labor-saving automation and data management/tool development. Funding from the following research projects is proposed for redirection:

- Arizona, Maricopa - Advancing Water Management and Conservation in Irrigated Arid Lands (-$2,000,000)
- Colorado, Ft. Collins - Management Practices for Long Term Productivity of Great Plains Agriculture (-$1,000,000)
- Indiana, West Lafayette - Conservation Practice Impacts on Water Quality at Field and Watershed Scales (-$1,200,000)
- Indiana, West Lafayette - Managing Agricultural Systems to Improve Agronomic Productivity, Soil, and Water Quality (-$800,000)
- Iowa, Ames - Agroecosystem Benefits from the Development and Application of New Management Technologies in Agricultural Watersheds (-$500,000)
- Maryland, Beltsville - Enhancing Sustainability of Mid-Atlantic Agricultural Systems Using Agroecological Principles and Practices (-$500,000)
- Maryland, Beltsville - Integrating Remote Sensing, Measurements and Modeling for Multi-Scale Assessment of Water Availability, Use, and Quality in Agroecosystems (-$1,000,000)
- Maryland, Beltsville - A Systems Approach to Improved Water Management for Sustainable Production (-$500,000)
- Maryland, Beltsville - Enhancing Sustainability of Mid-Atlantic Agricultural Systems Using Agroecological Principles and Practices (-$500,000)
- Maryland, Beltsville - Improving Agroecosystem Services by Measuring, Modeling, and Assessing Conservation Practices (-$500,000)
- Mississippi, Mississippi State - Closing the Yield Gap Of Cotton, Corn, and Soybean in the Humid Southeast With More Sustainable Cropping Systems (-$5,000,000)

- Mississippi, Oxford - Strategic Investigations to Improve Water Quality and Ecosystem Sustainability in Agricultural Landscapes (-$500,000)
- Mississippi, Oxford - Managing Water and Sediment Movement in Agricultural Watersheds (-$2,000,000)
- New Mexico, Las Cruces - Science and Technologies for the Sustainable Management of Western Rangeland Systems (-$500,000)
- New Mexico, Las Cruces - Science and Technologies for the Sustainable Management of Western Rangeland Systems (-$500,000)
- Ohio, Columbus - Agricultural Water Management in Poorly Drained Midwestern Agroecosystems (-$1,500,000)
- Ohio, Columbus - Agricultural Water Management in Poorly Drained Midwestern Agroecosystems (-$500,000)
- Oklahoma, Stillwater - Development of Engineering Tools for the Design and Rehabilitation Of Safe, Efficient Embankment Protection Alternatives, Hydraulic Structures, And Channels (-$500,000)
- Pennsylvania, University Park - Multifunctional Farms and Landscapes to Enhance Ecosystem Services (-$400,000)
- Pennsylvania, University Park - Sustaining Agroecosystems and Water Resources in the Northeastern U.S. (-$1,000,000)
- Texas, Bushland - Improved Practices to Conserve Air Quality, Maintain Animal Productivity, and Enhance Use of Manure and Soil Nutrients of Cattle Production Systems for the Southern Great Plains (-$300,000)
- Wyoming, Cheyenne - Adaptive Grazing Management and Decision Support to Enhance Ecosystem Services in the Western Great Plains (-$333,000)

J) A decrease of $5,917,070 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 reset priorities within the existing portfolio of projects. As a result, some projects no longer qualify for continued support. The 2021 Budget has identified the following ongoing projects for elimination given that the majority of their research is carried out by other research institutions including universities and land grant institutions.

- Arkansas, Booneville -Agroforestry (-$959,000)
- Kentucky, Bowling Green - Waste Management (-$355,000)
- Maryland, Beltsville – Developing Practices for Nutrient and Byproducts to Mitigate Climate Change, Improve Nutrient Utilization, and Reduce Effects on Environment (-$924,070)
- Maryland, Beltsville - Global Change Research (-$125,000)
- Maryland, Beltsville - Combined Water Quality Research (-$96,000)
- Maryland, Beltsville -Air Quality Associated with Agricultural Operations (-$628,000)
- Mississippi, Oxford - Acoustics (-$775,000)

- Mississippi, Oxford - Utilizing Acoustic and Geophysics Technology to Assess and Monitor Watersheds in the United States (-$811,000)
- Missouri, Columbia -Mid-West/Mid-South Irrigation (-$120,000)
- Texas, Bushland - Ogallala Aquifer - KS State University (-$270,000)
- Texas, Bushland - Ogallala Aquifer - TX A&M University (-$443,000)
- Texas, Bushland - Ogallala Aquifer - TX Tech University (-$237,000)
- Texas, Bushland - Ogallala Aquifer - West TX A&M University (-$174,000)

Library and Information Services

(9) A decrease of $3,712,000 and no staff year decrease for Library and Information Services ($28,791,000 and 92 staff years available in 2020).

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 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 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 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."

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.

The funding change is requested for the following item:

A) An increase of $109,000 for pay costs ($50,000 for annualization of the 2020 pay increase and $59,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $79,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $100,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) A decrease of $4,000,000 from ongoing projects and to help finance and support the Administration's budget priorities.

The goal of ARS is to make the most efficient use of taxpayer dollars within available resources. The 2021 Budget has identified the following lower priority project for elimination:

Maryland, Beltsville -Ag Law Partnership (-$4,000,000)

National Bio and Agro-Defense Facility

(10) An increase of $15,257,000 and no staff year increase for the National Bio and Agro-Defense Facility ($66,000,000 and 82 staff years available in 2020).

The funding change is requested for the following items:

A) An increase of $98,000 for pay costs ($45,000 for annualization of the 2020 pay increase and $53,000 for the 2021 pay increase).

Funding for pay costs is critical for recruiting and retaining top level scientists and staff, conducting viable research programs, and carrying out ARS' mission. Elimination of the pay cost increase would result in ARS unable to fully fund its staff and/or would require the agency significantly cutting travel, training, and mission support.

B) An increase of $70,000 for performance awards.

This increase will support a 1 percentage point increase in awards spending, consistent with objectives outlined in the President's Management Agenda, to enhance workforce development. Without this additional funding, ARS will be unable to absorb these costs in FY 2021, resulting in reductions to planned hiring levels, eroding USDA's ability to meet key Administration priorities contained in this Budget.

C) An increase of $89,000 for the Department's increased contribution to the Federal Employees Retirement System (FERS).

This increase will cover the expenses for the mandated increase of USDA's contribution to FERS. These increases were effective January 1, 2020, and impact a number of employees' retirement packages.

D) An increase of $15,000,000 and no staff year increase for the National Bio and Agro-Defense Facility--Operations and Maintenance.

The new National Bio and Agro-Defense Facility (NBAF) in Manhattan, Kansas will replace the outdated and inadequate Plum Island Animal Diseases Center (PIADC) in New York. NBAF will be a state-of-the-art biocontainment facility for the study of high consequence foreign, emerging, and zoonotic animal diseases that pose a threat to U.S. animal agriculture and to public health. NBAF will include the first Biosafety Level-4 biocontainment facility for large livestock in the United States.

ARS is working closely with the Department of Homeland Security and APHIS to ensure a smooth transition of operations from PIADC to NBAF. Once the transition is complete, both ARS and APHIS will share responsibility for NBAF's operations. USDA is scheduled to take over operational responsibility of NBAF in December 2020, with construction of the facility substantially completed at that time. Workforce development is critical given the significant loss of expertise expected during the transition.

As early as FY 2018, USDA began to recruit key staff to correspond with NBAF's construction and commissioning. By FY 2020, with the acceleration in hiring, approximately 80 percent of the staff will be in place to operate NBAF. In FY 2021, the remaining 20 percent (for animal caretaking containment operations, shift work) will be hired. Animal handling and disposal procedures and capabilities will need to be tested. Other "stand-up" activities to achieve full operational capability include purchase of animals, animal care materials, laboratory supplies, and facilities equipment. In addition, warehouse space will need to be leased to support the storage needs of NBAF.

NBAF is scheduled to be fully operational by December 2022.

As a result of this funding, ARS will

- Maintain NBAF's research and laboratory equipment, machinery, building infrastructure, and supporting utilities, and care for its livestock and other animals.

Repair and Maintenance

(11) No change in Repairs and Maintenance of ARS' Laboratories and Facilities ($20,144,000 available in 2020).

ARS' Repair and Maintenance (R&M) program is intended to improve existing facilities, that is, primarily for the protection of life and property, and 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 only addresses ARS' highest priorities.

National Bio and Agro-Defense Facility (Transition and Equipment Purchases)

(2) **ARS is requesting $0 in FY 2021 for its Salaries and Expenses account, National Bio-and Agro-Defense Facility (Transition and Equipment Purchases), a decrease of $13,100,000 from the FY 2020 Enacted level**. The FY 2021 Budget includes a decrease of $13,100,000 for one-time program transition costs associated with the transfer of operations from PIADC to NBAF which are no longer needed.

GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF YEARS (dollars in thousands)

State/Territory/Country	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
ALABAMA								
Auburn	$6,325	38	$8,774	37	$8,242	37	$8,242	37
Total	6,325	38	8,774	37	8,242	37	8,242	37
ARIZONA								
Maricopa	9,993	66	9,743	63	9,914	63	9,914	63
Tucson	6,463	49	6,791	47	6,420	47	6,420	47
Total	16,456	115	16,534	110	16,334	110	16,334	110
ARKANSAS								
Booneville	3,977	21	4,448	20	3,929	20	2,970	20
Fayetteville	2,074	10	2,180	12	1,862	12	1,862	12
Jonesboro	1,297	9	1,387	8	1,424	8	1,424	8
Little Rock	7,564	-	7,754	-	8,199	-	8,199	-
Stuttgart	7,730	60	7,544	55	7,888	55	7,888	55
Total	22,642	100	23,313	95	23,302	95	22,343	95
CALIFORNIA								
Albany	39,671	195	41,184	188	38,284	188	36,737	188
Davis	13,558	79	12,590	73	11,673	73	11,413	73
Parlier	12,239	85	11,684	86	12,219	86	12,219	86
Riverside	5,183	31	5,919	27	5,864	27	5,864	27
Salinas	6,212	42	6,695	44	7,041	44	7,041	44
Total	76,863	432	78,072	418	75,081	418	73,2741	418
COLORADO								
Akron	1,878	15	1,550	13	1,981	13	1,981	13
Fort Collins	18,997	139	21,087	130	20,006	130	20,006	130
Total	20,875	154	22,637	143	21,987	143	21,987	143
DELAWARE								
Newark	1,967	15	1,913	18	2,000	18	2,000	18
Total	1,967	15	1,913	18	2,000	18	2,000	18
DISTRICT OF COLUMBIA								
National Arboretum	12,245	55	12,987	54	13,783	54	13,783	54
Headquarters								
Federal Administration	124,881	471	145,609	595	94,842	825	94,842	825
Total	137,126	526	158,596	649	108,625	879	108,625	879
FLORIDA								

State/Territory/Country	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
Canal Point	2,764	26	2,853	25	2,936	25	2,936	25
Fort Lauderdale	2,374	33	2,429	30	2,446	30	2,446	30
Fort Pierce	15,532	109	16,970	100	16,523	100	16,522	100
Gainesville	11,812	83	11,973	79	12,025	79	11,981	79
Miami	5,524	27	5,067	25	5,928	25	5,928	25
Total	38,006	278	39,292	259	39,858	259	39,813	259
GEORGIA								
Athens	27,265	140	27,341	132	30,073	132	30,073	132
Byron	3,540	30	3,264	35	3,559	35	3,559	35
Dawson	3,275	25	3,393	23	3,714	23	3,714	23
Griffin	2,259	15	3,005	15	2,410	15	2,410	15
Tifton	10,256	78	9,943	67	10,161	67	10,161	67
Total	46,595	288	46,946	272	49,917	272	49,917	272
HAWAII								
Hilo	9,603	55	11,405	50	11,160	50	10,046	50
Total	9,603	55	11,405	50	11,160	50	10,046	50
IDAHO								
Aberdeen	7,020	41	6,686	38	7,039	38	6,750	38
Boise	2,953	25	2,788	29	2,878	29	2,878	29
Dubois	2,115	11	1,915	10	2,141	10	2,141	10
Kimberly	5,289	34	5,317	34	5,581	34	5,581	34
Total	17,377	111	16,706	111	17,639	111	17,350	111
ILLINOIS								
Peoria	31,288	186	31,030	170	32,625	170	31,343	170
Urbana	5,513	31	5,672	26	5,562	26	5,562	26
Total	36,801	217	36,702	196	38,187	196	36,905	196
INDIANA								
West Lafayette	8,094	51	7,380	50	7,537	50	7,479	50
Total	8,094	51	7,380	50	7,537	50	7,479	50
IOWA								
Ames	55,486	339	54,782	316	54,858	316	53,880	316
Total	55,486	339	54,782	316	54,858	316	53,880	316
KANSAS								
Manhattan	16,980	82	61,614	94	98,729	152	106,329	176
Total	16,980	82	61,614	94	98,729	152	106,329	176
KENTUCKY								
Bowling Green	2,660	15	2,534	14	2,621	14	2,137	14
Lexington	2,520	12	2,547	11	2,705	11	1,896	11
Total	5,180	27	5,081	25	5,326	25	4,032	25
LOUISIANA								
Baton Rouge	2,615	19	2,756	23	3,087	23	3,087	23
Houma	4,179	44	4,640	42	4,407	42	3,997	42
New Orleans	21,228	114	20,040	104	20,781	104	20,781	104
Total	28,022	177	27,436	169	28,275	169	27,865	169
MAINE								
Orono	2,438	17	2,249	15	2,260	15	2,260	15
Total	2,438	17	2,249	15	2,260	15	2,260	15
MARYLAND								
Beltsville	121,213	581	116,810	526	120,077	526	116,628	526

State/Territory/Country	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
National Ag Library	25,813	77	25,860	56	24,997	56	21,397	56
Frederick	5,467	28	5,662	30	6,096	30	6,096	30
Total	152,493	686	148,332	612	151,170	612	144,121	612
MASSACHUSETTS								
Boston	15,178	6	16,241	8	15,673	8	15,673	8
Total	15,178	6	16,241	8	15,673	8	15,673	8
MICHIGAN								
East Lansing	1,879	9	1,881	8	1,495	8	1,495	8
Total	1,879	9	1,881	8	1,495	8	1,495	8
MINNESOTA								
Morris	2,647	21	2,557	17	2,530	17	2,530	17
St. Paul	8,862	42	8,852	44	7,593	44	7,593	44
Total	11,509	63	11,409	61	10,123	61	10,123	61
MISSISSIPPI								
Mississippi State	13,404	60	13,310	59	14,202	59	14,202	59
Oxford	15,629	71	15,044	69	15,355	69	11,611	69
Poplarville	5,429	27	5,600	26	5,897	26	5,148	26
Stoneville	43,795	234	47,800	209	49,356	209	39,938	209
Total	78,257	392	81,754	363	84,810	363	70,899	363
MISSOURI								
Columbia	8,862	59	8,957	50	9,323	50	8,887	50
Total	8,862	59	8,957	50	9,323	50	8,887	50
MONTANA								
Miles City	3,644	22	4,814	23	3,755	23	3,755	23
Sidney	4,899	40	4,768	35	5,271	35	5,271	35
Total	8,543	62	9,582	58	9,026	58	9,026	58
NEBRASKA								
Clay Center	22,036	110	24,790	104	22,752	104	22,752	104
Lincoln	5,633	51	6,115	49	6,534	49	6,534	49
Total	27,669	161	30,905	153	29,286	153	29,285	153
NEVADA								
Reno	2,543	17	2,368	14	2,274	14	2,274	14
Total	2,543	17	2,368	14	2,274	14	2,274	14
NEW MEXICO								
Las Cruces	7,406	48	7,380	45	7,404	45	7,404	45
Total	7,406	48	7,380	45	7,404	45	7,404	45
NEW YORK								
Geneva	4,048	32	4,178	26	4,344	26	4,344	26
Greenport	4,978	17	8,111	19	12,849	19	11,350	19
Ithaca	17,953	51	21,439	51	4,130	51	4,130	51
Total	26,979	100	33,728	96	21,323	96	19,824	96
NORTH CAROLINA								
Raleigh	10,752	75	10,831	77	10,827	77	10,827	77
Total	10,752	75	10,831	77	10,827	77	10,827	77
NORTH DAKOTA								
Fargo	16,867	91	19,092	87	20,365	87	19,789	87
Grand Forks	9,517	41	8,977	35	9,273	35	9,273	35
Mandan	4,624	29	4,202	31	4,166	31	4,166	31
Total	31,008	161	32,271	153	33,803	153	33,228	153

