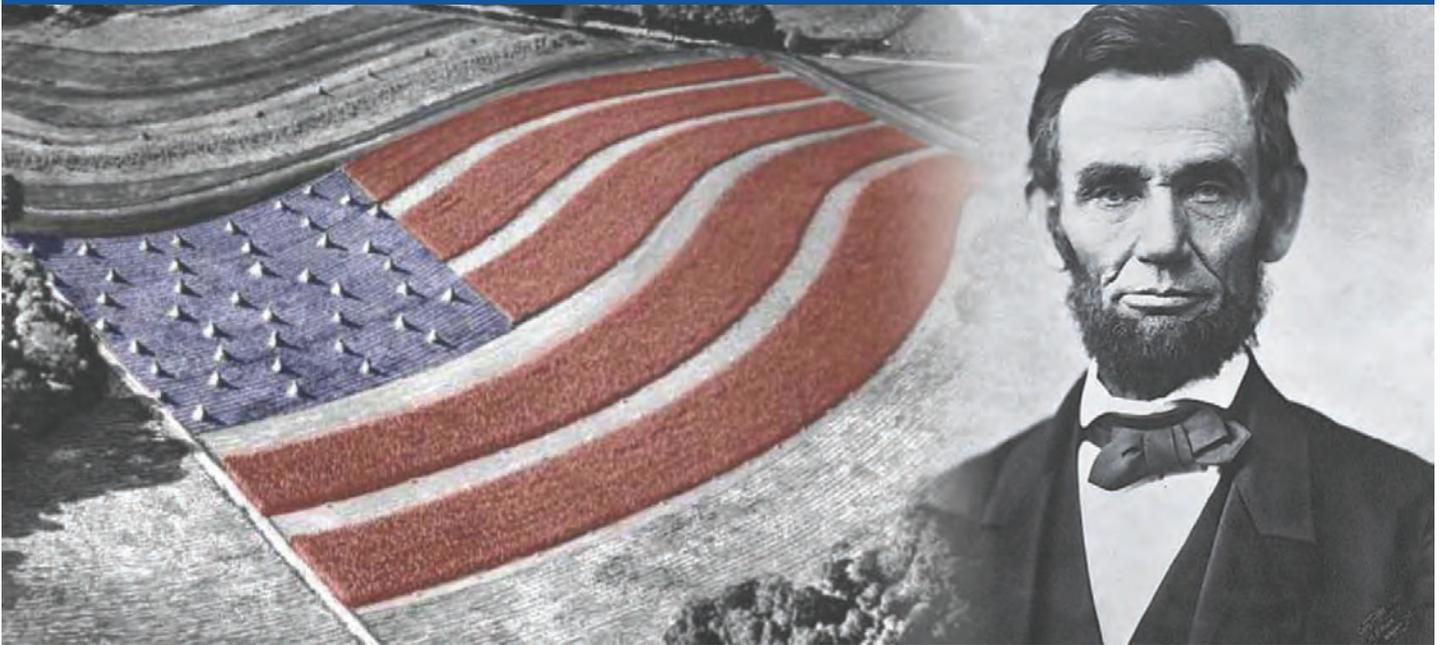


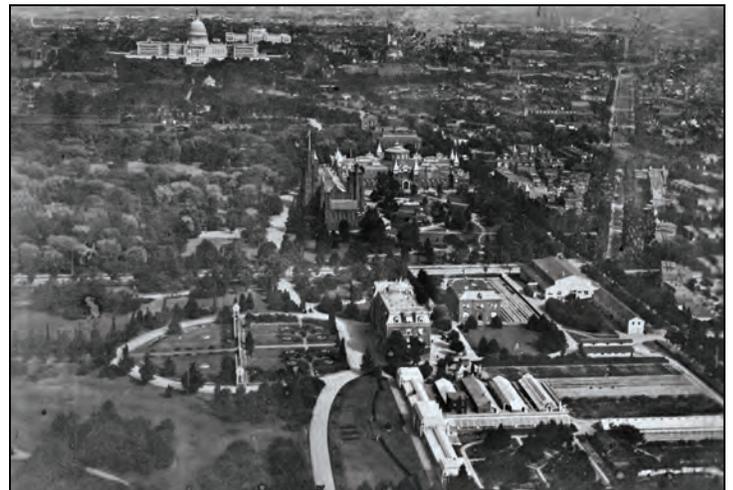


U.S. Department of Agriculture Annual Report on Technology Transfer FY2012



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EXECUTIVE SUMMARY

The principal goal of Federal research and development (R&D) is to solve problems and achieve anticipated public benefit. Agencies themselves cannot do this alone; rather, it is the private sector that serves as the essential delivery mechanism and intermediary between public research and realization of public benefit. Additionally, private sector involvement also adds the benefits of creating new or expanded businesses, jobs, and economic prosperity.

USDA broadly defines technology transfer as the adoption of research outcomes (i.e., solutions) for public benefit. These science-based innovations from USDA intramural research --- through these public / private partnerships --- create new or improved technologies, processes, products and services that benefit the nation by increasing productivity, increasing efficiency (keeping costs low) and enhancing global competitiveness for the U.S. agriculture sector. Thus, technology transfer functions are critical to accelerating utility of public R & D investments, creating economic activity, and in job creation and sustainable economic development.

Principal among the formal instruments of technology transfer are Cooperative Research and Development Agreements (CRADAs), patents, and invention licenses for commercialization by the private sector, as well as material transfer agreements with industry. In addition to these formal instruments, technology transfer also occurs through publications, workshops, field days, press releases and other conventional mechanisms. To assist USDA in transferring technologies to the private sector, the Agricultural Research Service (ARS) recently created the Agricultural Technology Innovation Partnership (ATIP) program consisting of nine economic development organizations across the U.S. serving as “intermediaries” to further enhance likelihood that research outcomes would be adopted by the private sector for commercialization. ATIP members coordinate regional co-sponsored events with USDA, showcasing available technologies for licensing, and USDA intramural research capabilities available to businesses to assist in solving high priority, mission-related issues connected to the agricultural industries. Additionally, members provide the current or prospective private sector partners of USDA with access to business mentors, entrepreneur schools, seed and venture funds, and the Manufacturing Extension Partnership programs.

The Agricultural Research Service (ARS) has been delegated authority by the Secretary of Agriculture to administer the patent program for ARS, the review of CRADAs and the technology licensing program for all intramural research conducted by USDA. Thus, this report covers technology transfer activities and metrics for the Agricultural Research Service (ARS), Forest Service (FS), Animal and Plant Health Inspection Service’s Wildlife Services (APHIS-WS), Animal and Plant Health Inspection Service’s Veterinary Services (APHIS-VS), Animal and Plant Health Inspection Service’s Plant Protection and Quarantine (APHIS-PPQ), Animal and Plant Health Inspection Service’s Biotechnology Regulatory Services (APHIS-BRS), Animal and Plant Health Inspection Service’s International Services (APHIS-IS), National Institute of Food and Agriculture (NIFA), Economic Research Service (ERS), National Agricultural Statistics Service (NASS), Foreign Agricultural Service (FAS), Rural Development (RD), Agricultural Marketing Service (AMS), Grain inspection, Packers and Stockyards Administration (GIPSA), Food Safety and Inspection service (FSIS) and Natural Resources

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Conservation Service (NRCS). The report includes tabular metrics of inventions, licenses, and Cooperative Research and Development Agreements for ARS, APHIS-WS, and FS, as well as a section on notable “Downstream Outcomes” and “Outreach, Workshops, Field Days & Forums Activities.” These Outcomes and Activities reflect the breadth of mechanisms used by USDA to effect technology transfer, as well as the breadth of scope in addressing issues for the agriculture sector.

The following are the combined Metric Tables for all of the USDA agencies included in this Report.

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Table 1 (data from APHIS-WS, ARS and FS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	Collaborative Relationships for Research & Development (CRADAs)					
1	Total number of active ⁽¹⁾ CRADAs	254	259	288	300	257
2	Number of new, executed CRADAs	77	80	99	88	59
	Traditional CRADAs ⁽²⁾					
3	Total number of active traditional CRADAs	223	207	218	186	180
4	Number of new, traditional CRADAs executed	70	55	67	57	37
5	Total number of active CRADAs with small businesses involvement ⁽³⁾	ND	ND	ND	ND	130
6	Total number of small businesses involved in all active CRADAs ⁽³⁾	ND	ND	ND	ND	130
	Non-traditional CRADAs ⁽⁴⁾					
7	Total number of active non-traditional CRADAs	31	52	70	114	77
8	Number of new, non-traditional CRADAs executed	7	25	32	31	22
	Other collaborative R&D relationships ^(3, 5)					
9	Total number of other active collaborative R&D relationships	5,821	10,306	11,570	13,458	14,351
10	Number of new, other collaborative R&D relationships, executed	2,043	1,681	1,590	1,919	1,534

(1) An Active CRADA is legally in force at any time during FY. The total number of active CRADAs is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).

(2) A traditional CRADA involves collaborative research and development activities by a federal laboratory and non-federal partners.

(3) Data from APHIS-WS and ARS.

(4) Non-traditional CRADAs are used for special purposes -- such as, material transfer or technical assistance that may result in protected information.

(5) Includes Confidentiality Agreements, Trust Fund and Reimbursable Cooperative Agreements, and Memorandums of Understanding. Material Transfer Agreements are listed in Table 3 (reference 32 & 33).

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Table 2 (data from APHIS-WS, ARS and FS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	Invention Disclosures ⁽¹⁾					
11	Total number of new inventions disclosed	100	143	149	142	160
12	Total number of new inventions disclosed by selected technology area					
12	Life Science	50	60	70	61	59
12	Chemical	40	52	36	36	53
12	Mechanical	8	25	24	28	16
12	Plant Cultivars	2	6	5	7	17
	Patents ⁽²⁾					
13	Total number of patent applications filed	123	123	112	121	122
14	Total number of patents issued	30	24	46	49	70
15	Total number of patents issued by selected technology area					
15	Life Science	ND	ND	ND	ND	ND
15	Chemical	ND	ND	ND	ND	ND
15	Mechanical	ND	ND	ND	ND	ND
15	Plant Cultivars	ND	ND	ND	ND	ND
	Licensing					
16	Total number of active licenses ⁽³⁾	328	330	344	358	384
17	Total number of new licenses executed	28	26	22	35	34
18	Total number of new licenses executed by selected technology area					
18	Life Science	ND	ND	ND	ND	ND
18	Chemical	ND	ND	ND	ND	ND
18	Mechanical	ND	ND	ND	ND	ND
18	Plant Cultivars	ND	ND	ND	ND	ND
19	Number of licenses granted to small businesses ⁽⁴⁾	ND	ND	ND	ND	118

(1) Inventions arising at the federal lab.

(2) Includes U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes provisional, continuation, duplicate foreign, and PCT applications.

(3) An active license is legally in force at any time during FY.

(4) Data from ARS.

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Table 3 (data from APHIS-WS, ARS and FS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	Invention Licenses					
20	Total number of Invention Licenses active	0	0	0	0	0
21	Total number of new invention licenses executed	0	0	0	0	0
	Patent Licenses⁽¹⁾					
22	Total number of Patent Licenses active	304	302	313	322	341
23	Total number of new Patent Licenses executed	24	22	18	29	28
	Material Transfers (inventions)					
24	Total number of active Material Transfers (inventions)	24	28	31	36	42
25	Total number of new Material Transfers (inventions) executed	4	4	4	6	6
	Other Invention Licenses					
26	Total number of Other active licenses	0	0	0	0	0
27	Total number of Other licenses executed	0	0	0	0	0
	Other IP Licenses⁽²⁾					
28	Total number of Other IP licenses active	0	0	0	0	0
29	Total number of Other IP licenses newly executed	0	0	0	0	0
	Copyright Licenses⁽³⁾					
30	Total number of fee bearing, Copyright licenses active	0	0	0	0	0
31	Total number of Copyright licenses, newly executed	0	0	0	0	0
	Material Transfer (non-inv)⁽⁴⁾					
32	Total number of Material transfers (non-inv.) active	ND	ND	ND	ND	ND
33	Total number of Material Transfers (non-inv.) newly executed	887	787	886	1,045	979
	Other⁽⁵⁾					
34	Total number "Other" category active	0	0	0	0	0
35	Total number "Other" category newly executed	0	0	0	0	0

(1) Total number of Patent Licenses includes patent applications which are licensed.

(2) Provide description of Other IP Licenses if appropriate.

(3) Multiple inventions in a single license are counted as one license. Licenses that include both patents and

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copyrights (I.e., hybrid licenses) are reported as patent licenses and are not to be included in the count of copyright licenses.

(4) Data from ARS and APHIS-WS.

(5) Provide description of Other category if appropriate.