State/Territory/Country	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
OHIO								
Columbus	1,511	15	1,845	14	1,904	14	1,904	14
Wooster	7,338	42	8,032	39	7,362	39	7,168	39
Total	8,849	57	9,877	53	9,266	53	9,072	53
OKLAHOMA								
El Reno	8,415	53	7,053	49	6,876	49	6,876	49
Stillwater	4,548	28	4,641	27	3,709	27	3,709	27
Woodward	2,198	16	2,187	16	2,219	16	2,219	16
Total	15,161	97	13,881	92	12,804	92	12,803	92
OREGON								
Burns	3,914	18	3,940	21	4,407	21	4,407	21
Corvallis	15,409	88	16,812	87	15,101	87	14,202	87
Pendleton	1,957	15	3,546	13	3,700	13	3,700	13
Total	21,280	121	24,298	121	23,208	121	22,308	121
PENNSYLVANIA								
University Park	6,318	36	7,211	34	6,457	34	6,457	34
Wyndmoor	30,317	151	30,731	134	32,875	134	30,360	134
Total	36,635	187	37,942	168	39,332	168	36,817	168
SOUTH CAROLINA								
Charleston	5,287	36	9,079	36	8,639	36	8,639	36
Florence	3,849	27	3,902	27	3,919	27	3,919	27
Total	9,136	63	12,981	63	12,558	63	12,558	63
SOUTH DAKOTA								
Brookings	2,676	20	2,397	17	2,974	17	2,974	17
Total	2,676	20	2,397	17	2,974	17	2,974	17
TEXAS								
Bushland	6,721	39	7,058	37	7,347	37	6,335	37
College Station	13,054	72	14,044	73	13,125	73	12,909	73
Houston	13,891	6	14,991	6	14,204	6	14,204	6
Kerrville	6,610	34	6,355	31	7,118	31	7,118	31
Lubbock	10,262	77	9,258	75	9,840	75	9,840	75
Temple	4,533	33	4,490	28	4,660	28	4,660	28
Total	55,071	261	56,196	250	56,294	250	55,066	250
UTAH								
Logan	9,277	70	9,299	69	9,721	69	9,721	69
Total	9,277	70	9,299	69	9,721	69	9,721	69
WASHINGTON								
Pullman	22,275	121	20,722	114	20,976	114	20,976	114
Wapato	5,872	44	5,846	45	5,885	45	5,885	45
Wenatchee	2,415	20	2,323	19	2,485	19	2,485	19
Total	30,562	185	28,891	178	29,346	178	29,346	178
WEST VIRGINIA								
Kearneysville	8,290	53	7,582	47	7,082	47	7,082	47
Leetown	7,435	33	7,276	32	7,589	32	5,629	32
Total	15,725	86	14,858	79	14,671	79	12,711	79
WISCONSIN								
Madison	18,872	100	20,188	99	20,063	99	19,218	99
Total	18,872	100	20,188	99	20,063	99	19,218	99
PUERTO RICO								

State/Territory/Country	2018 Actual	SY	2019 Actual	SY	2020 Enacted	SY	2021 Budget	SY
Mayaguez	3,195	33	2,900	33	3,384	33	3,384	33
Total	3,195	33	2,900	33	3,384	33	3,384	33
OTHER COUNTRIES								
France, Montpellier	3,967	1	4,248	1	3,201	1	3,201	1
Total	3,967	1	4,248	1	3,201	1	3,201	1
Extramural & Funds Administered from Headquarters-Held Funds	20,099	-	19,203	-	224,046	-	146,890	-
Repair & Maintenance of Facilities	20,137	-	20,144	-	20,144	-	20,144	-
Obligations	1,200,556	6,142	1,292,374	5,948	1,476,866	6,236	1,367,970	6,260
Lapsing Balances	2,437	-	3,494	-	-	-	-	-
Bal. Available, EOY	44,254	-	62,500	-	-	-	-	-
Total, Available	1,247,247	6,142	1,358,368	5,948	1,476,866	6,236	1,367,970	6,260

CLASSIFICATION BY OBJECTS (dollars in thousands)

Item No.	Item	2018 Actual	2019 Actual	2020 Enacted	2021 Budget
	Personnel Compensation:				
	Washington D.C.	$38,116	$39,256	$42,234	$43,352
	Personnel Compensation, Field	437,133	434,213	467,146	479,525
11	Total personnel compensation	475,249	473,470	509,380	522,878
12	Personal benefits	168,525	166,435	177,377	183,503
13.0	Benefits for former personnel	349	379	-	-
	Total, personnel comp. and benefits	644,124	640,284	686,757	706,381
	Other Objects:				
21.0	Travel and transportation of persons	11,095	10,245	12,413	10,394
22.0	Transportation of things	428	484	587	491
23.1	Rental payments to GSA	4,832	4,884	4,983	4,755
23.2	Rental payments to others	857	3,585	4,343	3,637
23.3	Communications, utilities, and misc. charges	42,391	44,176	54,461	45.020
24.0	Printing and reproduction	485	548	664	556
25	Other contractual services	-	-	-	-
25.1	Advisory and assistance services	1,082	804	975	816
25.2	Other services from non-Federal sources	24,049	27,760	33,636	28,164
25.3	Other goods and services from Federal sources	4,627	3,492	4,231	3,543
25.4	Operation and maintenance of facilities	52,618	45,476	55,102	46,139
25.5	Research and development contracts	244,211	288,666	349,764	292,871
25.6	Medical care	247	240	291	244
25.7	Operation and maintenance of equipment	15,584	18,651	22,599	18,923
25.8	Subsistence and support of persons	3	8	9	8
26.0	Supplies and materials	75,795	85,192	103,223	86,433
31.0	Equipment	48,148	65,487	79,347	66,440
32.0	Land and structures	7,964	22,491	27,251	22,818
33.0	Investments and loans	-	-	-	-
41.0	Grants, subsidies, and contributions	22,016	29,902	36,231	30,337
	Total, Other Objects	556,432	652,091	790,109	661,589
99.9	Total, new obligations	1,200,556	1,292,374	1,476,866	1,367,970
	DHS Building Security Payments (included in 25.3)	$156	$175	$136	$127
	Position Data:				
	Average Salary (dollars), ES Position	$169,076	$185,109	$189,738	$194,020
	Average Salary (dollars), GS Position	$72,220	$74,100	$75,953	$77,667
	Average Grade, GS Position	10.8	10.9	10.8	10.8

STATUS OF PROGRAMS

The Agricultural Research Service (ARS) is the U.S. Department of Agriculture's chief scientific in-house research agency. Our mission is to deliver scientific solutions to national and global agricultural challenges. ARS' major research programs -- New Products/Product Quality/Value Added; Livestock/Crop Production; Food Safety; Livestock/Crop Protection; Human Nutrition; and Environmental Stewardship -- address the Department's goals and priorities. A brief summary of the agency's selected FY 2019 accomplishments and current activities, including the National Agricultural Library, are detailed below.

Program Evaluations

In FY 2019, ARS conducted retrospective reviews of its Crop Protection and Quarantine; and Product Quality and New Uses research programs. Overall, the programs were found to have had high impact (i.e., significant benefit or influence). The programs were evaluated by 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. 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**.**

Selected Examples of Recent Progress:

New freezing technology retains fresh like fruit quality when thawed. Current freezing technologies (both slow and fast) ruptures cells, resulting in juice loss when thawed, which leads to sub-optimal flavor, juice content, and texture qualities. Together with colleagues at the University of California–Berkeley, ARS scientists in Albany, California, investigated a technology first developed to preserve human organs for transplanting called isochoric (constant-volume) freezing to extend the shelf life of food products and maintain their physical and nutritional properties. The research findings promise to greatly benefit the $54 billion U.S. frozen foods market by enabling frozen products that are thawed to have extended shelf life and fresh like taste, texture, juiciness, and nutrition.

A fresh fruit and vegetable cleaning system that prevents bacterial survival. In current commercial fresh fruit and vegetable processing plants, the accumulation of organic materials in washing tanks allows for unhealthy bacterial survival as chlorine in the water is depleted. ARS scientists in Beltsville, Maryland, invented a novel "in-flight" non-soaking cleaning system that removes organic material early in the process without damaging the fresh produce. This new process cleans all produce surface areas and effectively removes organic matter from cut surfaces while improving processing control and efficacy, thereby allowing the produce to be stored longer without bacterial decay and reducing food waste. ARS is scaling up this technology for commercialization.

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:

Application of an inter-species cross to improve the efficiency of genome sequencing and assembly. A new method for assembling genetic sequencing data into more complete genomes has been pioneered by ARS researchers in Clay Center, Nebraska, and Beltsville, Maryland, and collaborators at the National Institutes of Health, University of Nebraska, and University of Kentucky. Using the new process, an individual animal resulting from the mating of a Highland breed bull and a yak cow was used to create reference quality assemblies of the Highland breed of cattle and the yak in a single experiment. If generally applied, the technique to generate two genome sequences from a single individual is likely to improve the accuracy of genomic selection of all livestock and many plant species and could impact a wide range of industries.

Development of a model to predict illness using swine feeding behavior. Feeding is a good proxy for assessing an animal's health because as an animal gets sick, feed consumption often drops off even before diagnostic symptoms such as fever or difficulty breathing appear. ARS scientists in Clay Center, Nebraska, and South Dakota State University collaborators, used an electronic system to monitor the feeding behavior of pigs during the grow finishing phase and applied machine learning tools to predict swine feeding behavior based on temperature and time of day. This research will be used to develop a computer-based modeling system for swine feeding behavior. Future work is expected to lead to the development of software that will enable swine producers to use real time feeding behavior data as an early predictor of illness and stress events in individual animals.

Crop Production

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

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

Selected Examples of Recent Progress:

New citrus trees for U.S. growers. Huanglongbing (HLB) disease has been devastating to the Florida citrus industry and severely threatens citrus production in other parts of the United States. The use of tolerant rootstocks and scions can be effective in ameliorating disease effects. ARS researchers in Ft. Pierce, Florida, have released three HLB tolerant citrus rootstocks that produced sweet orange trees with improved health, fruit yield, and fruit quality over multiple years in a HLB endemic environment. ARS researchers have also released the first citrus scion cultivar, called "U.S. SunDragon," that has good fruit quality and tolerance to HLB disease.

New tomato flavor gene discovered. Tomatoes are the most valuable fruit crop globally and are among the most widely consumed fruit or vegetable in the United States at 70 pounds per capita annually. Tomatoes are also an important source of the antioxidant lycopene, which gives tomatoes their red color, and beta-carotene, which our bodies convert to vitamin A. However, many consumers complain that store bought tomatoes lack flavor. ARS researchers in Ithaca, New York, identified a rare version of the *TomLoxC* gene. *TomLoxC* contributes to tomato flavor by catalyzing the synthesis of aromatic compounds that taste panels show consumers really like.

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 Research, Education, and Economics agencies, as well as with the FSIS, APHIS, FDA, CDC, DHS, and the EPA. The agency also collaborates in international research programs to address and resolve global food safety issues. Specific research efforts are directed toward developing new technologies that assist ARS stakeholders and customers, including regulatory agencies, industry, and commodity and consumer organizations in detecting, identifying, and controlling foodborne diseases that affect human health.

Selected Examples of Recent Progress:

Escherichia coli O157:H7 transmission by cattle pest flies found in leafy greens. Leafy greens are a leading source of *E. coli* O157:H7 bacteria that cause human foodborne illness. Pest flies can carry this pathogen and may transmit it to leafy greens and other fresh produce. ARS scientists in Clay Center, Nebraska, determined the occurrence of *E. coli* O157:H7 positive flies in leafy greens planted up to 600 feet from a cattle feedlot, and assessed their potential risk for transmitting this pathogen to leafy greens. Due in part to this work and previous research, the produce industry has revised its guidelines for growers to increase the set-back distance between leafy greens fields and concentrated animal feeding operations. This information is critical for understanding the food safety risks associated with

growing leafy greens in close proximity to cattle production, for determining safe distances between cattle feedlots and fresh produce that will reduce preharvest contamination and protect public health.

Development of hot-fill pasteurization of cucumber pickle spears as an alternative to tunnel pasteurization. For commercial production of acidified vegetable products, a tunnel pasteurizer is typically used for thermal processes. To help reduce energy costs and water use, ARS researchers in Raleigh, North Carolina, developed a hot-fill method for pasteurizing cucumber pickle spears in 24 ounce pickle jars.

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. ARS' animal research program includes: 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:

Systems biology tool for the analysis of agriculturally important bacteria. Systems biology is the computational modeling of genes, their interactions, and the influence of the environment on the system. Until now, microbiologists and other researchers working on bacteria-related problems in animal disease, food safety, bioengineering, and other agricultural domains were not able to efficiently create realistic systems biology models. Through an ARS scientific/high performance computing collaborative research initiative, the Pathway Tools systems biology analytical platform was customized to run on Amazon Web Services to host systems biology models of bacterial field isolates sequenced and assembled by USDA. The primary beneficiaries of this resource are researchers and others wishing to use, create, and publish systems biology models that relate bacterial genes to key bacterial functions or physical traits. These models will assist in generating evidence-based strategies to combat the effects of bacterial infection, improve food safety protocols, and promote solutions to bacteria-related problems.

Understanding and detecting *Brucella abortus* vaccine RB51 shed in milk. *B. abortus* is a highly contagious bacterial pathogen for livestock and humans and is classified as a select agent because of its potential use as a bioweapon. In the United States, a vaccine strain called RB51 is routinely used to

vaccinate female calves to prevent infection and limit human exposures. Over the past two years, people in at least three States have been infected with the *B. abortus* RB51 vaccine strain after drinking unpasteurized milk. ARS scientists in Ames, Iowa, collaborated with colleagues at the CDC and the APHIS to better understand why some cattle vaccinated as calves shed RB51 in their milk as adults. Their results showed cattle that shed RB51 in milk have a different type of immune response than animals that do not shed RB51 in their milk. ARS further developed an assay that can detect cattle shed RB51 in milk. Due to the widespread use of RB51 vaccination in cattle, this research is critical to the work of protecting public health and understanding why some cattle become persistently infected with the vaccine strain.

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:

Canine detection of Huanglongbing (HLB) in California to mitigate an impending Statewide epidemic. HLB epidemics continue to spread worldwide and devastate the citrus industry. The key to mitigating HLB is early detection and rapid response. ARS researchers in Fort Pierce, Florida, have trained 20 dogs to detect HLB shortly after a tree has been infected (i.e., within 2 to 4 weeks after infection). The canines are being integrated and deployed by the California Department of Food and Agriculture to detect asymptomatic incipient infections of HLB.

Proof that Brome mosaic virus (BMV) can cause significant yield loss in U.S. wheat. BMV is well known to infect many plants, including wheat and other grain crops, but it has long had the reputation of being an unimportant pathogen of crops. Following repeated detection of BMV in Ohio surveys of wheat from 2012 to 2017 at incidences of up to 25 percent, ARS scientists in Wooster, Ohio, and university collaborators showed that all tested Ohio grown wheat cultivars were susceptible to infection, and that inoculation with BMV at any of four tested growth stages resulted in up to 60 percent yield losses. The results were published in an April 2019 edition of *Phytopathology.*

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 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.

Selected Examples of Recent Progress:

A healthy microbiome in infants predicts better vaccine response. Vaccination is the best approach to prevent infectious diseases, but response to vaccines can be highly variable for unknown reasons, especially when given in early infancy. ARS scientists in Davis, California, conducted a study of 306 infants aged birth to three years to determine whether an infant that had a microbiome colonized with greater numbers of a beneficial bacteria (*Bifidobacterium infantis*) had better responses to four vaccines (tuberculosis, polio, hepatitis B, and tetanus) also given in early infancy. The abundance of *Bifidobacterium* was positively associated with better responses to the tuberculosis, tetanus, and hepatitis B vaccines when the responses were measured in early infancy and was also associated with better responses to the tuberculosis, tetanus, and polio vaccines measured at two to three years of age. This study is the first to demonstrate that bifidobacteria, which are abundant in the infant gut as a result of breastfeeding, may lead to long-term enhancement of the immune system. This observation demonstrates that early life nutrition can improve health by enhancing vaccine memory responses.

Newly created atlas of epigenetic variation in humans. More than 15 years after scientists first mapped the human genome, most diseases still cannot be predicted based on genes, leading researchers to explore epigenetics as causes of disease. The most stable form of epigenetic regulation is DNA methylation, which changes gene conformation and gene expression, but progress on this topic has been limited by lack of information on cell type specificity. ARS supported scientists in Houston, Texas, performed deep sequencing of genomic DNA in tissues representing the three germ layers during development, followed by producing a computer algorithm to identify individual regions that vary in DNA methylation. The nearly 10,000 regions the researchers mapped out, called correlated regions of systemic interindividual variation (CoRSIVs), comprise a previously unrecognized level of molecular individuality in humans. Because epigenetic marking of genes has the power to either stably silence or activate them, any disease that has a genetic basis may also have an epigenetic component. This map forms the basis of understanding about disease processes from an epigenetic perspective.

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:

Stepped spillway design criteria adopted by Federal agencies and architectural and engineering consulting firms. Roller compacted concrete (RCC) stepped spillways provide embankment overtopping protection and increased capacity for aging embankment dams. An ARS researcher in Stillwater, Oklahoma, developed a systematic, step by step RCC spillway design guideline to rehabilitate aging embankment dams. The Natural Resources Conservation Service (NRCS) is incorporating the criteria into its *National Engineering Handbook* and expects it to be implemented on approximately 1,200 aging USDA assisted dams. NRCS experts say the criteria will provide construction cost savings ranging from $600 million to $1.2 billion compared with other embankment overtopping protection systems. The U.S. Army Corps of Engineers is also integrating the criteria into its revised spillway design technical manual. In addition, this research has become an industry standard among architectural and engineering consulting firms across the United States for upgrading aging dams.

Improving water quality with field edge nitrate removal. Saturated riparian buffers are a promising new development in efforts to remove nitrate from farm field drainage; however, only limited data are available on the effectiveness of the practice. By monitoring six sites, ARS researchers in Ames, Iowa, and at Iowa State University, have shown that saturated riparian buffers can remove 40 to 90 percent of nitrate leaving a farmer's field before it enters a river. This research has led NRCS to develop a new conservation practice for Midwest farms.

Library and Information Services

Current Activities: 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, which was created with the USDA in 1862, was named a national library 100 years later, in 1962, by Congress as "the primary agricultural information resource of the United States." NAL is the premier library for collecting, managing, and disseminating agricultural knowledge.

Selected Examples of Recent Progress:

Ag Data Commons and public access to digital scientific research data. Ag Data Commons is the platform that provides public access to USDA funded digital scientific research data. In FY 2019, NAL carried out major upgrades to Ag Data Commons to meet its customer's needs for data management and access.

PubAg expanding quickly. NAL makes available USDA funded peer reviewed literature through the PubAg platform. During FY 2019, NAL continued development of PubAg and built up the content of the service.

ACCOUNT 2: BUILDINGS AND FACILITIES

LEAD-OFF TABULAR STATEMENT

Item	Amount
2020 Appropriations	$192,700,000
Change in Appropriation	-142,700,00
2021 Budget Request	**$50,000,000**

APPROPRIATIONS LANGUAGE

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, [$192,700,000] $50,000,000 to remain available until expended[, of which $166,900,000 shall be allocated for ARS facilities co-located with university Partners].