Table 4 (data from APHIS-WS, ARS and FS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	Income Bearing Licenses ⁽¹⁾					
36	Total number of all income bearing, licenses	326	327	340	354	379
37	Total number of all income bearing, exclusive licenses	235	234	248	257	277
38	Total number of all income bearing, partially exclusive licenses	20	20	16	16	14
39	Total number of all income bearing, non-exclusive licenses	71	73	76	81	88
	Invention Licenses, Income Bearing					
40	Total number of income bearing, invention licenses	0	0	0	0	0
41	Total number of income bearing, exclusive invention licenses	0	0	0	0	0
42	Total number of income bearing, partially exclusive invention licenses	0	0	0	0	0
43	Total number of income bearing, non-exclusive invention licenses	0	0	0	0	0
	Patent Licenses ⁽²⁾					
44	Total number of income bearing, patent licenses	302	299	309	318	337
45	Total number of income bearing, exclusive patent licenses	233	231	245	253	271
46	Total number of income bearing, partially exclusive patent licenses	20	20	16	16	14
47	Total number of income bearing, non-exclusive patent licenses	49	48	48	49	52
	Other IP Licenses					
48	Total number of income bearing licenses for "Other IP"	24	28	31	36	42
49	Total number of income bearing, exclusive licenses for "Other IP"	3	4	4	5	7
50	Total number of income bearing, partially exclusive licenses for "Other IP"	0	0	0	0	0

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51	Total number of income bearing, non-exclusive licenses for “Other IP”	21	24	27	31	35
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(1) In general, license income can result from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs. Totals for Invention licenses and Other IP licenses are presumed to include all the license types identified in the previous Table 3.

(2) Patent license tally includes patent applications which are licensed.

Table 5 (data from APHIS-WS, ARS and FS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	Copyright licenses (fee bearing)					
52	Total number of copyright licenses (fee bearing)	0	0	0	0	0
53	Total number of exclusive, copyright licenses (fee bearing)	0	0	0	0	0
54	Total number of partially exclusive, copyright licenses (fee bearing)	0	0	0	0	0
55	Total number of non-exclusive, copyright licenses (fee bearing)	0	0	0	0	0
	Royalty Bearing Licenses ⁽¹⁾					
56	Total number of all royalty bearing licenses	124	142	144	149	147
57	Total number of royalty bearing, invention licenses	0	0	0	0	0
58	Total number of royalty bearing, patent licenses	116	133	132	138	133
59	Total number of royalty bearing, “Other IP licenses”	8	9	12	11	14
60	Total number of fee bearing copyright licenses	0	0	0	0	0

(1) Note that royalties are one component of total license income.

Table 6 (data from ARS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	Licensing Management					
	Number of licenses	315	316	323	337	363
61	The total number of licenses active	291	288	292	301	321
62	The total number of newly executed licenses	23	21	18	27	25

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	Elapsed execution time ⁽¹⁾ for licenses granted					
63	All licenses					
64	average (months)	4.8	6.7	6.6	5.9	5.8
65	minimum (months)	0.5	0.7	0.7	0.6	0.3
66	maximum (months)	11.4	18.4	18.5	18.2	19.7
	Patent licenses					
67	average (months)	7.2	8.2	6.1	8.6	8.4
68	minimum (months)	3.9	1.2	2.3	1.0	0.5
69	maximum (months)	11.4	18.4	11.9	18.2	19.7
	Licenses terminated for cause,					
70	Invention licenses	0	0	0	0	0
71	Patent licenses ⁽²⁾	0	0	0	0	0

(1) Date of license application to the date of license execution. Date of license application is the date the lab formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.

(2) Patent licenses includes patent applications which are licensed.

Table 7 (data from ARS).

Ref #	Technology Transfer Metrics	FY-2008	FY-2009	FY-2010	FY-2011	FY-2012
	License Income ⁽¹⁾					
72	Total income ⁽²⁾ for all licenses active	\$3,953,415	\$5,376,463	\$3,641,476	\$3,989,228	\$3,806,164
	Total income of invention licenses	0	0	0	0	0
73	Total income for patent licenses ⁽³⁾	\$3,883,922	\$5,318,483	\$3,566,048	\$3,854,820	\$3,670,692
	Other IP licenses	\$69,493	\$57,980	\$75,428	\$134,408	\$135,472
74	Total income for copyright licenses	0	0	0	0	0
	Total Earned Royalty Income (ERI) ⁽⁴⁾	\$3,009,774	\$4,422,023	\$3,075,199	\$3,136,813	\$3,059,989
75	Median ERI	\$4,258	\$4,485	\$4,911	\$4,748	\$5,000
76	Minimum ERI	\$7	\$12	\$2	\$6	\$44
77	Maximum ERI	\$761,553	\$1,715,890	\$331,674	\$630,847	\$757,219
78	ERI from top 1% of licenses	NA ⁽⁵⁾				
79	ERI from top 5% of licenses	\$1,657,059	\$2,756,811	\$1,493,456	\$1,932,197	\$1,752,367
80	ERI from top 20% of licenses	\$18,573	\$21,282	\$32,711	\$42,241	\$59,075
	Invention licenses, total ERI	0	0	0	0	0
81	Median ERI	0	0	0	0	0
82	Minimum ERI	0	0	0	0	0
83	Maximum ERI	0	0	0	0	0
84	ERI from top 1% of licenses	0	0	0	0	0
85	ERI from top 5% of licenses	0	0	0	0	0

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86	ERI from top 20% of licenses	0	0	0	0	0
	Patent licenses, total ERI	\$2,982,281	\$4,386,042	\$3,014,771	\$3,067,390	\$2,969,517
87	Median ERI	\$4,579	\$4,612	\$5,000	\$4,800	\$5,000
88	Minimum ERI	\$45	\$117	\$2	\$6	\$44
89	Maximum ERI	\$761,553	\$1,715,890	\$331,674	\$630,847	\$757,219
90	ERI from top 1% of licenses	NA ⁽⁵⁾				
91	ERI from top 5% of licenses	\$1,544,031	\$2,756,811	\$1,493,456	\$1,855,388	\$1,752,367
92	ERI from top 20% of licenses	\$2,485,319	\$3,819,292	\$2,485,208	\$2,628,537	\$2,529,658
	Other IP licenses, total ERI	\$27,493	\$35,980	\$60,428	\$69,423	\$90,472
93	Median ERI	\$1,003	\$3,186	\$1,705	\$2,000	\$2,844
94	Minimum ERI	\$7	\$12	\$42	\$37	\$82
95	Maximum ERI	\$9,508	\$13,690	\$17,988	\$22,867	\$27,847
96	ERI from top 1% of licenses	\$9,508	\$13,690	\$17,988	\$22,867	\$27,847
97	ERI from top 5% of licenses	\$9,508	\$13,690	\$17,988	\$22,867	\$27,847
98	ERI from top 20% of licenses	\$18,573	\$21,282	\$32,711	\$42,241	\$59,075
	Copyright licenses, total ERI	0	0	0	0	0
99	Median ERI	0	0	0	0	0
100	Minimum ERI	0	0	0	0	0
101	Maximum ERI	0	0	0	0	0
102	ERI from top 1% of licenses	0	0	0	0	0
103	ERI from top 5% of licenses	0	0	0	0	0
104	ERI from top 20% of licenses	0	0	0	0	0
	Disposition of License Income					
	Invention license income distributed					
105	Total amount of invention license income distributed	\$3,013,522	\$3,673,922	\$3,137,670	\$3,220,920	\$3,550,930
106	Total amount of invention license income distributed to inventors	\$756,458	\$1,371,346	\$1,370,296	\$1,391,111	\$1,206,713
107	Total amount of invention license income distributed to others	\$562,427	\$1,633,536	\$1,179,579	\$1,181,859	\$1,686,521
	Patent license income distributed					
108	Total amount of patent license income distributed	\$2,958,996	\$3,631,660	\$3,084,726	\$3,202,394	\$3,474,591
109	Total amount of patent license income distributed to inventors	\$729,892	\$1,346,512	\$1,341,289	\$1,343,366	\$1,152,848
110	Total amount of patent license income distributed to others	0	0	0	0	0

(1) The statute makes it clear that reporting these distributional statistics can be suspended if such information would inappropriately reveal the amount of royalty income associated with an individual license or licensee.

(2) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

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(3) Total income for patent license includes patent applications which are licensed.

(4) Earned royalty is based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

(5) Represents a single license.

Table 8

Ref #	Technology Transfer Metrics	FY-4	FY-3	FY-2	FY-1	FY
111	Number of startups ⁽¹⁾ created	Data gathered by NSF and entered by TPO				
112	U.S. Scientific and Engineering (S&E) Articles by Selected Technology Areas and Agencies	Data gathered by NSF and entered by TPO				
113	Citation of U.S. articles in U.S. Patents, by Selected S&E Field and Article	Data gathered by NSF and entered by TPO				
114	The Annual Number of Technology Transfer Impact Studies Completed by Agency	ND	ND	ND	ND	ND
	Other Performance Measures Deemed Important by the Agency	ND	ND	ND	ND	ND

(1) A "startup" company is a privately-held, for-profit company operating for less than 5 years and actively seeking financing to commercialize a federal scientific work product.

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U.S. Department of Agriculture (USDA): The Culture of “Technology Transfer” and Overview of Agencies <http://www.usda.gov/>

This year marks the 150th anniversary of the Department of Agriculture. Established on May 15, 1862, President Abraham Lincoln later coined the phrase “the People’s Department” in acknowledging the role of the Department in solving problems for the agriculture sector that benefits all people every day. Thus, well before the coining of the modern day phrase of “technology transfer,” it was the culture of USDA to deliver these solutions to the people of the United States. Today, USDA broadly defines technology transfer as the *adoption of research outcomes (i.e., solutions) for public benefit*. Seemingly a simple statement, that process of adoption is complicated, requiring integration of many assets from disparate sources in the successful delivery of solutions. “Public benefit” is achieved through many mechanisms including public release of information, tools, and solutions (e.g., germplasm, plants and other materials), adoption by partners through collaborative research, formal cooperative research and development agreements (CRADA) authorized by the Federal Technology Transfer Act (1986), direct federal, state, or local technical assistance, or through licensing of biological materials or protected intellectual property directly to not-for-profit entities and for-profit private sector firms. Additionally, successful adoption of USDA knowledge and research outcomes typically requires complementary assets and services provided by multiple agencies in USDA, including agencies that are not primarily engaged in direct research in the physical and life science arenas.

Agencies themselves seldom can transfer technologies to the end user and knowledge alone; except where benefit is provided directly by federal, state, or municipal entities, the private sector serves as the essential delivery mechanism and intermediary between public research and realization of public benefit. Additionally, private sector involvement also adds the benefits of creating new or expanded businesses, jobs, and economic prosperity.

Science-based innovations from USDA intramural research --- often developed through public / private partnerships --- create new or improved technologies, processes, products and services that benefit the nation by increasing productivity, increasing efficiency (keeping costs low) and enhancing global competitiveness for the U.S. agriculture sector. Thus, technology transfer functions are critical to accelerating utility of public R & D investments, creating economic activity, and in job creation and sustainable economic development.

The Agricultural Research Service (ARS) has been delegated authority by the Secretary of Agriculture to administer the patent program for ARS, and the review of CRADAs and the technology licensing program for all intramural research conducted by USDA. These activities are housed in the Office of Technology Transfer.

On October 28, 2011, following a series of reports identifying the status of technology transfer from federal funds and federal laboratories, the White House issued the Presidential Memorandum – Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses.” Issuance of this Memorandum provided an unprecedented opportunity for unifying technology transfer across USDA S&T agencies as the mechanism to deliver these outcomes for public good. In the USDA’s response to the Presidential Memorandum ([https://www.ars.usda.gov/sp2UserFiles/Place/00000000/USDA%20Plans%20for%20Accelerating%20Technology%20Transfer%20and%20Commercialization%20FY%202013-2017%20\(OMB%20Clearance%209%2013%2012\)v3.pdf](https://www.ars.usda.gov/sp2UserFiles/Place/00000000/USDA%20Plans%20for%20Accelerating%20Technology%20Transfer%20and%20Commercialization%20FY%202013-2017%20(OMB%20Clearance%209%2013%2012)v3.pdf)), several initiatives were identified to promote technology transfer and commercialization. Most of the initiatives described in this plan will begin in FY 2013 and will continue through the five year period, ushering in a new era of unprecedented collaboration

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among agencies of USDA to enhance services and opportunities to the customers and stakeholders of the Department. Beginning with the FY2012 Annual Report on Technology Transfer, USDA will begin to report, when possible, on these initiatives. Specifics are provided in agency sections within this report.

This report covers technology transfer activities and metrics for the Agricultural Research Service (ARS), Forest Service (FS), Animal and Plant Health Inspection Service's Wildlife Services (APHIS-WS), Animal and Plant Health Inspection Service's Veterinary Services (APHIS-VS), Animal and Plant Health Inspection Service's Plant Protection and Quarantine (APHIS-PPQ), Animal and Plant Health Inspection Service's Biotechnology Regulatory Services (APHIS-BRS), Animal and Plant Health Inspection Service's International Services (APHIS-IS), National Institute of Food and Agriculture (NIFA), Economic Research Service (ERS), National Agricultural Statistics Service (NASS), Foreign Agricultural Service (FAS), Rural Development (RD), Agricultural Marketing Service (AMS), Grain inspection, Packers and Stockyards Administration (GIPSA), Food Safety and Inspection service (FSIS) and Natural Resources Conservation Service (NRCS).