The first change (line 3 of paragraph) deletes the allocation for ARS facilities co-located with university partners.

PROJECT STATEMENT

	2018 Actual		2019 Actual		2020 Enacted		2021 Budget Request			Change from 2020 Enacted	
	B.A.	SY	B.A.	SY	B.A.	SY	B.A.	SY		B.A.	SY
ARS Buildings and Facilities											
Buildings and Facilities……....	140,600	-	133,500	-	25,800	-	50,000	-	(1)	24,200	-
ARS Co-located Facilities……....	-	-	247,700	-	166,900	-	-	-	(2)	-166,900	-
Direct Appropriations……	140,600	-	381,200	-	192,700	-	50,000	-		-142,700	-
Supplemental Appropriations:											
Emergency Supplemental……	22,000	-	-	-	-	-	-	-		-	-
Subtotal, Supplemental Appropriations….	22,000	-	-	-	-	-	-	-		-	-
Total, Discretionary Funding…….	**162,600**	-	**381,200**	-	**192,700**	-	**50,000**	-		**-142,700**	-
Carryover from Prior Years:											
Subtotal, Carryover……..……..	200,996	-	335,163	-	697,006	-	461,396	-		-235,610	-
Total Available……..……	**363,596**	**-**	**716,363**	-	**889,706**	-	**461,396**	-		**-378,310**	-
Balances, Available End of Year….....	-335,163	-	-697,006	-	-461,396	-	-365,796	-		95,600	-
Total Obligations…….	**$28,433**	-	**$19,357**	-	**$428,310**	-	**$145,600**	-		**-$282,710**	-

Agricultural Research Service
Buildings and Facilities
(Dollars in Thousands)

Funding Detail	2018 Actual B.A.	2019 Actual B.A.	2020 Enacted B.A.	2021 Budget Request B.A.
Buildings and Facilities				
Beltsville, MD, Beltsville Area Research Center, Buildings 002, 005 and 308	-	-	$12,300	-
Beltsville, MD, Beltsville Area Research Center, Building 002	-	-	-	$24,500
Clay Center, NE, U.S. Meat Animal Research Center	-	-	-	10,000
Corvallis, OR, National Clonal Germplasm Repository	-	-	13,500	-
Gainesville, FL, Center for Medical Agriculture and Veterinary Entomology	-	-	-	7,500
Griffin, GA, Plant Genetics Resources Conservation Unit	-	-	-	2,000
Kerrville, TX, Knipling Bushland Research Laboratory	$50,700	-	-	-
Madison, WI, U.S. Dairy Forage Research Center	-	$71,700	-	-
Mississippi State, MS, Crop Science Research Laboratory	-	-	-	6,000
Salinas, CA, U.S. Agricultural Research Station	71,200	-	-	-
Temple, TX, Grassland, Soil and Water Research Laboratory	18,700	-	-	-
Tifton, GA, Southeast Watershed Research Laboratory	-	39,900	-	-
University Park, PA, U.S. Pasture Laboratory	-	21,900	-	-
Subtotal	140,600	133,500	25,800	50,000
ARS Co-located Facilities				
Auburn, AL, National Soil Dynamics Laboratory	-	43,300	-	-
Columbia, MO, University of Missouri	-	-	24,800	-
Davis, CA, University of California	-	-	76,200	-
Geneva, NY, Grape Genetics Research Center	-	68,900	-	-
Lexington, KY, University of Kentucky	-	-	65,900	-
Pullman, WA, Pullman ARS Research Laboratory	-	104,900	-	-
Raleigh, NC, Raleigh Research Laboratory	-	30,600	-	-
Subtotal	-	247,700	166,900	-
Total	**140,600**	**381,200**	**192,700**	**50,000**

JUSTIFICATIONS OF INCREASES/DECREASES

Buildings and Facilities

ARS operates laboratories and facilities that have a capitalization value of nearly $4 billion. Many of these laboratories/facilities are decades old, have outlived their functional lifespan, and are badly in need of major repairs, renovation, or replacement.

In 2012, ARS completed an extensive review of its laboratory portfolio and developed a plan for future capital investments. The report, known as the "Capital Investment Strategy (CIS)," highlighted ARS' aging infrastructure, noting that approximately $200,000,000 in capital investments was needed on a regular and recurring basis. Since 2012, modernization or replacement has begun on 12 of ARS' priority facilities.

ARS has updated its 2012 CIS to identify its highest priority facilities in need of modernization or replacement. Some of the highest priority facilities are listed below.

(1) An increase of $24,200,000 for the programming/design/construction of selected high priority ARS laboratories ($25,800,000 available in 2020).

The funding change is requested for the following items:

A) An increase of $24,500,000 for renovation/construction of the Beltsville Agricultural Research Center (BARC), Beltsville, Maryland, Building 002, and its supporting utilities.

BARC is one of the largest agricultural research centers in the world, in terms of program scope and number of scientists (over 200) and support staff (over 500). It has long had a worldwide reputation because of its prominent scientists, quality of research, and contributions to agriculture. BARC's programs include hundreds of research projects related to: food animal production; animal health; veterinary, medical, and urban entomology; food safety; human nutrition; water availability and watershed management; grass, forage, and rangeland agroecosystems; sustainable agricultural systems; plant genetic resources, genomics, and genetic improvement; plant diseases; crop protection and quarantine; crop production; and product quality and new uses.

Building 002 is a laboratory/office building on BARC-West in need of major renovations to meet current research needs. The facility does not meet state-of-the-art research requirements for high quality scientific research. This renovation will continue the consolidation of BARC's campus, moving the Food Quality and Entomology Laboratories into the BARC-West cluster of buildings that face the main thoroughfare traversing Beltsville. Building 002 is located in the historic district of Beltsville, and must comply with State Historical Society requirements.

In FY 2020, ARS received $2,400,000 for the programming and design for the renovation of Building 002.

B) An increase of $10,000,000 for the programming and design for major renovations of buildings at the U.S. Meat Animal Research Center.

The U.S. Meat Animal Research Center (USMARC) is located in Clay Center, Nebraska. Its scientists are tasked with increasing the efficiency of beef, sheep, and swine production while maintaining a lean, high quality, safe product. Its research benefits consumers (i.e., from improved product quality) and agri-business (i.e., from improved animal production). USMARC's research programs include food animal production, animal health, food safety, water availability/watershed management, and soil/air.

The scope of the project is the selective renovation of all 152,000 gross square feet (g.s.f.) of USMARC's Laboratory/Office space in Area 24; replacement of 102,000 g.s.f. of specialized swine facilities in Area 25; modernization/improvement of the Feed Mill in Area 25; replacement of 11 Pole Barns; and site improvements, including rehabilitation of the feed lot.

C) An increase of $7,500,000 for the programming and design of the Center for Medical, Agricultural and Veterinary Entomology.

The Center for Medical, Agricultural and Veterinary Entomology (CMAVE) is located in Gainesville, Florida. The Center began during the second World War in Orlando, as a unit tasked with developing methods for stopping the transmission of insect-borne diseases. Today, the Center is located on the campus of the University of Florida. While it continues studying mosquitoes, CMAVE now also researches crop pests, including the identification of insect pheromones and attractants that can be used in traps, the production of genetically altered medflies for population eradication, the isolation of biological control agents for fire ants and crop pests, and the development of innovative methods of detecting pests in stored grains.

The Center needs new, up-to-date facilities to effectively conduct its research. Its current facilities are over 50 years old. The requested funding is for the programming and design of all 78,000 g.s.f. of the Center's Laboratory/Office space.

D) An increase of $6,000,000 for the programming and design of the Crop Science Research Laboratory.

The Crop Science Research Laboratory (CSRL) is located in Mississippi State. CSRL is comprised of the Genetics and Sustainable Agriculture Research Unit, Corn Host Plant Resistance Research Unit, and the Waste Management and Forage Research Unit. The mission of CSRL is to conduct research on cotton, corn, and forages for major insect and disease pests; expand the molecular processes of cotton and corn; develop precision agricultural technologies applying cotton growth and development models in conjunction with remote sensing capabilities; and improving nutrient removal from lands heavily fertilized with waste from confined poultry and swine operations.

CSRL's facilities were constructed in the 1960s and are in poor condition. A major modernization is needed to upgrade these facilities to meet the state-of-the-art research needs of the Center. The facilities included in the modernization are the 36,000 g.s.f. Laboratory/Office

building; approximately 50,000 g.s.f. of greenhouse, headhouse, and climate chambers; and approximately 15,000 g.s.f. of other support facilities.

E) An increase of $2,000,000 for the programming and design of the Plant Genetic Resources Conservation Unit.

The Plant Genetic Resources Conservation Unit is located in Griffin, Georgia. The mission of the Unit is to preserve plant genetic resources for present and future researchers and educators. The Unit acquires, characterizes, conserves, evaluates, documents, and distributes genetic resources of agronomic and horticultural crops including sorghum, peanut, vegetables, subtropical and tropical legumes, warm season grasses, cowpeas, and annual clovers.

The facilities at the Plant Genetic Resources Conservation Unit are between 30 and 50 years old and are in need of major renovation. In addition to their condition, a major renovation is needed to upgrade these facilities to meet the state-of-the-art research needs of the Unit. The facilities included in the renovation are approximately 31,000 g.s.f. of greenhouses, climate controlled seed storage, and other support facilities.

F) A decrease of $24,200,000 for fully funded construction projects.

Fully funded construction projects are complete.

Buildings and Facilities – ARS Co-located Facilities

ARS operates laboratories and facilities that are co-located on a university campus.

(2) A decrease of $166,900,000 for ARS Co-located Facilities ($166,900,000 available in 2019).

A) A decrease of $166,900,000 for fully funded construction projects.

Fully funded construction projects are complete.

CLASSIFICATION BY OBJECTS

Item No.	Item	2018 Actual	2019 Actual	2020 Enacted	2021 Budget
	Other Objects:				
32.0	Land and structures	$28,433	$19,357	$428,310	$145,600
99.9	Total, new obligations	28,433	19,357	428,310	145,600

STATUS OF CONSTRUCTION

Status of Construction Projects as of December 2019

Status of research facilities authorized or funded in prior years and reported as uncompleted in the 2020 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
Alabama, Auburn National Soil Dynamics Research Laboratory	2019 Design and Construction	$43,300,000	New funding was provided in 2019. Anticipated award of POR expected 4th Quarter 2020.
Arizona, Tucson Southwest Watershed Research Center	2016 Design and Construction	$12,400,000	Design/Programming completed 1st Quarter 2018. Construction contract awarded 4th Quarter 2018. The construction contractor was incorporated by a Native American tribe and has been dissolved. SBA is working with ARS to award the contract to another firm. Construction completion date will be reestablished on award to a new contractor, but completion is not anticipated before 3rd Quarter 2021.
California, Albany Western Regional Research Center (Research and Development Facility)	2000 Pl*ann*ing and Design 2001 Construction 2002 Construction 2009 ARRA 2015 Recession 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	$2,684,070 2,976,000 3,588,750 1,869,819	POR completed 2nd Quarter 2007. Lease agreement was not executed.

	2009 Construction	2,192,000	
	2010 Construction	3,000,000	
	2011 Rescission	($16,062,114)	New funding provided in FY 2020 for planning, design
University of California	2020 Planning, Design and		and construction of the laboratory, office, greenhouse,
Grape and Genetics Genomics	Construction	76,200,000	headhouse and ancillary facilities to support tree, fruit,
	Total	76,448,525	nut and grape research.
California, Salinas	2004 Planning and Design	$4,473,450	Design (100%) completed 2nd Quarter 2007.
Agricultural Research Station	2005 Planning and Design	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,869,819	A design update was awarded 1st Quarter 2017 and
	2009 Construction	2,192,000	completed 4th Quarter 2018. Design changed from 3
	2010 Construction	3,654,000	phases to 2 phases for construction. A construction
	2011 Rescission	($14,937,644)	contract solicitation was advertised "open to small-
	2016 Design	1,300,000	business only" in FY 2019. No bids were received. The
	2017 Construction	30,200,000	project has been resolicited and construction (both
	2018 Construction	71,200,000	phases) is estimated to be awarded by the end of 2nd
	Total	106,516,375	Quarter 2020.
Connecticut, Storrs	2008 Planning and Design	$1,869,819	POR completed 4th Quarter 2010. Lease agreement was
Center of Excellence for Vaccine	2009 Design and Construction	2,192,000	not executed.
Research	2010 Construction	3,654,000	
	2011 Rescission	($7,221,296)	
	Total	494,523	
District of Columbia	2000 Planning and Design	$500,000	Design (100%) of Bladensburg Road Entrance completed
U.S. National Arboretum	2001 Design and Construction	3,322,674	1st Quarter 2006. The Administrative Building
	2002 Design and Construction	4,600,000	Modernization design completed 1st Quarter 2006. The
	2003 Design and Construction	1,688,950	construction of Phase 2, greenhouse and mechanical
	2008 Construction	695,100	support space, completed 1st Quarter 2009. ARRA
	2009 ARRA	8,041,842	funds were used to award a construction contract for
	2011 Rescission	($2,066,637)	Administrative Building Modernization 4th Quarter
	Total	16,781,929	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 2016. Demolition was completed in the 4th Quarter 2016 2017.
Georgia, Athens U.S. National Poultry Research Center	2005 Planning 2005 Construction 2008 Planning and Design 2009 Planning and Design 2011 Rescission 2015 Planning, Design, Const. 2016 Construction Total	$400,000 677,000 2,780,400 2,427,000 ($5,832,898) 45,000,000 113,701,000 159,152,502	Draft POR completed 1st Quarter 2007. The POR was awarded in the 3rd Quarter 2015 and completed 4th Quarter 2015. POR/Bridging documents were awarded 4th Quarter 2015 and completed in the 3rd Quarter 2016. Design Build Construction Contract was awarded in the 4th Quarter 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 2023). The Government will take ownership of buildings as they are completed and accepted. The estimated completion by building is as follows: B43A Hatchery/Brooding - 3rd Quarter 2019 (actual) B47 BLS-3 Animal Holding/Laboratory - 3rd Quarter 2020 B48 SPF Animal Holding - TBD when funded B45 Laboratory/Office/Administration - 1st Quarter 2021 B46 BSL-2 Animal Holding - 4th Quarter 2022 Finalize Roadways, Sidewalks etc. - 3rd Quarter 2023
Georgia, Tifton Southeast Watershed Research Laboratory	2019 Design and Construction	$39,900,000	New funding was provided in 2019. Funds have been transferred to the US Army Corps of Engineers (USACE) to manage design and construction of this project. Anticipated award of program of requirements in 3rd Quarter 2020.
Hawaii, Hilo U.S. Pacific Basin Agricultural	1999 Planning and Design 2000 Construction	$4,500,000 4,500,000	Design of Phases 1 and 2 is complete. Construction of Phase 1 completed 3rd Quarter 2007. Construction

Research Center	2001 Construction	4,989,000	contract for Phase 2 awarded 4th Quarter 2010 and
	2002 Construction	3,000,000	completed 1st Quarter 2012.
	2003 Design and Construction	2,980,500	
	2004 Construction	4,831,326	
	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2008 Construction	1,737,750	
	2009 Construction	1,565,000	
	2010 Construction	5,000,000	
	2011 Rescission	($7,730,452)	
	2015 Rescission	($129,570)	
	Total	31,808,304	
Idaho, Hagerman	2005 Planning and Design	$992,000	Lease agreement is in place. POR completed 3rd
Aquaculture Facility	2006 Construction	990,000	Quarter 2007.
	2008 Construction	695,100	
	2009 Construction	544,000	
	2011 Rescission	($2,907,600)	
	Total	313,500	
Illinois, Peoria	2000 Construction Design	$1,800,000	The modernization of the Chemical Wing was completed
National Center for Agricultural	2002 Construction	6,500,000	in 3 segments. The construction of phases 1 and 2 is
Utilization Research (Central	2004 Construction	2,684,070	complete. Construction for all remaining phases of the
Wing)	2005 Construction	2,976,000	Central Wing awarded 2nd Quarter 2010 using ARRA
	2006 Construction	3,588,750	funding and completed 3rd Quarter 2012.
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2009 ARRA	16,237,165	
	2015 Rescission	($142,565)	
	Total	37,705,239	
Iowa, Ames	2001 Design and Construction	$8,980,200	The accelerated plan for the completion of the
National Centers for Animal	2002 Design and Construction	40,000,000	modernization of ARS/APHIS animal facilities is in
Health	2002 Construction	50,000,000	progress. All major components of the modernization
	2002 APHIS Transfers	15,753,000	are complete.