1. Agricultural Marketing Service (AMS)

<http://www.ams.usda.gov/AMSV1.0/>

1.1. Mission Statement

The mission of AMS is to facilitate the strategic marketing of agricultural products in domestic and international markets, while ensuring fair-trading practices, and promoting a competitive and efficient marketplace to the benefit of consumers of U.S. food and fiber products. This includes distributing market information, developing grade standards—many of which are used in the voluntary grading programs funded by user fees—protecting producers from unfair marketing practices, random testing of commodities for pesticide residues, granting intellectual property rights protection to new plant varieties, and oversight of industry funded programs to promote agricultural products and research.

1.2. Nature and Structure of Program

The Agricultural Marketing Service (AMS) is a service-oriented organization that provides a vast array of marketing services to the agricultural industry. Its mission is derived from 50 statutes aimed at facilitating the marketing of food and fiber commodities in domestic and international commerce, commodity grade standards, and voluntary certification and inspection programs and laboratory testing. The challenge for AMS is to adapt these programs to changing marketing practices and technological advances and be responsive to the grading, quality and health issues facing domestic agriculture. AMS does not have a research and development program in place to address these needs. However, AMS works with other Federal, State and local agencies, academia and food and fiber industry stakeholders in developing and testing innovative technologies that improve upon current marketing tools and services in a cost effective way. Both AMS commodity and support programs and our stakeholders have benefited from this association.

1.3. Current Technology Transfer Goals, Objectives, and Measures of Success (Metrics)

Although AMS does not have a formal technology program in place, the agency does oversee the Plant Variety Protection Act (of 1970, and amended in 1994), which provides legal protection in the form of intellectual property rights to developers of new varieties of plants. The intent of the Act was to “encourage the development of novel varieties of sexually reproduced plants and tuber propagated plants and to make them available to the public, providing protection to those who discover, develop and/or breed new varieties, and thereby promoting progress in agriculture in the public interest.” In order to gain protection over their intellectual property, plant breeders must demonstrate that their new varieties are distinct from previously existing variety, uniform within each generation of reproduction, and stable across generations of reproduction. Once these standards have been met, plant breeders gain control over the marketing of their new variety (i.e., advertising, exportation, importation, and sales). The term of protection is 20 years for most crops and 25 years for trees, shrubs, and vines. This creates an incentive for investment in the development for new plant varieties. Thus, the PVP Act facilitates technology transfer by protecting the intellectual property rights of those individuals who discover, develop and/or breed new plant varieties.

The AMS’ Plant Variety Protection (PVP) Office has the responsibility for administering the program and is user-fee funded. Since 1970, PVP Office has issued more than 7300 certificates of protection. The Office maintains crop databases for over 180 species including 70,000 commercial seed-reproduced varieties.

1.4. Strengthening Current Activities

The PVP Office interacts with several Federal agencies and international organizations. These relationships help to coordinate the application of Federal regulations related to the marketing of plant

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varieties. For example, applicants for PVP certificates are required to submit seed samples or tissue cultures to support and enable their applications. These samples are stored at the National Center for Germplasm Resources Preservation (NCGRP) in Ft. Collins, Colorado. The PVP Office regularly discusses issues of common concern with NCGRP staff. A Memorandum of Understanding between the two programs is updated on a regular basis. The samples deposited in support of applications are released to others after the term of protection ends. The deposit form and SOPs are currently being updated to ensure that the eventual distribution of the samples is unencumbered by other intellectual property rights or regulations related to genetically modified crops.

Seeds from outside the United States must be accompanied by a phytosanitary certificate. When they are shipped into the U.S., they must be shipped to USDA's Animal and Plant Health Inspection Service, Plant Protection and Quarantine (PPQ) office. Once the seeds or tissues pass quarantine, PPQ sends them directly to NCGRP. Plant varieties also need to have a variety name that is unique for marketing purposes. The Federal Seed Act, administered by the AMS' Livestock and Seed (LS) Program, oversees truth-in-labeling laws to protect consumers. Such laws cover variety naming and trueness-to-variety testing. The PVP Office uses the services of the LS Program to determine if the variety names provided in PVP applications are acceptable. PVP Office also cooperates with the LS Program to provide descriptive information to compare to field observations for trueness-to-variety tests.

The U.S. is a member of The International Union for the Protection of New Varieties of Plants, known by its French acronym UPOV. The UPOV treaty sets forth the principles of how intellectual property rights are granted to plants. These principles are then used to enact legislation in each member country, such as the PVP Act and the Plant Patent Act. Regular meetings with UPOV working groups and the governing council help to update treaty language and processes. As a member of this treaty organization, the PVP Office provides information about what plant varieties are seeking PVP protection. Recently, UPOV released an online version of this information so it is more quickly available to member countries. (Previously, this information was released on CD-ROMs bi-monthly.) UPOV is also leading the discussion about harmonization of forms, processes, and the sharing of varietal descriptive information. The PVP Office is actively involved in these discussions.

The office prepares annual reports for the World Intellectual Property Organization to track the effectiveness of this form of intellectual property protection. These reports detail the number and sources of new applications filed, and the numbers and sources of grants of protection. The most recent report was filed in March 2012.

1.5. Activities in FY2012

In 2012, the PVP Office received 491 applications for protecting new agricultural, floral, and seed plant varieties. During the fiscal year, the PVP Office conducted searches on 570 applications to determine whether the plant constituted a new variety. On the basis of those searches, the program issued 323 certificates of protection. At the end of the fiscal year, 5,021 certificates were in force while protection had expired on 208 different varieties.

During the FY 2012, 1440 different variety names were cleared from Seed Regulatory and Testing Division. A total of 406 trueness-to-variety (TTV) Samples for 4 different kinds of seeds were tested during FY 12.

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2. Animal and Plant Health Inspection Service (APHIS)

<http://www.aphis.usda.gov/>

Definition of Technology Transfer within APHIS and how Technology Transfer Activities Support the Agency's Mission

The mission of the Animal and Plant Health Inspection Service (APHIS) is to protect the health and value of American agriculture and natural resources. APHIS is a multi-faceted Agency and this broad mission includes protecting and promoting U.S. agricultural health, regulating genetically engineered organisms, administering the Animal Welfare Act, and carrying out wildlife damage management activities. These efforts support the overall mission of USDA, which is to protect and promote food, agriculture, natural resources and related issues.

APHIS Metric Tables

Table 1. Collaborative Relationships for Research and Development (R&D)

APHIS-Wildlife Services (WS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• CRADAs, total active	5	4	4	8	9
- New, executed	1	2	1	5	3
▪ Amendments¹, total active	3	2	1	2	2
- New, executed	0	1	0	2	0
▪ Traditional CRADAs, total active	5	4	4	8	9
- New, executed	1	2	1	5	3
▪ Small Business Cooperators, total active	1	1	1	4	5
- New, executed	0	1	0	3	1
▪ Foreign Cooperators, total active	2	1	2	4	6
- New, executed	0	1	1	3	2
• Other Collaborative R&D Relationships					
▪ Confidentiality Agreements	4	6	11	33	38
- New, executed	1	2	17	16	10
▪ Material Transfer Agreements	9	5	7	14	30
- New, executed	3	3	1	7	9
▪ Other Agreements², total active	81	89	99	109	149
- New, executed	43	47	54	69	76
• Publications					
-Peer-Reviewed (Indexed) Scientific Publications	94	77	113	123	87
-Non-Indexed Publications	46	3	31	11	17

¹Amendments extend CRADAs for additional years to maximum of 5 years, and/or change Statements of Work, and/or change funding levels.

²Includes Trust Fund Agreements, Cooperative Service (Reimbursable) Agreements, Non-Funded Cooperative Agreements, and MOUS.

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Table 2. Invention Disclosures and Patenting

APHIS-Wildlife Services (WS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• New invention disclosures in FY	0	1	0	1	0
• Patent applications filed in FY, total	0	0	0	1	1
-Non-Provisional	0	0	1	0	1
-Provisional	0	0	0	0	0
• Patents issued in FY					
-Life Sciences	0	0	1	0	0
-Chemical	0	0	0	0	0
-Mechanical & Measurement	0	0	0	0	1

Table 3. Licensing: Profile of Active¹ Licenses

APHIS-Wildlife Services (WS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
▪ All licenses, total active in the FY ²	0	1	1	1	1
▪ Patent licenses, total active in FY	0	1	1	1	1

¹Active means legally in force at any time during the FY, whether or not the license is income bearing. USDA licenses are patent invention and material transfer (invention) licenses. There are no other invention licenses of other IP licenses.

²WS/NWRC has only one license

Table 4. Income Bearing Licenses¹

APHIS-Wildlife Services (WS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• All royalty bearing licenses ^{1,2}	0	1	1	1	1
- Patent licenses	0	1	1	1	1

¹Totals include only those licenses that actually received royalty income.

²WS/NWRC has only one license

Table 5. License Income

APHIS-Wildlife Services (WS)	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
- Patent licenses	0	\$500	\$1,339	\$432	ND
• Total Earned Royalty Income (ERI) ¹	0	\$500	\$1,339	\$432	ND
-Patent licenses, total ERI	0	\$500	\$1,339	\$432	ND

¹WS/NWRC has only one license

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Table 6. Disposition of License Income

APHIS-Wildlife Services (WS) ¹	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• Income distributed, total	0	\$500	\$1,339	\$432	ND
- To Inventors	0	\$500	\$1,339	\$432	ND
▪ Patent licenses, total	0	\$500	\$1,339	\$432	ND
- To inventors	0	\$500	\$1,339	\$432	ND

¹Amendments extend existing CRADAs for additional years to a maximum of 5 years, and/or change Statements of Work, and/or change funding levels.

²WS/NWRC has only one license

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2.1. Wildlife Services (WS)

http://www.aphis.usda.gov/wildlife_damage/nwrc/

2.1.1. Mission Statement

The mission of USDA APHIS Wildlife Services (WS) is to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. Wildlife is an important public resource greatly valued by the American people. However, wildlife is a dynamic and mobile resource that can damage agricultural and industrial resources, pose risks to human health and safety, and affect other natural resources. The WS program carries out the Federal responsibility for helping to solve problems that occur when human activity and wildlife are in conflict with one another. The WS program strives to develop and use wildlife damage management strategies that are biologically sound, environmentally safe, and socially acceptable.

2.1.2. Nature and Structure of Research Program

WS conducts program delivery through its Regional and State Offices and National Programs, providing high quality wildlife damage management services for its customers that result in the protection of agriculture, wildlife and other natural resources, property, and human health and safety. WS also continuously improves and modifies wildlife damage management strategies through research at its National Wildlife Research Center (NWRC). The NWRC is the research arm of WS and is the federal institution devoted to resolving problems caused by the interaction of wild animals and society. The Center applies scientific expertise to the development of practical methods to resolve these problems and to maintain the quality of the environments shared with wildlife.

NWRC is headquartered on the Foothills Research Campus of Colorado State University (CSU) in Fort Collins, CO. Approximately two-thirds of NWRC's 150 scientists, technicians, and support personnel are located in Fort Collins; the remainder of the highly specialized staff are located at field stations throughout the United States, and address regional wildlife damage management issues. Further, NWRC routinely conducts international consultancies in this specialized area. Scientific staff have experience in many disciplines including animal behavior/psychology, chemistry, biology / ecology / zoology, economics, genetics, immunology, pharmacology/toxicology, physiology, wildlife biology, and wildlife disease. The Center relies on the services of people with additional specialties through cooperative ties with universities, not-for-profit research facilities, and other public and private research entities.

The emerging technologies and improved knowledge of wildlife behavior and human values developed at the NWRC lead to new strategies for resolving wildlife damage problems. NWRC develops effective wildlife damage management methods through contributions in the following areas: Damage assessment; Investigation of the biology and behavior of problem animals; Evaluation of the impact of management practices on wildlife and the environment; Development and improvement of present management technologies; Investigation of potential applications of new management technologies; Support of registration of chemicals and drugs used to manage wildlife; Transfer of scientific and technical information; Provision of scientific guidelines on wildlife damage for use by regulatory agencies; Development of cooperative research and training with other organizations; and Responsiveness to needs of user groups and the public.