	[Supplemental]	[14,081,000]	-Phase 1 Lab/Office (APHIS) completed in 2004.
	[Other Transfers]	[1,672,000]	-Large Animal BSL-3Ag facilities construction
	2002 Construction	25,000,000	completed 2nd Quarter 2007.
	2003 Construction	32,785,500	-Central Utility Plant and Infrastructure, Phase 1 and 2
	2003 Construction	110,000,000	construction is complete. Phase 3 construction
	2005 Construction	121,024,000	completed 1st Quarter 2009.
	2006 Construction	58,212,000	-Construction of the Consolidated Laboratory Facility
	2015 Rescission	($1,108,686)	completed 2nd Quarter 2009.
	Total	460,646,014	-Low Containment Large Animal Facility construction completed 1st Quarter 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 4th Quarter 2017. Construction awarded 4th Quarter 2018 and will be completed 3rd Quarter 2020.
Kentucky, Bowling Green	2005 Planning and Design	$2,281,600	POR is complete for total project. Design (100%) for the
Animal Waste Management	2006 Construction	2,970,000	Headhouse/Greenhouse only was completed 3rd
Research Laboratory	2008 Construction	1,390,200	Quarter 2008. Lease agreement is in place. Construction
	2009 Construction	1,088,000	of the Headhouse/Greenhouse awarded 4th Quarter
	2010 Construction	2,000,000	2010 and completed 2nd Quarter 2012.
	2011 Rescission	($5,880,338)	
	Total	3,849,462	
Kentucky, Lexington	2005 Planning and Design	$2,976,000	POR is complete. Lease agreement terminated 2016.
Forage Animal Research	2006 Construction	3,960,000	Design (100%) was completed 2nd Quarter 2011.
Laboratory	2008 Construction	2,085,300	
	2009 Construction	1,632,000	
	2010 Construction	2,000,000	
	2011 Rescission	($9,678,689)	

	2020 Planning, Design and Construction	65,900,000	New funding provided in FY 2020 for the planning, design, and construction of the laboratory, office,
	Total	2,974,611	greenhouses, headhouse, and ancillary facilities.
Louisiana, Houma	2004 Planning and Design	$1,342,035	Design (100%) completed 4th Quarter 2007.
Sugarcane Research	2005 Construction	2,976,000	Repackaging of design to allow for construction of some
	2006 Construction	3,588,750	elements within the available funding completed 2nd
	2008 Construction	1,869,819	Quarter 2008. Phase 1A construction completed 4th
	2009 Construction	2,505,000	Quarter 2010. Phase 1b construction awarded 2nd
	2010 Construction	3,654,000	Quarter 2011 and completed 3rd Quarter 2013.
	2015 Rescission	($100)	
	Total	15,935,504	
Louisiana, New Orleans	1998 Planning and Design	$1,100,000	The 2006 Supplemental funding was appropriated for
Southern Regional Research	1999 Modernization	6,000,000	the design and construction of the Long-Term
Center (Industrial Wing)	2000 Modernization	5,500,000	Restoration (LTR) of facilities damaged by Hurricane
	2006 Supplemental (design)	4,900,000	Katrina. Design (100%) for the LTR of facilities
	2006 Supplemental (construct.)	20,000,000	completed 4th Quarter 2008. Construction of the LTR
	Total	37,500,000	awarded 3rd Quarter 2009 and completed 3rd Quarter 2011.
Maine, Orono/Franklin	2001 Planning and Design	$2,494,500	Construction of all facilities at Franklin (Pump House,
National Cold Water Marine	2002 Construction	3,000,000	Storage Tanks, Lab/Office/Tank Bldg.) is complete.
Aquaculture Center	2003 Construction	9,090,525	Program for the laboratory facility located at the
	2004 Design and Construction	2,684,070	University of Maine Campus in Orono, ME needs to be
	2005 Design and Construction	2,976,000	developed when funds are made available.
	2006 Design and Construction	2,475,000	
	2011 Rescission	($2,012,504)	
	Total	20,707,591	
Maryland, Beltsville	1988 Design and Construction	$5,750,000	Study to evaluate boiler plants, steam lines, and
Beltsville Agricultural Research	1989 Design and Construction	6,100,000	electrical distribution completed 4th Quarter 2009.
Center, (BARC)	1990 Design and Construction	9,860,000	Construction contract for repairs to boiler plants and
	1991 Design and Construction	15,999,792	portions of the steam distribution system awarded 4th
	1992 Design and Construction	16,000,000	Quarter 2010 with ARRA funding and completed 2nd

	1993 Design and Construction	13,547,000	Quarter 2012. Design-Build contract for major
	1994 Design and Construction	19,700,000	renovations to Building 306 awarded 4th Quarter 2010
	1995 Design and Construction	3,960,000	with ARRA funding and completed 4th Quarter 2012.
	1996 Design and Construction	8,000,000	
	1997 Design and Construction	4,500,000	
	1998 Design and Construction	3,200,000	
	1999 Design and Construction	2,500,000	
	2000 Design and Construction	13,000,000	
	2001 Design and Construction	13,270,740	
	2002 Design and Construction	3,000,000	
	2003 Design and Construction	4,152,830	
	2004 Design and Construction	2,684,070	Preparation of design bridging documents for Building
	2005 Design and Construction	2,976,000	307 was awarded 4th Quarter 2016 and completed 1st
	2006 Design and Construction	3,588,750	Quarter 2018. Construction was be awarded in the 1st
	2009 Design and Construction	2,192,000	Quarter 2020 with completion in the 1st Quarter 2022.
	2009 ARRA	21,513,046	
	2010 Construction	3,000,000	New funding provided in FY 2020 for planning,
	2011 Rescission	($9,831,954)	design, a complete gutting and modernizing of
Renovate Building 307	2016 Design and Construction	37,100,000	buildings 002, 005 & 308. Infrastructure upgrades for
Renovate Buildings 002, 005 and	2020 Planning and Design	12,300,000	both BARC West and BARC East campuses.
308	Total	218,062,274	
Maryland, Beltsville	1998 Design and Construction	$2,500,000	Renovation of the NAL building continues. Completed
National Agricultural Library	1999 Design and Construction	1,200,000	projects include: replacement of the computer room
	2001 Design and Construction	1,766,106	HVAC and fire suppression systems; completion of
	2002 Construction	1,800,000	chiller replacement and brick repairs of three building
	2003 Design and Construction	1,490,250	elevations; and 14th floor window replacements.
	2004 Design and Construction	894,690	Construction for the deteriorated building envelope,
	2009 ARRA	6,357,422	repair of brick facade, and replacement of the plumbing
	2011 Rescission	($115,175)	system awarded 1st Quarter 2010 using ARRA funding
	Total	15,893,293	and completed 3rd Quarter 2012.
Maryland, Frederick (Fort Detrick)	2016 Design	$4,900,000	Design/Programming awarded 4th Quarter of 2016 and
Foreign Disease-Weed Science	2017 Construction	64,300,000	completed 2nd Quarter of 2018. Construction currently
Research Laboratory	Total	69,200,000	scheduled to be awarded 4th Quarter 2020.

Michigan, East Lansing	1992 Planning	$250,000	Design (100%) for this multi-phased facility
Avian Disease and Ocology	1993 Planning	212,000	modernization is complete.
Laboratory	1998 Planning and Design	1,800,000	
	2011 Rescission	($63,193)	
	Total	2,198,807	
Mississippi, Lorman	2006 Planning and Design	$1,980,000	A lease agreement with Alcorn State University for the
Biotechnology Laboratory	2008 Planning and Design	1,390,200	new facility completed 4th Quarter 2009. POR completed
Alcorn State University	2009 Construction	1,176,000	3rd Quarter 2008.
	2010 Construction	1,500,000	
	2011 Rescission	($5,798,055)	
	Total	248,145	
Mississippi, Poplarville	2002 Design	$800,000	Construction of the Headhouse/Greenhouse awarded
Thad Cochran Southern	2003 Construction	9,140,200	4th Quarter 2007 and completed 1st Quarter 2008.
Horticulture Laboratory	2006 Supplemental	4,300,000	2007 and completed in the 1st Quarter 2008.
	2011 Rescission	($9,178)	
	Total	14,231,022	
Mississippi, Starkville	2005 Planning and Design	$2,976,000	Lease agreement is in place. Design (100%) completed
Poultry Science Research Facility	2006 Construction	4,950,000	1st Quarter 2008.
	2008 Construction	1,390,200	
	2009 Construction	3,177,000	
	2011 Rescission	($10,345,645)	
	Total	2,147,555	
Mississippi, Stoneville	2004 Construction	$4,831,326	Design (100%) completed. Construction of Phase 1
Jamie Whitten Delta States	2005 Construction	2,976,000	completed. Construction of mechanical, electrical, and
Research Center	2008 Construction	2,780,400	plumbing systems for phases 2 thru 5 (of 5 total) and
	2009 ARRA	36,347,783	repair of deteriorated building envelope awarded 3rd
	2010 Construction	4,000,000	Quarter 2010. Phase 2 and 3 completed 1st Quarter 2013,
	2011 Rescission	($6,047,327)	Phase 4 completed 2nd Quarter 2015, and Phase 5
	2015 Rescission	($134)	completed 2nd Quarter 2016.
	Total	44,888,048	

Missouri, Columbia	2004 Planning and Design	$2,415,663	Design (100%) completed 4th Quarter 2008.
National Plant and Genetics	2005 Construction	4,960,000	
Security Center	2006 Construction	3,687,750	
	2008 Construction	2,085,300	
	2009 Construction	1,633,000	
	2010 Construction	3,500,000	
	2011 Rescission	($15,590,075)	
	2020 Planning, Design and Construction	24,800,000	New funding provided in FY 2020 for the planning, design, and construction of the laboratory, office, greenhouses, headhouse, and ancillary facilities.
	Total	27,491,638	
Montana, Bozeman	2005 Planning and Design	$1,984,000	Lease agreement in place. Conceptual Design (35%) completed 3rd Quarter 2008.
Animal Bioscience Facility	2006 Construction	3,960,000	
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($12,720,879)	
	Total	938,940	
Montana, Sidney	1998 Planning and Design	$606,000	Construction of Phase 1 (Lab/Office Building) completed 2003 and Phase 2 (Quarantine Lab) completed 4th Quarter 2008.
Northern Plains Agricultural	1999 Construction	7,300,000	
Research Laboratory	2004 Design and Construction	2,505,132	
	2011 Rescission	($29,505)	
	Total	10,381,627	
Nebraska, Lincoln	2008 Planning and Design	$1,390,200	POR completed 3rd Quarter 2011.
Systems Biology Research Facility	2009 Planning and Design	1,088,000	
	2010 Construction	3,760,000	
	2011 Rescission	($5,782,528)	
	Total	455,672	
New York, Geneva	2004 Planning and Design	$2,415,663	Design (100%) completed 4th Quarter 2007.
Grape Genetics Research Center	2005 Construction	2,976,000	
	2006 Construction	3,588,750	