2.1.3. Current Technology Transfer Goals, Objectives, and Measures of Success

NWRC scientists produce the appropriate methods, technology, and materials for reducing animal

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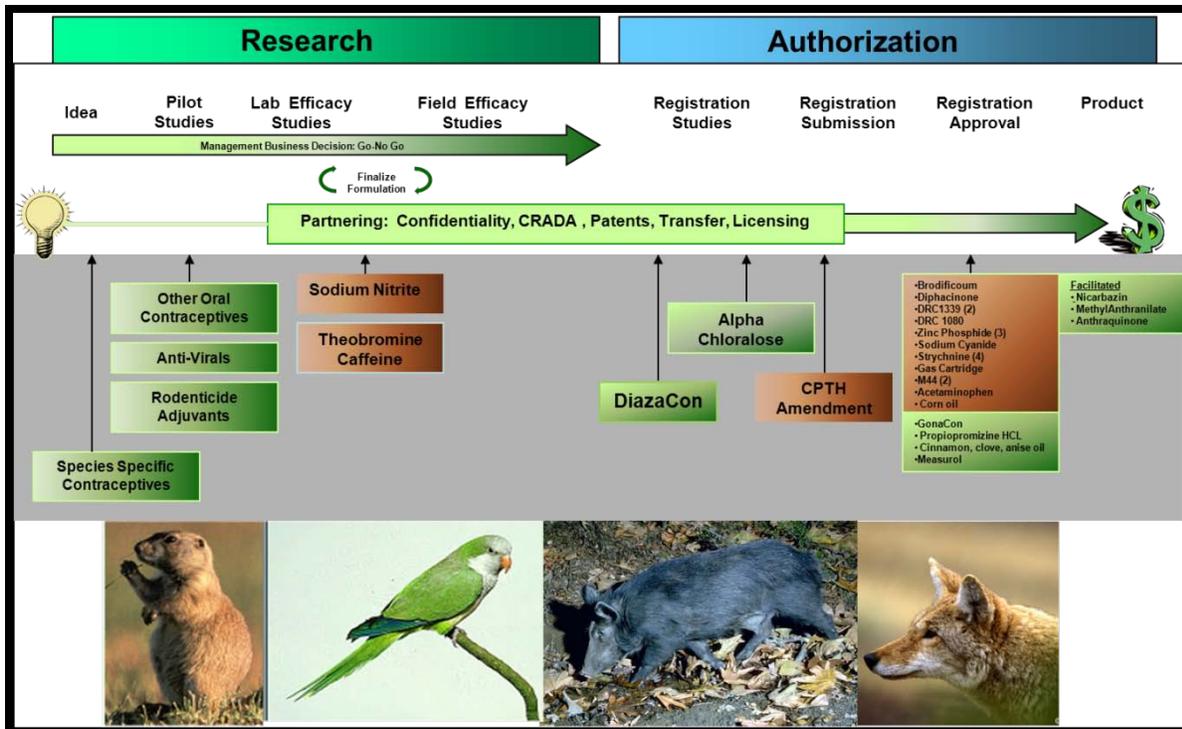
damage. Through the publication of results and the exchange of technical information, the Center provides valuable data and expertise to the public and the scientific community, as well as to APHIS's Wildlife Services (WS) program.

Wildlife Services follows the general USDA definition of technology transfer as the adoption of research outcomes (i.e., solutions) for public benefit. These innovations from WS research, through public / private partnerships, create new or improved technologies, processes, products and services that benefit the nation by increasing productivity, increasing efficiency (keeping costs low) and enhancing global competitiveness for the U.S. agricultural sector. Technology transfer is critical to accelerating use of public research and methods development, creating economic activity, creating jobs, and sustaining economic development. WS uses formal instruments of technology transfer, including material transfer agreements and Cooperative Research and Development Agreements (CRADAs). In addition, WS transfers technology through patents and invention licenses for commercialization by the private sector. Wildlife Services has an ongoing formal agreement with the ARS Office of Technology Transfer to administer WS patents and licensing; ARS' annual report therefore includes technology transfer activities and metrics for the Animal and Plant Health Inspection Service's Wildlife Services (APHIS-WS), including tabular metrics of inventions, licenses, and Cooperative Research and Development Agreements, as well as a section on notable "downstream outcomes." For APHIS-WS, invention disclosures are evaluated within ARS patent review committees that are expanded to include three APHIS-WS members. ARS committee recommendations for APHIS-WS inventions are made to the Director of the APHIS National Wildlife Research Center in Ft. Collins. ARS Patent Advisors prepare, file, and prosecute WS inventions on behalf of APHIS, and coordinate patent application filings in other countries through a contractor.

In addition to patents and licenses, WS/NWRC transfers knowledge and technology through many other formal and informal mechanisms. Primary among these methods is publication in peer-reviewed scientific journals. Other important mechanisms for transferring technology and knowledge include: presentations at technical or professional conferences and publications in proceedings; technical assistance to the public or stakeholders; development of stakeholder announcements, fact sheets and other outreach materials; informal and formal exchange of information and products among colleagues; and laboratory open houses. Formal agreements, including cooperative agreements, cooperative service agreements, material transfer agreements, and confidentiality agreements are used to formalize collaborations with other government scientists, universities, private companies and other stakeholders.

The schematic below depicts one additional method by which Wildlife Services supports the Agency mission through its technology transfer activities. APHIS/Wildlife Services has a dedicated staff devoted to registration / authorization of products with regulatory agencies, including the Environmental Protection Agency, the Food and Drug Administration and the USDA Center for Veterinary Medicine. When products are developed, they proceed through the research and development pipeline shown in the schematic, are registered with the appropriate regulatory agencies, and are typically produced for sale by a private company. In the past, the majority of methods and products have not been licensed, but efforts are currently being made by WS to increase the number of patents and licenses for WS products (e.g., co-hosting regional technology transfer fairs, enhancing training for NWRC scientists in technology transfer, and developing a technology transfer brochure for the NWRC, and beginning engagement with the ATIP network).

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Wildlife Services currently measures success of its technology transfer using several metrics. To measure the success with which its scientists are partnering with collaborators, the NWRC looks at the number of agreements established with collaborators. These include confidentiality agreements, material transfer agreements and CRADAs established with partners. However, because many of our partnerships do not necessarily involve the transfer of intellectual property, NWRC also follows the number of other agreements established, including cooperative agreements, cooperative service agreements, and interagency agreements, all of which measure the degree of collaboration that NWRC has with universities, businesses, other federal government agencies, state and local governments, non-governmental organizations, and foreign governments and universities. Cooperator funding is very important to Wildlife Services and the NWRC in accomplishing its mission, with an effort being made to increase the amount of cooperator funding generated. For example, cooperator funding at NWRC averages about 10% of the annual budget, generating \$1.6 million in 2010, \$1.4 million in 2011 and \$2.0 million in 2012. Other federal agencies make up ~75% of cooperator funding, while 25% is derived through research agreements with other collaborators.

The NWRC tracks its outreach and communication efforts through numbers of technical publications. NWRC has a full-time legislative and public affairs staff person and is increasing its outreach efforts through press releases, stakeholder announcements, fact sheets, website postings, facility tours, and workshops. One area we have begun to emphasize is outreach to the business community and communication to Wildlife Services operations and stakeholders regarding the economic value received for their research investment. The NWRC also tracks the number of registrations (existing and new) that have been obtained with regulatory agencies. This is an indicator of new product development that has been provided for use by the public or by Wildlife Services operational staff.

2.1.4. APHIS-WS response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

In the USDA's implementation plan for the Presidential Memorandum, APHIS-WS described three

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initiatives to promote technology transfer and commercialization. The initiatives and their implementation in FY 2012 are described below.

***Strengthening Current Activities**

****New Initiatives**

USDA 20: Increase awareness in WS of technology transfer mechanisms, leading to increased pace of effective technology transfer and commercialization

	Objective	Activity	Performance Metrics
1*	Increase awareness and participation in technology transfer activities by NWRC scientists	Provide technology transfer training	-Training provided for scientists -Scientists with at least one TT agreement
2**	Increase awareness and participation in technology transfer activities by non-federal partners	Initiate outreach activities, such as workshops / TT fairs for private industry	Contacts/transactions developed from workshops
3*	Increase number of agreements with stakeholders, including CRADAs	Provide incentives for stakeholder collaboration through research awards, etc.	Number of agreements; examples of research outcomes adopted by end users (also see ARS metrics)

During 2012, WS provided a day of training on technology transfer to its scientists in conjunction with a technology transfer fair. In August, 2012 the NWRC partnered with 4 other federal research laboratories in Northern Colorado to host the “2012 Northern Colorado Technology Transfer Fair: Creating an Innovation Economy through Industry-Government Partnerships” in Fort Collins, Colorado. This event showcased federal research to encourage new partnerships and collaborations, and create opportunities for economic growth and innovation in northern Colorado and southern Wyoming.

WS will continue to track the number of agreements it maintains each year in the annual report table. In FY 2012, WS/NWRC increased its number of CRADAs by 3, for a total of 9 active CRADAs with a value of \$336,144 over the life of the CRADAs (up to 5 years). A total of \$87,841 was collected by NWRC from CRADAs in FY 2012.

USDA 21: Increase knowledge of WS and NWRC and their impact in preventing wildlife conflicts, leading to increased development of collaborative research and more effective use of public resources

	Objective	Activity	Performance Metrics
1*	Increase information on economic or other value received for research investment	Produce analyses of economic or other benefits of WS or NWRC operations or research	Economic benefits of WS /NWRC activities
2*	Increase communications to stakeholders	Develop communication strategies and products for dissemination	Communications to stakeholders
3**	Develop internal partnerships within APHIS	APHIS Wildlife Disease working group	Collaborations among APHIS programs

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WS/NWRC increased information provided on value received based on research investment by publication of 3 economic assessments, focusing on dollars saved by implementation of wildlife damage management programs. An effort is being made to increase internal APHIS collaborations. An APHIS wildlife disease working group was developed in 2012 and a steering committee is holding regular meetings.

WS is attempting to increase communications with stakeholders through development of communication strategies and products.

USDA 22: Increase the pace of WS technology transfer and commercialization activities

	Objective	Activity	Performance Metrics
1**	Obtain partners for technologies ready to be commercialized	Work with ARS to use the ATIP Program	Partnerships developed
2*	Maintain existing products and register new products	Provide registration data/information to regulatory agencies	Number of registered products

Wildlife Services maintains existing products and registers new products with the Environmental Protection Agency and the Food and Drug Administration for use by Wildlife Services personnel and the public. In FY 2012, APHIS/WS maintained 15 Section 3 EPA Registrations and made 1 new registration application submission. A total of 24 Section 24c (Special Local Need) Registrations were maintained and three new labels were obtained; 1 Experimental Use Permit was in place. One supplemental label for rodent eradication on islands was maintained and 2 new supplemental labels were obtained. In addition, APHIS/WS maintained 2 FDA Investigational New Animal Drug permits.

For both “USDA 21” and “USDA 22”, ATIP members will be enlisted to survey CRADA and licensing partners of USDA as to effectiveness of programs, and to seek input for improving processes.

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2.1.5. Downstream Outcomes from APHIS-WS Technology Transfer Activities

- 15 Research Projects
- 8 Locations
- 27 Research Grade Scientists

Bioeconomic Modeling of Raccoon Rabies Spread: Management Impacts in Quebec

Rabies is an acute, fatal viral disease that can infect people as well as animals. Impacts to society from this disease can be great, especially in underdeveloped countries. The cost of detection, prevention, and control of rabies in the U.S. alone exceeds \$300 million annually. Approximately 90 percent of the reported rabies cases in the U.S. occur in wildlife. Raccoons and skunks account for the most reported cases, but bats, foxes, and coyotes are also among those commonly infected. Since 1995, the WS program has been working cooperatively with local, State, and Federal agencies, universities, and other partners to reduce rabies in wildlife. Each year, WS and cooperators distribute about 6.5 million ORV baits in selected States to create a zone where raccoon rabies can be contained. NWRC economists have evaluated the value of the WS' ORV vaccination efforts on several fronts. Initially, simulation models were developed to determine likely scenarios related to the spread of raccoon rabies if the program were terminated. Based on these scenarios, economic models were then developed to determine the likely economic consequences of abandoning the ORV program. Economists estimated that an enhanced rabies program (i.e., one that pushes for the full eradication of the raccoon strain of rabies) would likely prevent an estimated \$48 to \$456 million in rabies related damages. The costs associated with enhancing the rabies ORV program was estimated to cost \$58 to \$158 million. Thus, the return on investment for national ORV programs in wildlife could be as high as \$8 dollars for every dollar spent. *Project: Economic Research of Human-Wildlife Conflicts, Fort Collins, CO*

Producer Survey of Bird-Livestock Interactions in Commercial Dairies

A producer survey of dairy operators within Pennsylvania, New York, and Wisconsin was conducted to identify and estimate damage caused by bird-livestock interactions in commercial dairies. The interactions between birds and livestock have previously been implicated in causing economic



damage while contributing to the environmental dissemination of microorganisms pathogenic to livestock and humans but little information existed on what bird species use dairies, why they use dairies, or the scope and nature of damage created as a result of bird-livestock interactions. To better quantify the damage from starling-livestock interactions such as these, NWRC economists looked at starling-related costs associated with the consumption of cattle feed, increased feed spoilage, and higher veterinary expenses. “The economic costs associated with starling damage at farms is significant,” states NWRC economist Stephanie Shwiff. “In an

analysis of dairy farms in Pennsylvania, we discovered starling damage at dairies costs the State more than \$10 million annually in lost productivity.” Results also showed that Pennsylvania dairies lose approximately 6 percent (or 178 million pounds) of cattle feed to starlings each year, costing farms thousands of dollars in additional feed. Dairies with large starling populations were associated with higher

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occurrences of Johne's disease (up to a 148-percent increase) and Salmonella (up to a 900-percent increase) in their herds, resulting in increased veterinary costs compared to farms with lower starling numbers. *Economic Research of Human-Wildlife Conflicts, Fort Collins, CO*

PHOTO: Starlings at feedlots. Photo by James Carlson.

Ensuring Safe Rodent Eradication Efforts

Rats have been introduced to over 80% of the world's islands, accounting for an estimated 40-60% of all bird and reptile extinctions in the world. Seabird colonies on islands are highly vulnerable to introduced rats, which find the ground-nesting birds, their eggs and chicks to be easy prey. In the last 20 years, New Zealand conservationists pioneered development of methods to eradicate invasive rats from islands using anticoagulant rodenticides. In 2001, the US Fish and Wildlife Service approached Wildlife Services about developing rodenticide product registrations for eradicating rodents from islands in the US. Wildlife Services worked with FWS and two private rodenticide manufacturers to register three anticoagulant rodenticide products. Because of its expertise in product development and environmental compliance, Wildlife Services has played a key role in US rodent eradication projects; these projects are now approached as cooperative ventures between Federal and private entities, thus ensuring that eradication success is balanced with minimal impact on the environment. Since 2009, the three APHIS rodenticide products have been used on 8 islands in the Caribbean and Pacific, and plans are being made for eradication efforts on three more islands within the next few years. Four of these projects required bait application rates and methods that were outside the approved label allowances. In these cases, Wildlife Services worked with the US Fish and Wildlife Service, Island Conservation (NGO) and the US Environmental Protection Agency to craft project specific labels to meet the logistical and environmental needs for those island projects.



A recently completed rat eradication effort conducted on Palmyra Atoll was a collaborative effort among the US Fish and Wildlife/Pacific Reefs National Refuge Complex, the Nature Conservancy of Hawaii, Island Conservation, and Wildlife Services. The eradication effort used the highly toxic second generation anticoagulant rodenticide, brodifacoum. Because island crabs are numerous on the atoll and compete for food with rats, the rodenticide bait needed to be applied aerially on the island at a rate 5 times greater than the approved labels allow, presenting significant environmental risks to this fragile ecosystem. Wildlife Services secured the required regulatory approval for the project and assembled a team to monitor the post-application impact on the island wildlife. NWRC scientists measured the application rate and bait distribution on the ground following aerial application, documented the fate of bait, collected non-target animals that died during the study, and systematically collected soil, water, insects, lizards, fish, and crabs to determine environmental residue levels. Carcasses of 81 animals representing 54 species were collected during daily carcass searches and rodenticide residues were detected in birds, fish and crabs as a result of direct consumption of bait and secondary exposure through scavenging of poisoned rat carcasses. Despite the apparent impact on the atoll, recovery of the biota appears to be rapid and the benefits of rat removal are already being seen. Seedlings of trees have increased significantly without rat foraging, leading to a healthier ecosystem. Bird populations appeared to be unaffected by the application of brodifacoum, and with the decrease in rat predation, nesting success is expected to be greatly improved, allowing for recolonization of indigenous seabirds. The benefits of rat eradication will be greatest for

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nesting species of birds but migratory shorebirds will also benefit. The benefit of this conservation action is significant from a regional perspective because Palmyra is the only moist tropical atoll ecosystem in the Central Pacific with strong protections, as well as the only moist tropical atoll ecosystem in this region that is not experiencing exploitation of both marine and terrestrial natural resources by burgeoning human populations.

Wildlife Services expects to be heavily involved in rodent eradication efforts in the future. Wildlife Services pesticide registration staff have developed strong working relationships with regulatory partners. NWRC scientists are routinely sought out to participate in environmental and toxicological studies associated with project planning, and the Wildlife Services Operational personnel have the ability to conduct or participate in eradication efforts when their expertise is requested. *Project: Managing Invasive Species Impacts to Agriculture, Natural Resources, and Human Health and Safety, Hilo, HI; and Registration Unit, Fort Collins, CO*

PHOTO: Hoops used to measure the application rate and bait distribution on the ground following aerial application of brodifacoum. Photo by Tom McAuliffe.

Avian Influenza Database Development

“No other disease has brought wildlife surveillance to the forefront of people’s minds like avian influenza,” notes Dr. Thomas Deliberto, former coordinator for the National Wildlife Disease Program (NWD) and current NWRC Assistant Director. “In 2006, Wildlife Services led an effort to sample for highly pathogenic avian influenza in wild birds, as well as in lakes and ponds across the country. This effort shed new light on how avian influenza viruses circulate in the wild and what can be done from a biosecurity standpoint to protect agricultural operations and humans.”



As part of the U.S. National Strategy for Pandemic Influenza, the NWDP participated in the development and implementation of an Interagency Strategic Plan for the Early Detection of Highly Pathogenic H5N1 Avian Influenza in Wild Migratory Birds in 2006. The purpose of the plan was to create a national system for detecting highly pathogenic avian influenza viruses (HPAIV), specifically the H5N1 subtype, in migratory birds. While the immediate concern was a potential introduction of HPAIV H5N1 into the U.S., the system was developed to detect any HPAIV in migratory waterfowl regardless of the source. Additionally, the system increases knowledge regarding low pathogenic avian influenza viruses and the general health of wild birds. The plan was used to develop flyway and state-specific HPAIV surveillance strategies by establishing guidelines consisting of standardized protocols for sampling wild birds, handling and shipping samples, diagnostic testing, and communicating results.

In 2005, the NWDP established the Wildlife Tissue Archives. From April 2006 through March 2011, over 491,000 samples from wild birds were collected in the U.S. Thankfully, no HPAIV were detected. Taking advantage of this large sample size, NWDP experts conducted a freedom of disease analysis, which provided the U.S. and its trading partners’ confidence that the early detection system was capable of detecting a HPAIV even if fewer than five wild birds out of a population of over 50 million waterfowl were infected.

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NWRC researchers and collaborators have taken advantage of the large data set to develop risk assessment models for poultry operations in the U.S. and network analyses that reveal connectedness among populations and geographic areas. Both are useful for optimizing surveillance and detection strategies for avian influenza virus. This large tissue archive has also been used for surveillance for diseases carried by feral swine, and monitoring for plague and tularemia in wildlife. The collection is unique in its quantity of samples, diversity of species, broad geographic range, and consistent sampling effort over extended periods of time. The archives support numerous types of studies, including emerging disease diagnosis, wildlife health studies, assay method validation, and a variety of retrospective studies. Some recent examples include the study of the distribution of avian bornavirus in wild birds, the validation of a portable field PCR (polymerase chain reaction) system for avian influenza detection, and the study of the transfer of parasites between pasture-raised domestic pigs and feral swine. The NWRC welcomes inquiries about using archive tissues for studies. *National Wildlife Disease Program, Fort Collins, CO*

PHOTO: NWRC Diagnostics Laboratory

Managing Turf at Airports to Prevent Bird-Strikes

Because of their large size and flocking behavior, Canada geese pose a serious threat to aviation safety. Management strategies that reduce the use of airport grasslands by Canada geese are needed to reduce costly and dangerous collisions with aircraft. Previous NWRC research has shown that grazing Canada geese do not consume endophyte-infected tall fescue. Grasses containing endophytic fungi have several benefits, such as resistance to both grazing and insect herbivory, heat and drought stress tolerance, and increased vigor. Over 200 varieties of turf-type tall fescue are currently available from the turfgrass industry for use in airfield re-vegetation projects. However, airports often have poor soil conditions and not all grasses grow well at airports. NWRC scientists identified several commercially available tall fescue cultivars, including Titan LTD, 2nd Millennium and Crossfire II, that will grow successfully given the environmental conditions found on airfields while providing a feeding deterrent to Canada geese. Airport biologists around the U.S. use information such as this when preparing airport-specific Wildlife Hazard



Management Plans and when providing recommendations for airport renovation and expansion. *Project: Development of Management Strategies To Reduce Wildlife Hazards to Aircraft, Sandusky, OH*

PHOTO: turf grass plots. Photo by Tom Seamans

Northern Colorado Technology Transfer Fair

On August 7, 2012 the NWRC partnered with 4 other federal research laboratories in Northern Colorado to host the “2012 Northern Colorado Technology Transfer Fair: Creating an Innovation Economy through Industry-Government Partnerships” at the Drake Center in Fort Collins, Colorado. This free, one-day event showcased federal research to encourage new partnerships and collaborations, and create

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opportunities for economic growth and innovation in northern Colorado and southern Wyoming. Approximately 170 people attended the Northern Colorado Technology Transfer Fair, including business owners, entrepreneurs, academics, Congressional staffers, government researchers, and representatives from numerous economic development entities. This was the first technology transfer fair hosted in northern Colorado to highlight the expertise of federal research laboratories in Larimer County and other nearby locations. The event had a tradeshow atmosphere with case studies of effective industry-government partnerships; booths highlighting federal expertise and available technologies related to agriculture, bioscience, clean energy and natural resources; and discussions on how to partner with federal labs. The event was hosted by the USDA-Animal and Plant Health Inspection Service/ National Wildlife Research Center, DHHS-Centers for Disease Control and Prevention, DOE-National Renewable Energy Laboratory, USDA-Agricultural Research Service, and USDA-Forest Service. Local city governmental and private groups sponsored the event and provided refreshments. *Technology Transfer Program, Fort Collins, CO.*

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2.2. Veterinary Services (VS)

http://www.aphis.usda.gov/animal_health/index.shtml

2.2.1. Mission Statement

As the recognized animal health leader and trusted partner, Veterinary Services safeguards the health of animals, people, and the environment. VS's authorities derive from the Animal Health Protection Act and the Virus Serum Toxin Act. VS integrates One Health principles with USDA business objectives by contributing leadership, expertise, infrastructure, networks, and systems to collaborate effectively with local, State, Tribal, national, and international partners. Its comprehensive and integrated on-farm surveillance activities provide VS the capability to achieve national goals for animal disease prevention, detection, and early response.

2.2.2. Nature and Structure of Program

VS is organized into policy and permitting staffs, a field force, and three science centers, described below:

The National Veterinary Services Laboratories (NVSL)

The mission of NVSL is to safeguard U.S. animal health and contribute to public health by ensuring that timely and accurate diagnostic laboratory support is provided directly or by its coordination of the nationwide animal-health diagnostic system. NVSL accomplishes its mission through:

- Performing diagnostic laboratory testing for Veterinary Services' program disease and for suspected outbreaks of foreign animal diseases
- Serving as the U.S. national and international reference laboratory for animal disease diagnosis by providing unique veterinary diagnostic capabilities, providing other diagnostic laboratories with animal disease information, technical guidance, reagents and reference materials;
- Providing national leadership in coordination of the National Animal Health Laboratory Network (NAHLN) and emergency laboratory response by training State, University and foreign laboratory personnel, providing proficiency testing, and developing improved diagnostic technologies;
- Preparing for responding to animal health emergencies and emerging threats to animal agriculture including threats to the poultry and aquaculture industries by being able to conduct and/or support diagnostic testing in an outbreak environment

Among other potential TT activities, NVSL develops and validates assays, and manufactures and distributes over 500 biological reagents to support veterinary diagnostics, many of which are not available from any other source.

Before a test is utilized by Veterinary Services for disease control or surveillance, it must be validated for that purpose. Samples for test validation for program diseases such as brucellosis and tuberculosis are in serum and tissue banks generated and maintained at the NVSL. These samples are made available to commercial kit manufacturers for their initial validation, and additional test validation is conducted at the NVSL before the results are submitted to the USAHA Scientific Advisory Committees. This is in addition to any testing for licensure required by the Center for Veterinary Biologics.

The NVSL is also involved in the development and validation of assays used to detect diseases that are foreign to the United States. Some of these assays are utilized in the reference laboratory as confirmatory tests, while others are deployed to the NAHLN laboratories and utilized in surveillance programs.

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Identification, feasibility testing, development, optimization and validation of new assays and/or technologies are all accomplished within the NVSL. The NVSL staff collaborates with, and provides scientific advice to other Federal and State Government agencies that are also developing new assays and technologies, and NVSL scientists partner with other reference laboratories around the world to obtain diagnostic specimens from naturally infected animals. These collaborative efforts result in enhanced expertise at the NVSL and in reference collections that are available for assay development and validation.

Centers for Epidemiology and Animal Health (CEAH)

The mission of CEAH, with a view to the future, is to explore and analyze animal health and related agricultural issues to facilitate informed decision-making in government and industry. CEAH also partners with the World Organization of Animal Health (OIE) and its member countries to improve international disease surveillance capabilities and analytic methods supporting trade decisions. CEAH has a multidisciplinary staff that includes agricultural economists, spatial analysts, GIS and computer specialists, veterinary epidemiologists, technical writers/editors, and data managers.

CEAH collaborates with university partners on analysis methods and tools. In some cases the products produced are commercialized by the academic partners.

Center for Veterinary Biologics (CVB)

The mission of the CVB is to implement the provisions of the Virus-Serum-Toxin Act (VST) to assure that pure, safe, potent and effective veterinary biologics are available for the diagnosis, prevention, and treatment of animal diseases. This mission mandates the use of sound scientific technology to:

- Ensure that biologics are free of disease producing agents, especially foreign animal diseases
- Develop appropriate standards and procedures for product release
- Issue licenses and permits
- Monitor and inspect products and facilities
- Control field tests and release of veterinary biologics

CVB-developed methods and biological standards are applied equally to all products, but by the same token can be adopted whole by the regulated commercial manufacturers, becoming part of their manufacturing and release process.

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2.3. Plant Protection and Quarantine (PPQ)

http://www.aphis.usda.gov/plant_health/index.shtml

2.3.1. Mission Statement

PPQ safeguards agriculture and natural resources from the entry, establishment, and spread of animal and plant pests and noxious weeds into the United States of America; and supports trade and exports of U.S. agricultural products.