	2008 Construction	1,869,819	New funding was provided in 2019. The site that was
	2009 Construction	2,192,000	the basis for the previous completed design in 2007 is no
	2010 Construction	3,654,000	longer an option. Funds have been transferred to the US
	2011 Rescission	($14,806,870)	Army Corps of Engineers (USACE) to manage design
	2019 Design and Construction	68,900,000	and construction of this project. Anticipated award of
	Total	70,789,362	program of requirements in 4th Quarter 2020.
New York, Ithaca	2004 Planning and Design	$3,847,167	Design (100%) completed 2nd Quarter 2008.
Crop-based Health Genomics	2005 Construction	2,976,000	
	2006 Construction	3,588,750	
	2011 Rescission	($7,314,491)	
	Total	3,097,426	
North Carolina, Raleigh	2019 Design and Construction	$30,600,000	New funding was provided in 2019. Anticipated award
Plant Science Research			of program of requirements in 4th Quarter 2020.
Ohio, Toledo	2005 Planning and Design	$1,984,000	Design (100%) completed 1st Quarter 2010. Lease
University of Toledo	2006 Construction	1,584,000	agreement in place.
	2008 Construction	1,869,819	
	2009 Construction	2,192,000	
	2010 Construction	3,654,000	
	2011 Rescission	($9,356,845)	
	Total	1,926,974	
Oklahoma, Woodward	2002 Planning and Design	$1,500,000	Phases 1 and 2 of the three-phased construction project
Southern Plains Range Research	2003 Construction	7,948,000	completed.
Center	2005 Construction	2,976,000	
	2011 Rescission	($152,556)	
	Total	12,271,444	
Oregon, Corvallis	2020 Planning, Design and	13,500,000	New funding provided in FY 2020 for the planning,
National Clonal Germplasm	Construction		design, and construction of the laboratory, office,
Repository			greenhouses, headhouse, and ancillary facilities.

Pennsylvania, Wyndmoor Eastern Regional Research Center	1997 Construction	$4,000,000		Modernization of the Center 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.
	1998 Construction	5,000,000		
	1999 Construction	3,300,000		
	2000 Construction	4,400,000		
	2002 Design and Construction	5,000,000		
	2009 ARRA	15,084,486		
	2015 Rescission	($2)		
	Total	36,784,484		
Pennsylvania, University Park Pasture Systems & Watershed Management Research	2019 Design and Construction	21,900,000		New funding was provided in 2019. Project includes construction at the Klingerstown, PA field site. Anticipated award of program of requirements in 3rd Quarter 2020.
South Carolina, Charleston U.S. Vegetable Laboratory	1988 Feasibility Study	$50,000		Construction of Phase 1 (laboratory) and Phase 2A (Headhouse) completed. Phase 2B (Greenhouse) construction awarded 2nd Quarter 2007 and completed 4th Quarter 2008.
	1990 Planning and Construction	1,135,000		
	1994 Construction	909,000		
	1995 Construction	5,544,000		
	1996 Construction	3,000,000		
	1997 Construction	3,000,000		
	1998 Construction	4,824,000		
	2000 Construction	1,000,000	***	
	2002 Construction	4,500,000		
	2003 Design	1,390,900		
	2004 Construction	3,131,415		
	2005 Construction	2,976,000		
	2006 Construction	1,980,000		
	2011 Rescission	($517)		
	Total	33,439,798		

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

Texas, Houston Children's Nutrition Research Center	2016 Design and Construction	$29,200,000	Design awarded 4th Quarter 2016 and completed 4th Quarter 2017. Construction solicitation on hold pending Congressional B&F Funding decisions for ARS.

Texas, Kerrville	2008 Planning and Design	$1,390,200	POR completed 2nd Quarter 2010 for a new site.
Knipling Bushland Laboratory	2009 Planning and Design	1,957,000	In 2017, funding was appropriated for planning and
	2011 Rescission	($2,768,214)	design of a replacement laboratory and animal facilities
	2017 Planning and Design	3,700,000	at the existing Kerrville location. Additional funding
	2018 Construction	$50,700,000	provided in 2018 for construction. The design was
	Total	54,978,986	awarded 1st Quarter 2019. Anticipated construction award in 2nd Quarter 2021.
Texas, Temple	2017 Planning and Design	$1,400,000	In 2017, funding was appropriated for planning and
Grassland Soil & Water Research	2018 Construction	$18,700,000	design of a laboratory modernization at Temple and
Laboratory		$20,100,000	repairs at the associated field site in Riesel, TX. The POR and Investigative Study was awarded 1st Quarter 2018. Additional funding provided in 2018 for construction. Design completed in 4th Quarter 2019. Construction award planned for 2nd Quarter 2020.
Utah, Logan	2008 Planning and Design	$5,560,800	Lease completed 3rd Quarter 2010. POR completed 4th
Agricultural Research Center	2009 Design and Construction	4,351,000	Quarter 2010.
	2010 Construction	4,527,000	
	2011 Rescission	($13,839,929)	
	Total	598,871	
Washington, Pullman	2004 Planning and Design	$3,936,636	Lease agreement with Washington State University in
Pullman ARS Research	2005 Construction	2,976,000	place. Conceptual Design (35%) completed.
Laboratory	2006 Construction	3,588,750	
	2008 Construction	1,869,819	New funding was provided in 2019. The previous
	2009 Construction	2,192,000	design, completed to 35% cannot be used. Funds have
	2010 Construction	3,740,000	been transferred to the US Army Corps of Engineers
	2011 Rescission	($17,240,830)	(USACE) to manage design and construction of this
	2019 Design and Construction	$104,900,000	project. Anticipated award of program of requirements
	Total	105,962,375	in 4th Quarter 2020.
West Virginia, Kearneysville	2003 Planning and Design	$471,913	Construction of Phases 1 and 2 (immediate laboratory
Appalachian Fruit Laboratory	2004 Construction	1,789,380	repairs and renovation) completed 3rd Quarter 2007.
	2005 Construction	3,608,896	The construction of the Greenhouse completed 1st

	2006 Construction	2,024,550	Quarter 2008. POR for the new laboratory completed
	2008 Planning and Design	1,529,220	2nd Quarter 2010. Conceptual design for new laboratory
	2009 Planning and Design	783,000	completed 3rd Quarter 2011.
	2010 Construction	2,000,000	
	2011 Rescission	($3,430,725)	
	Total	8,776,234	
West Virginia, Leetown	2002 Design and Construction	$2,200,000	Construction completed 3rd Quarter 2008.
National Center for Cool and	2006 Construction	891,000	
Cold Water Aquaculture	2011 Rescission	($4,717)	
(Broodstock Facility)	Total	$3,086,283	
Wisconsin, Marshfield	2003 Planning, Design and	$2,980,500	Design (100%) of Phase 1 and Phase 2 completed. Phase
Nutrient Management Laboratory	Construction		1 (Nutrient Lab) construction completed 4th Quarter
	2004 Construction	3,668,229	2008. Phase 2 construction (Animal Holding Facility)
	2005 Construction	4,860,800	awarded 4th Quarter 2007. Phase 2 construction
	2006 Construction	7,920,000	completed 1st Quarter 2010.
	2011 Rescission	(18,229)	
	Total	19,411,300	
Wisconsin, Prairie du Sac	2008 Planning and Design	$2,502,360	POR completed 3rd Quarter 2011.
Dairy Forage Agriculture Research	2009 Construction	$2,002,000	
Center	2010 Construction	$4,000,000	New funding was provided in 2019. Funds have been
	2011 Rescission	($7,675,381)	transferred to the US Army Corps of Engineers (USACE)
	2019 Design and Construction	$71,700,000	to manage design and construction of this project.
	Total	$72,528,979	Anticipated award of program of requirements in 3rd
			Quarter 2020.

Emergency Hurricane Supplemental Funding	2018 Planning, Design and Construction	$22,000,000	In 2019, more than 30% of contracts were awarded for Hurricane Irma & Maria damages. Projects covered a wide variety of repair, renovation, and hardening. Boundary surveys, fencing projects, roof replacements, greenhouse glazing repairs, emergency generator installations, drainage repairs, improvements and other similar-type construction anticipated to be completed 2nd Quarter 2020. Final design, specifications and drawings completed 2nd Quarter 2020 and construction contract expected to be awarded 4th Quarter 2020. Construction contract for greenhouse repairs and perimeter awarded 1st Quarter 2020.