2.3.2. Nature and Structure of PPQ's Methods and Technology Development Program

PPQ's technology development is centered with its Center for Plant Health Science and Technology (CPHST). CPHST is responsible for ensuring that PPQ has the information, tools and technology to make the most scientifically valid regulatory and policy decisions possible. In addition, CPHST ensures

PPQ's operations have the most scientifically viable and practical tools for pest exclusion, detection, and management. CPHST's services and products support PPQ and cooperator programs, strengthen regulatory actions, and enhance policy development.

CPHST is headquartered on the campus of North Carolina State University in Raleigh, North Carolina. The broader CPHST system however consists of approximately 250 employees in 7 labs, 4 units, and several work stations throughout the United States. CPHST supports regulatory plant protection activities by developing methods and conducting analyses in the following areas:

- Plant pest risk analysis
- Commodity treatment technology
- Pest detection
- Pest identification
- Diagnostic methods
- Pest management methods
- Biological control

CPHST activities are primarily focused on supporting PPQ needs, but also support stakeholders such as State plant regulatory programs and the agricultural and nursery industry. As well as conducting work internally, CPHST works with cooperators in other agencies (i.e. ARS, Forest Service), academia, and industry to develop methods needed for plant protection and management of invasive pests.

2.3.3. Current Technology Transfer Goals, Objectives, and Measures of Success

PPQ transfers new methods and technology through several mechanisms. Technical reports are distributed directly to stakeholders or are made available through the PPQ website. Another important mechanism is through the publication of results in peer-reviewed journals. CPHST also provides technical training and accreditation to stakeholders in certain areas. For example, the CPHST Beltsville Lab provides hands-on training on newly developed molecular diagnostics for regulated plant diseases and accredits state and academic laboratory staff to perform specific diagnostics.

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Other important mechanisms for transferring technology and knowledge include presentations at technical or professional conferences and publications in proceedings and technical assistance to public or stakeholders. Formal agreements, including cooperative agreements and memoranda of understanding are used to formalize collaborations with other government scientists, universities, private companies and other stakeholders.

PPQ is also authorized by the Stevenson-Wydler Act of 1980 to engage in formalized technology transfer activities with its cooperators. In carrying out its methods development projects, the statute allows the directors of any federally funded research and development center (our laboratories) to enter into cooperative research and development agreements (CRADA's) with any person, any agency or instrumentality of the United States, any unit of State or local government, and any other entity specified in the statute.

PPQ also enters into confidentiality agreements with entities when necessary to allow for appropriate protection of confidential business information, thus facilitating technology transfer information exchange.

Additionally, PPQ is in the process of establishing a Technology Transfer Coordinator to further help identify technology transfer needs and opportunities, and to ensure for a good linkage between its technology development laboratories and end-users.

2.3.4. APHIS-PPQ response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

In the USDA's implementation plan for the Presidential Memorandum, APHIS-PPQ described four initiatives to promote technology transfer and commercialization. The initiatives and their implementation in FY 2012 are described below.

USDA 23: Enhance Collaboration Efforts in Pest Detection and Management

PPQ's scientific support focuses on improving and developing pest detection and management tools to discover new invasive species early and respond quickly, better identify and target offshore pest threats, develop diagnostic tools and techniques, and transfer technology to cooperators and impacted industries.

Objective 1- Enhance the Understanding of Potential Threats: Collaboration, cooperation and participation between PPQ and domestic and foreign plant health communities result in information transfer and project cooperation and participation.

Objective - Make Technically Accurate Diagnostic Tools Widely Available on a Timely Basis: PPQ leverages partnerships with academic institutions, state and federal agencies, industry, and international partners to share data, transfer technology, and ensure PPQ and cooperators are provided with the most current and robust diagnostic tools. Strategies include:

- Develop infrastructure to provide technical advice and support to facilitate the technology transfer of methods involving standardized surveys and operational diagnostics standard operating procedures (SOPs); work instructions; and on-site hands-on training for PPQ and collaborating labs in the use of survey, detection and identification protocols for high consequence plant pests and pathogens.
- Enhance the technology transfer process to ensure transparency and effective use of the provided tools.

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- Work with the Plant Germplasm Quarantine Program and its cooperators to identify methods to be validated to screen germplasm for targeted pests; work cooperatively with programs to transfer these methods into operations.

Objective - Make Appropriate and Technically Sound Survey Methods Widely Available on a Timely Basis: PPQ science support provides survey methods and techniques that are practical and feasible for the end-user.

Objective - Provide New Technologies for Existing and New Programs: PPQ stays abreast of cutting-edge technology developments by maintaining partnerships with industry, academia, state and federal agencies, international entities, and PPQ program personnel and transfers these technologies to cooperators and industry impacted by plant pests.

USDA 24: Provide Timely Scientific and Technical Support for Emergency Response and Management

PPQ must develop and maintain a high level of expertise to support preparedness in the areas of science, technical support, and technology transfer for rapid response efforts.

Objective - Ensure CPHST Resources and Tools Meet PPQ's Emergency Response Needs: Resources and tools must be accessible to collect information, analyze and respond to plant health and all-hazard emergencies. CPHST must be able to effectively communicate and deploy the appropriate tools to support PPQ in emergencies. CPHST must establish partnerships with external collaborators to coordinate Technical Working Groups that analyze scientific information and data in support of emergency response. Strategies include:

Imbed scientists in pest programs beyond the Science Advisory Panel capacity on an ongoing basis to learn from and consult with PPQ operations in plant health and all-hazard emergencies.

USDA 25: Improve Communications between CPHST and its Customers to assure Market Relevance

CPHST aims to establish and maintain an effective dialogue with its customers to ensure development activities are useful and applicable to customer needs.

Objective - Improve CPHST Knowledge and Understanding of Customers: Scientists must understand the customer and circumstance to provide appropriate deliverables. Strategies include:

- Place scientists responsible for tool development in the field to ensure effective tech transfer and learn more about implementation under field conditions and environment.
- Hold periodic reviews with customers to discuss ongoing projects and identify new needs and requirements.

USDA 26: Improve the CPHST Work Plan Development and Project Prioritization Process to Assure High Quality Outcomes for Customers / Stakeholders

CPHST will continue to develop a process with PPQ operations to produce mutually acceptable workplans that ensure appropriate product quality.

Objective - Deliver Quality Products that Are Acceptable to the Customer and CPHST Scientist: CPHST strives to deliver quality products that are acceptable and utilized by the customer. CPHST will accomplish this objective by the customer and scientist agreeing on the product quality-level and building quality-control mechanisms into the projects. CPHST scientists will work closely with their customers to

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ensure the end-user is prepared to use the product appropriately and effectively, and will routinely review and evaluate products after they are delivered and used by the customers. Strategies include:

- Establish a work group of PPQ operations staff and CPHST personnel to develop a process that details workplans for priority projects. The work group is charged with considering all elements of the process starting with the request-for-work through identifying and selecting priority projects
- Elements of workplans should be defined to include:
 - Project scope: Define project needs and required effort levels
 - Clearly identified project champion at the appropriate level of PPQ organization to ensure engagement and investment in project
 - Identify end-user of deliverable(s)
 - Clarify roles and responsibilities through the project's life
 - Establish an acceptable quality level that meets operational needs
 - Resource allocation
 - Realistic total project cost
 - Technology transfer costs, timelines, milestones and deadlines
 - Technology transfer strategy: CPHST transfers the technology to the operational programs and then assumes an advisory role to focus on next priority issue. The customer and CPHST scientist meet to discuss and mutually agree on the final product's specific deliverables and acceptable quality level, balancing political realities and field conditions where the product is to be used and the standards for scientific integrity of the product
 - Craft Quality Control (QC) mechanisms into the project to ensure delivery of the product's agreed quality level
 - Ensure the technology transfer component of the project adequately prepares the customer to use the product appropriately and effectively
 - Develop and implement a process to routinely review and evaluate products after delivered to and used by the customer
 - Fix or refine products based on reviews and evaluations of the product.

2.4. Biotechnology Regulation Services (BRS)

<http://www.aphis.usda.gov/biotechnology/index.shtml>

2.4.1. Mission Statement

The mission of BRS is to protect and enhance U.S. agricultural and natural resources using a dynamic, science-based regulatory framework to ensure the safe importation, interstate movement, and environmental release of genetically engineered (GE) organisms.

2.4.2. Nature and Structure of Program

BRS does not perform research. BRS regulates the introduction (importation, interstate movement, and release into the environment) of GE organisms that may pose a risk to plant health. Researchers and product developers, Federal or private, should understand and work with the appropriate regulatory agencies that may have oversight of an organism at different stages in the development of a product. This can facilitate efficient development of the appropriate information necessary for regulatory review.

Since 2009, BRS has provided compliance assistance to the regulated community for the voluntary adoption of a Biotechnology Quality Management System (BQMS) Program. A BQMS serves as an important tool to help organizations involved in biotechnology research and development analyze the critical control points within their management system to better maintain compliance with USDA APHIS regulations for the import, interstate movement, and environmental release of regulated GE organisms (7 CFR part 340).

The BQMS Program integrates a dynamic, science-based approach of risk assessment and mitigation, allowing for sound decision making and effective management of the research and development of regulated GE organisms. The program integrates principles from other quality management systems, such as the Codex Alimentarius Hazard Analysis Critical Control Point System and ISO 9001:2008. The BQMS program offers to organizations a flexible approach to implementing a quality management system, where the BQMS is tailored to the organization's individual size and research scope. The BRS Office of Compliance Assistance provides participants with the tools and guidance needed to develop a BQMS through training, documented guidelines and one-on-one assistance. BRS provides an initial assessment of an organization's regulatory compliance processes and assists with periodic reviews and audits of the organization's BQMS. Twenty two organizations, including public sector research institutions and multi-national corporations, have voluntarily established a BQMS within their organization through the services provided by BRS. These organizations share common goals of responsible research and facilitating regulatory compliance. Information on the APHIS BRS BQMS Program can be found at http://www.aphis.usda.gov/biotechnology/compliance_assistance_main.shtml

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2.5. International Services (IS)

http://www.aphis.usda.gov/international_safeguarding/index.shtml

2.5.1. Mission Statement

The International Services (IS) Mission is to advance the Agency's mission of protecting the health and value of U.S. plant and animal resources through its overseas programs and workforce.

2.5.2. Nature and Structure of Program

IS' presence abroad enables the Agency to monitor and respond to pest and disease threats, develop international strategies and partnerships to prevent their spread to the United States, and support U.S. agricultural trade through the resolution of technical barriers. Through its services, IS contributes directly to global food security by promoting safe global trade and facilitating the development of science-based regulatory systems around the world. IS works closely on an ongoing basis with its sister units, including VS, PPQ, BRS, WS and other headquarters staff to ensure that its day-to-day work overseas reflects the priorities of these domestic programs. This collaboration is key to IS' success and is achieved through joint planning, enhanced communications, clear direction to the field, and implementing coordinated strategies.

Consistent with the APHIS mission, IS' overall strategic goals are the following:

- IS Goal 1: Protect U.S. agricultural and natural resources by working with foreign governments to prevent the spread of high-risk plant pests and animal diseases.
- IS Goal 2: Facilitate the safe international movement of agricultural commodities, including those derived from modern biotechnology, through science-based regulations and internationally accepted standards.
- IS Goal 3: Enhance global health and U.S. biosecurity through the development of science-based regulatory systems and policies around the world.

IS supports APHIS Program Unit work overseas related to technology transfer through creating linkages and supporting partnerships, collaborations and cooperative programs.

While IS did not have any specific goals related to technology transfer, IS supports APHIS Program Unit work overseas related to technology transfer through creating linkages and supporting partnerships, collaborations and cooperative programs. For example, in the island of Hispanola, IS assisted in the continued study of swine field samples, which APHIS collected with the governments of Haiti and the Dominican Republic. This allowed IS to help set a multi-pronged strategy for the ongoing classical swine fever (CSF) eradication efforts and for controlling Teschen's Disease, a new swine disease to the island.

In an experimental field trial, a commercial swine vaccine was used to improve the population's immune status, and an experimental autogenous Teschen's vaccine was produced in the US by APHIS for a field trial in Haiti and possibly in the Dominican Republic. IS, also continued to assist with the efforts to install modern CSF laboratory diagnostics in both national veterinary laboratories.

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3. Agricultural Research Service (ARS)

<http://www.ars.usda.gov/main/main.htm>

3.1. Mission Statement

ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provides 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 U.S. natural resources and the environment; and
- provide economic opportunities for rural citizens, communities, and society as a whole.

3.2. Nature and Structure of Research Program

ARS is USDA’s principal intramural scientific research agency. Agency goals are to find solutions to agricultural problems that affect Americans every day, from field to table, such as (a) protecting crops and livestock from pests and diseases, (b) improving the quality and safety of agricultural products, (c) determining the best nutrition for people from infancy to old age, (d) sustaining our soil and other natural resources, (e) ensuring profitability for farmers and processors, and (f) keeping costs down for consumers.

ARS employs over 8,000 people; approximately 1,950 permanent full-time scientists and approximately 3,300 technical and support staffs conduct research in projects funded by Congressional appropriations at more than 90 locations. Research projects are managed as 19 National Programs (Table 1). The Office of National Programs in Beltsville, MD plans the scope and objectives of Agency’s research projects, while eight Area Directors implement research projects at the locations in their geographic areas.

Table 1. Research program management of ARS, showing 19 National Programs in four pillars.

Animal Production & Protection	Natural Resources & Sustainable Ag Systems	Crop Production & Protection	Nutrition, Food Safety and Quality
Food Animal Production	Water Availability & Watershed Management	Plant Genetic Resources, Genomics & Genetic Improvement	Human Nutrition
Animal Health	Climate Change, Soils, and Emissions	Plant Biological & Molecular Processes	Food Safety (animal & plant products)
Veterinary, Medical, & Urban Entomology	Pasture, Forage & Range Land Systems	Plant Diseases	Quality and Utilization of Agricultural Products

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Aquaculture	Bioenergy	Crop Protection & Quarantine	
	Agricultural & Industrial Byproduct	Crop Production	
	Agricultural System Competitiveness & Sustainability	Methyl Bromide Alternative	

ARS conducts a series of reviews designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. Customer input helps keep the research focused on the needs of the American food and agricultural system. Plans for each of the approximately 1,000 research projects undergo a thorough independent external prospective peer review managed by the Office of Scientific Quality Review (OSQR). All ARS employees, including the scientific workforce, are subject to annual performance reviews, and all scientists and engineers have technology transfer as a performance element in their annual performance appraisal. Senior scientists undergo a rigorous peer review (Research Position Evaluation System-RPES) on a 3- to 5-year cycle. These processes ensure the continuing high quality output of the ARS research addressing the needs of U.S. agriculture.

3.3. ARS Approach and Plans for Conducting Technology Transfer

Because of the delegations of authority by the Secretary (stated previously), ARS's Office of Technology Transfer (OTT) is assigned the responsibility for obtaining patent protection for intellectual property (IP), developing strategic partnerships with outside organizations, and performing other activities that effectively transfer ARS research outcomes and technologies to the marketplace. USDA's Office of the General Counsel provides legal guidance to OTT in regard to intellectual property

The technology transfer program is centralized in policy and approval procedures, and provides one-on-one customer service to intramural researchers through *Technology Transfer Coordinators (TTCs)* in the Area Offices. To facilitate technology transfer, the office is organized into five sections. The *Administrative and Headquarters Section* conducts day-to-day operations, coordinates technology transfer policy development, and executes licenses and Cooperative Research and Development Agreements (CRADAs). The *Patent Section* (8 in-house registered patent agents) provides strategic guidance to scientists in protecting IP, coordinates invention reports and Invention Disclosure Review Committees, prepares and prosecutes patent applications, and oversees any patent applications prepared by cooperator law firms for domestic and foreign patent rights and contract law firms for foreign patent rights. The *Licensing Section* (4 specialists) negotiates licenses for IP developed by intramural scientists in any USDA agency and monitors license performance. The *Technology Transfer Coordinators (TTCs)* are strategically stationed across the United States and serve as liaisons with scientists, ARS managers, the patent advisors, licensing specialists, university partners, and the private sector. They also negotiate CRADAs and other technology transfer agreements.

Technology transfer is accomplished through many mechanisms, such as:

- developing written information for customers and stakeholders, including scientific publications, publications in trade journals, and reports to stakeholders;
- releasing plant germplasm to the public;
- transferring research materials to scientists outside of ARS;
- entering into formal partnership agreements, such as CRADAs, and other cooperative agreements;

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- delivering specific research results to regulatory agencies to support their actions;
- licensing IP (patents, Plant Variety Protections Certificates, and biological materials);
- participating in meetings with industry organizations and universities, workshops and field days; and distributing information to the public via the ARS Information Staff, the National Agricultural Library, and other sources.

Because the ARS mission is to transfer technologies for broad public use by the most effective mechanism, ARS pursues patents and licensing principally when this facilitates technology transfer to the marketplace. This is usually the case when complementary investment by the private sector is necessary to commercialize a product, and patent protection is required to protect this investment. By policy of ARS, IP considered a research tools is not protected so as to encourage scientific research. In licensing practices, ARS continues to reserve the right to allow use of any protected technology for research purposes (non-commercial).

Meaningful performance metrics in technology transfer are often difficult for research agencies. ARS is continuing to work on defining better metrics for technology transfer within USDA. For example, for ARS, successful outcomes may include improved agricultural practices, scientific information that enhances U.S. competitiveness, increased awareness about pathogens to help prevent human and animal diseases, or findings that help corporations and universities make informed decisions in allocating their research resources. Many of these outcomes do not require a patent and subsequent license for implementation. Additionally, ARS uses its ATIP program (see below) to gather economic impacts of technology adoption by private sector partners, including jobs created, regional impact on the economy, and ability to match technical expertise of intramural researchers with firms who can capitalize on this national network of labs, regardless of geographic proximity to the businesses.

Licensing policies also promotes small business success with nominal licensing fees in the early years, but with annual maintenance fees and royalties that escalate in outyears, usually after sales of product have begun. Terms of sublicensing by the exclusive licensee also incentivize small-businesses, in that the licensee retains a substantial percentage of all fees and royalties arising from the sublicenses. This policy further enhances commercialization by encouraging broadest utilization of a federal invention. ARS also incentivizes scientists on the reporting of inventions, patenting, and licensing by providing 25% of the license revenues to inventors (statute requires $\geq 15\%$). Thus, there are policies in place that incentivize commercialization, minimize transaction costs, yet provide fair and equitable compensation for those who create federal innovations. Development of the ATIP program further enhances opportunities for the outcomes of scientists to be adopted, thereby documenting impact of their accomplishments which is used in evaluating promotions.

These are all parts of a robust and effective technology transfer program that consists of a variety of mechanisms and programs to complement the research conducted by the agencies. The technology transfer program must be clearly communicated to scientists in a *Policy and Procedures* document that describes responsibilities, opportunities, and processes to effect technology transfer.

3.4. Agricultural Technology Innovation Partnership program (ATIP)

ARS established ATIP to further enhance likelihood that USDA intramural research outcomes would be adopted by the private sector for commercialization. Although replete with scientific expertise, the intramural research components of USDA do not have the resources nor the authority to provide business partners of USDA (licensees) with marketing, manufacturing, and fiscal resources (complementary assets) needed by them for their businesses to be successful. Consequently, ATIP was established to

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strategically form geographic partnerships with well-established economic development entities that excel in providing the complementary assets that ARS cannot. Ten organizations across the U.S. each have a Partnership Intermediary Agreement with ARS Office of Technology Transfer to formalize their membership in ATIP. This network represents a novel approach to enhance and accelerate commercialization of USDA-ARS research outcomes.

The ATIP Network is comprised of 9 technology-based economic development (TBED) “Partners”, each serving as a portal anchored to an ARS Area. Partners become members of ATIP through a Partnership Intermediary Agreement (PIA) executed with the Office of Technology Transfer. Members of ATIP include the Maryland Technology Development Corporation (TEDCO), Mississippi Technology Alliance (MTA), Wisconsin Security Research Consortium (WSRC), Georgia Research Alliance (GRA), Ben Franklin Technology Development Authority (BFTDA), Kansas Bioscience Authority (KBA), Center for Innovation at Arlington, TX (CFI), California Association for Local Economic Development (CALED), and the Center for Innovative Food Technologies, Toledo, OH (CIFT).

In 2011, the members of ATIP established a Foundation to provide a unifying entity independent of ARS, as well as, the flexibility to engage other organizations that have a vested interest in seeing USDA research outcomes adopted by the private sector. Foundation objects are: (1) Expedite the transition of USDA-ARS technologies from USDA-ARS labs into the commercial sector; (2) Seek funds to support the research needs of the USDA-ARS; (3) Develop industry access to utilize USDA-ARS research and research facilities; (4) Create sustainable communities by promoting regional innovation clusters, supported by USDA/ARS research outcomes; and (5) Host regional events co-sponsored with USDA-ARS, showcasing technologies and research capacity.

The Foundation’s interface with the USDA-ARS for seeking funds to support ARS research needs will be through the USDA-ARS Liaison Committee (LC). The LC is an internal USDA committee and not a part of the Foundation. The LC serves three primary purposes: (1) to ensure the independence of USDA-ARS research activities; (2) maintain mission relevance; and (3) align the purpose of research and mission with the work of the ATIP Foundation.

In FY 2012 the ATIP accomplished:

- **Foundation**

Developed and initiate an administrative structure and strategy plan for the ATIP Foundation. Developed a white paper on the common message for the ATIP program that can be used by ATIP members and ARS in presentations to stakeholders. This paper was used by ARS to create a brochure on the program (<https://www.ars.usda.gov/sp2UserFiles/Place/01090000/ATIPbrochure.pdf>).

Co-PI on NIFA grant “Accelerated Development of Commercial Hydrotreated Renewable Jet (HRJ) Fuel from Redesigned Oil Seed Feedstock Supply Chains.” ATIP’s role is to organize rural business development forums to identify regional issues that are perceived as barriers to establishment of advanced biofuel supply chains, and build bridges for development of expanded trans-supply chain partnership networks.

- **California Association for Local Economic Development (CALED)**

Held a Strategic Planning Conference to discuss refinement and realignment of CALED

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priorities incident to its change in leadership and changes to Economic Development resources in California.

Utilized WIN (CALED Steering Committee is also known as Western Innovation Network or WIN) as its advisory group for the Innovation Portion of an EDA grant. ARS is expected to play a role in this grant. Facilitated ARS presenting information on research capacity and opportunities for partnering at numerous meetings: San Joaquin Valley Regional Economic Summit; City of Maricopa / AzBio meeting; Project 17 / Salinas Economic Development Meeting; and Project 17 / CSU Monterey Bay.

Facilitated discussions at the Chico Sierra Nevada Challenge on partnering opportunities. Led to a follow-up meeting to identify appropriate ARS technologies and research capacities to support Chico-area businesses and economic development .

Involved in discussions on applications of broadband technologies for Fresno-area economic development with USDA-ARS, USDA-Rural Development, and Lawrence Livermore National Laboratory (8/31/2012).

- **Center for Innovation (CFI)**

Established in 2010 TechComm as an inter-Department coalition of five Federal Departments (USDA, U. S. Department of Defense, U.S. Department of Homeland Security, National Institutes of Health, and U.S. Department of Energy) to coordinate technology transfer across the Departments. TechComm is establishing a network of “affiliate partner intermediaries,” comprised of corporations, universities, economic development organizations, trade associations, venture funds, municipalities, and government entities throughout the U.S. CFI works with and through this network of affiliate partners; connecting the affiliate partners to TechComm’s Federal partner Departments and labs, thereby enabling technology transfer and commercialization on a broad, national and international scale.

Established in 2012 the Beta Lab Network, with 14 Federal labs to work directly with the CFI on in the development of the TechComm model. The Beta Lab Network engages these selected federal labs to provide guidance, direction, and oversight to TechComm on how federal labs can interact with TechComm’s “Affiliate Partner Network” of corporate, university, economic development, venture capital, and municipal affiliates. TechComm works with and through the Beta Lab Network to develop its processes, leveraging its Affiliate Partner Network to commercialize Beta Lab technologies and invite R&D through cooperative research.

Established strategic goals, as well as the initiatives and projects necessary to achieve the goals and managed four “Industry Consortiums.” These Consortiums are essentially collaborative coalitions comprised of government, academic, and industry partners, focused on emergent opportunities in (1) biofuels, biochemicals; and bio products; (2) unmanned aircraft & vehicle systems, (3) software development: and (4) health care/medical device opportunities.

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- **Center for Innovative Food Technology (CIFT)**

Facilitated the use of USDA-ARS patented technologies by students in classes at Bowling Green State University Dallas Hamilton Center for Entrepreneurial Leadership. These technologies were selected based on relevance to the local industry. Students presented their class results to more than 40 representatives from Ohio companies.

Held an Agricultural & Business Innovation Forum on specific specialty crop varieties for food processing or regional applicability, new market opportunities, organic and sustainable production practices, composting, soilless mixtures for increased performance, spray application technology, disease detection and reduction, emerging pests, the impact on season extension both in varieties and profitability, and funding outlets to support operations. More than 75 growers and industry partners attended. Local congressional leaders and Deputy Secretary Merrigan were among the presenters. This was the official rollout announcement of similar activities throughout the ATIP network.

Held an Agricultural & Business Innovation Forum on chemical detection capabilities, hyperspectral imaging, sensor technology, potato cultivars, vegetable oil investigations, and advanced ingredients. More than 20 food processors and suppliers attended.

Collaborated with Ohio Bio-products Innovation Center (OBIC) to present several webinars for publicizing USDA-ARS technologies to a broad audience. At least two companies are in further discussion on commercializing presented technologies.

- **Georgia Research Alliance (GRA)**

Identified significant research projects and commercialization efforts at its six partner universities for research and development collaborations with South Atlantic Area of the Agricultural Research Service. Including: To address the staggering obesity issue in Georgia, where 65 percent of adults and 40 percent of children are overweight or obese, the University of Georgia has launched an Obesity Initiative. Led by GRA Eminent Scholar Cliff Baile, the initiative involves more than 100 faculty from a variety of disciplines and will examine the issue from research, technology and community perspectives.

- **Kansas Bioscience Authority (KBA)**

Awarded \$868,515 in Research Transition Program funds over three years in support of a team of researchers led by Kansas State College of Veterinary Medicine and USDA-ARS Arthropod-Borne Animal Diseases Research Unit to establish diagnostic and control methods to address Schmallenberg virus (SBV). SBV is an emerging animal disease causing considerable losses in European cattle, goat and sheep herds. The bio-containment work for this project will be conducted in the Biosecurity Research Institute (BRI) at Kansas State.

- **Mississippi Technology Alliance (MTA)**

Managed the MS Biomass and Renewable Energy Council which will provide some good cross-over activities with USDA. Completed a statewide study for Mississippi BIO in conjunction with Battelle to kick-start BIO industry group. Interviewed ARS Research Leaders in Stoneville to determine their laboratories research competencies. Interview information will be used to determine the level of Industry-academic-government

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partnerships, collaborations, and research commercialization in Mississippi. Distributed ARS patent portfolios to potential cooperators for commercialization.

- **Maryland Technology Development Corporation (TEDCO)**

Took the lead for the Foundation on the NIFA grant “Accelerated Development of Commercial Hydrotreated Renewable Jet (HRJ) Fuel from Redesigned Oil Seed Feedstock Supply Chains” (see above under Foundation).

Held an Agricultural & Business Innovation Forum on water management, greenhouse management and aquaculture. Irrigation systems, cover crops, utilization of fish culture with aquaponics and year-round utilization of greenhouses were some of the major issues for producer growers in the Mid and Upper Shore region. Attended by over 50 growers and farmers. In addition, ATIP members participated in this Forum, as a “training session” for adopting this format across the ATIP landscape.

USDA commercial partners received technical and business assistance through the Rural Business Innovation Initiative (RBI²). TEDCO business mentors provide assistance to technology-based companies in five rural regions of Maryland. The goal of RBI² is to help companies advance to the next growth level through intensive mentoring. Companies may receive special projects for prototype development or in depth business analysis.

Hosted a meeting of University of Maryland Extension (UME) agents across the state and ARS scientists to discuss how Extension could work more closely with ARS. UME director Andy Lazur led the discussion on extension activities on possible projects.

- **Pennsylvania Ben Franklin Technology Development Authority (BFTDA)**

Held monthly discussions with state agency partners, PA Department of Agriculture and PA Department of Conservation and Natural Resources in which ARS research capacity and technologies were discussed.

- **Wisconsin Security Research Consortium (WSRC)**

Developed relationship with the Wisconsin Energy Research Consortium to focus on the commercialization of bio fuels. Connected ARS researchers and the Consortium to discuss collaboration.

Facilitated the use of USDA-ARS patented technologies by students in CAPStone classes at the University of Wisconsin at Oshkosh. This program is currently in its 3rd year. Teamed with the Wisconsin Innovation Network to allow the students to present their business plans to regional businesses. Over 20 people attended this event.

Coordinated a meeting with key leadership from the University of Wisconsin at Platteville about the possibility of UW Platteville providing their farming 101 course ARS researchers who may not have a farming background. This would provide the ARS researchers an opportunity to work on a research farm and develop a better understanding of how their research may impact farm operations.

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3.5. Technology Transfer Accomplishments

- ARS continues to prioritize the development of collaborative research projects with ARS scientists for near-term commercialization of outcomes. CRADA numbers were slightly lower from 1 CRADA per 27 scientists in FY2011 to 1 CRADA per 35 scientists in FY2012. The total number of other R&D agreements was also down from slightly from more than 1 agreement per 1.5 scientists in FY2011 to slightly less than 1 agreement per 1.5 scientists in FY2012. The number of agreements per scientist has been inconsistent over the last five years and no trends can be noted. 53 new CRADAs were executed and the research was expanded in 82 active CRADAs. The current 243 active CRADAs are valued at nearly \$125M over the course of their life (up to 5 years) with \$22M in funds directly to ARS researchers. The trend in research is to form large multi-disciplinary teams. This is reflected in the number of CRADA having multiple partners which has more than doubled in the last three years. Approximately half of the active CRADAs are with U.S. small businesses. See Figures 1, 2 and 3 in Section 10.
- ARS received 137 new invention disclosures and filed 108 patent applications with the U.S. Patent and Trademark Office (USPTO) in FY2012. Approximately 8% more invention disclosures were received this year as compared to last year. If we take into account a 12% drop in the number of scientists in FY2012 (1835) compared to FY2011 (2094), the increase in invention disclosures is quite significant. As compared to FY2011, there was significant increase (nearly 3-fold) in the percentage of ARS-University co-owned disclosures in FY2012. This reflects the fact that ARS scientists are located on the campus of many of the 1862 Landgrant Universities. A trend can be seen in an increase in the number of invention disclosures on plant cultivars. ARS, as well as our university collaborators, is adapting with new policies to the industry trend and standard. Our industry stakeholders are changing from a system of publically released plant cultivars to a system of protection and more intense marketing. See Figure 4, 5, 6, and 7 in Section 10.
- The ARS patenting and licensing program has a strong emphasis on partnerships with small businesses and universities. Of the 31 new licenses that were executed, 15 (48%) were to small businesses and 12 (39%) to universities. Even though the number of income bearing licenses has steadily increased from 313 to 360 over the last five years, the percent of those licenses that were granted exclusively remained constant at ~70%. Over 60% the revenue generated came from 2 licenses. See Figure 8 and 9 in Section 10.
- The number of peer-reviewed publications per scientist has steadily been increasing from 2.4 in FY2009 to 2.7 in FY2012. The number of presentations at meetings, as reflected in the number of abstracts, has remained constant at a little less than 2 per scientists. See Figure 10 and 11 in Section 10.
- A new position (Technology Transfer Liaison) was created. The major emphasis of this position will be to coordinate the Agricultural Technology Innovation Partnership (ATIP) activities across Areas. Currently, the Technology Transfer Coordinator (TTC) located in the field is responsible for utilizing their ATIP partner for technology transfer in their Area. OTT-HQ is responsible for coordinating ATIP activities across the Areas. Until the TTL position was created, OTT-HQ did not have adequate resources to effectively coordinating ATIP across ARS. It is expected that this position will be foundation for reorganizing how ARS “markets” its technologies and research capacities. We expect that ATIP will play a leading role in these technology transfer activities.

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- Cooperative Research and Development Agreement's (CRADA) Statements of Work and their review process was streamlined for more efficient and effective National Program Staff approval. By discovering issues and addressing them early in the process, the total negotiating time is significantly reduced.
- A list of ARS scientist and engineers based upon their scientific research expertise was created. This list will be used internally within ARS to more efficient identify the appropriate researcher for collaborative projects with ATIP and NIFA-SBIR commercial partners, as well as other outside parties (see USDA-8 below).
- A number of different consortium agreements with ARS and multiple public and private sector partners were developed. The ARS partners in these agreements include both foreign and US entities. Negotiation of these agreements is complex due to divergent IP ownership and policy issues. These consortium agreements define the technology transfer strategy for the collaborative research which is required before the teams can apply for funding.
- A series of in-person talks and webinars with University Cooperative Extension specialists were held to enlist their support for holding the listening session component of ARS-ATIP Rural Agriculture and Business Innovation Forums (see USDA-7 below). One of the roles of Extension is in community and economic development. In this role, they have direct contact with the local government officials, businesses and farmers/ growers/ ranchers within the community. This connection would greatly improve the quality and efficiency Forum listening sessions.
- Worked with the Eureka program of NIST to created Merwyn Business Simulation reports for ARS technologies that are in the public domain. The reports will be uploaded to the NIST National Innovation Marketplace web site. Many ARS research results are in the public domain and this is a novel way of reaching the private sector with “free” technology.
- An ongoing series of discussions was begun between OTT and ONP to develop specific technology transfer strategies for each of the research programs. The results of specific research program may require a unique technology transfer strategies. For example, a large animal vaccine may require a patent and a license to a large business; while the creation of new plant germplasm may require public access. By knowing the technology transfer strategy for a specific research program, one can be proactive in developing the appropriate partnerships for transfer solutions to stakeholders.
- An agreement with CAB International was developed to provide public domain data from ARS to their Plantwise Knowledge Bank. Plantwise collects and makes available on the web valuable data on the identification, distribution, and control of plant pests/diseases. This data, harnessed effectively, can form this basis of an early warning system alerting the plant health community to a change in distribution of existing pests/diseases or the threat of a disease in a new region.
- The ARS Partnering website and the brochure “Forming Partnerships with the Agricultural Research Service” (<https://www.ars.usda.gov/sp2UserFiles/Place/01090000/Partnership%20Brochure.pdf>) were updated.

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3.6. ARS response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Business

In the USDA's implementation plan for the Presidential Memorandum, ARS described 13 initiatives to promote technology transfer and commercialization. Most of the initiatives described in this plan will begin in FY 2013; however several of the initiatives were already in place in FY 2012. The initiatives and their implementation in FY 2012 are described below.

USDA 1: New metrics proposed for standard annual reporting in addition to those required by Circular A-11 instructions on annual reporting of technology transfer

Over the past few years, ARS has added tabular metrics beyond those required by OMB Circular A-11 instructions for annual reporting to Congress as part of the President's budget submission. In response to this Presidential Memorandum, ARS initiated several new performance metrics (Table 3) above those already reported in the Annual Report on Technology Transfer, and formalized those that had been added voluntarily. These metrics will enhance our ability to better monitor partnerships with small businesses, and/or quantify some activities specific to USDA technology transfer.

Table 2. New metrics included in the standard annual reporting in addition to those required by Circular A-11 instructions on annual reporting of technology transfer.

General TT Activities	CRADA-related	Invention / Patent-related	License-related	Partnership intermediary-related (ATIP)
# plant varieties released	# of small business CRADA partners	# of jointly owned inventions / patents with universities	# of small business licenses	# companies reviewing inventions available for licensing
# of germplasm requests and amounts distributed	# of CRADAs modified with an expanded research plan (reflects a measure of satisfaction by private sector partner)	# of jointly owned inventions / patents with small entity owners	# joint inventions licensed to university co-owners	# CRADAs and licenses facilitated by PIA partners
# of Material Transfer Research Agreements (MTRA; new agreement)	# of personnel employed on CRADA research funds	# of Patent Cooperation Treaty applications filed	earned royalty income received from commercial sublicensees reported by university co-owners	# of transactions facilitated by ATIP member (includes entrepreneurship school engagements, tours of facilities, presentations to potential USDA partners, etc.)

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Provide examples of significant technology transfer outcomes (transactions) that did not involve a patent and license	# of CRADAs by subcategory <ul style="list-style-type: none"> • with private sector • with universities • with governments (state / federal) • with multiple parties 		
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USDA 2: Update Policy and Procedure (P&P) 141.2 “Technology Transfer in ARS”

An update is necessary to reflect statutory changes since 2000, and to reflect changes in structure and operation of Invention Disclosure Review Committees, licensing of biological materials, and use of intermediaries. ARS’s Program Leadership Team (PLT) is taking holistic look at technology transfer in ARS. The PLT believes that conducting high quality research will have little impact without a robust and broad technology transfer program. They are currently redefining the roles of the Office of Technology Transfer, Line Management, and the Office of National Programs in technology transfer. Once the roles are defined, a new P&P will written.

USDA 3: Expand Agricultural Technology Innovation Partnership (ATIP) efforts to enhance access of complementary assets to partners of USDA

ATIP members provide the current or prospective private sector partners of ARS with access to business mentors, entrepreneur schools, and seed and venture funds (see ATIP FY2012 accomplishments described above).

The Wisconsin Security Research Consortium in collaboration with the University of Wisconsin at Oshkosh used technologies developed by both ARS and FS to provide real life entrepreneurial experiences in the University’s business classes. Students conducted market research and developed business plans that could be used by companies to commercialize the USDA technologies.

USDA 4: Expand outreach efforts of Office of Technology Transfer (OTT) to scientists and engineers in ARS

A series of fact sheets were developed that helped scientists and engineers navigate the principles and policies concerning industry partnerships. Created a monthly newsletter (USDA-ARS Grantsmanship Times) that provides updates to researchers on finding funding, forming partnerships and collaborations; preparing and submitting grant proposals; intellectual property management strategy; and new ARS initiatives, policies and procedures. These facts sheets and Newsletters were posted on a newly created Partnerships and Grants SharePoint site.

The number of users visiting the Partnerships and Grants SharePoint site increased from a total of 228 in 2011 to 427. Of these, 279 are scientists, 14 are agency leadership, 35 ONP staff, and 64 program/agreement support staff.

Began the development of a series of training events organized by ARS National Program rather than

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general training by geographic area. This approach will result in more robust technology transfer approaches tailored to the agricultural industry sector served by the scope of the national program. For example, training to the scientists working on human nutrition and development of more nutritious foods will differ in partnership approaches from training of scientists working in water and soil management. Held the first discipline oriented (insect biocontrol) training that included both OTT and Office of National Program staff.

USDA 5: Encourage other S&T agencies to adopt OTT's approach to technology transfer

This initiative will be begin in FY2013 and will require leadership of the USDA Chief Scientist through her Council composed of the USDA science agencies. The result would be a "one USDA" approach to policies and procedures of technology transfer. Consequently, USDA would be able to provide more uniform nurtured relationships for common customers and stakeholders of agencies in USDA.

Provided input to FAS on the development of international ATIP-like organizations to help developing countries to create the infrastructure required to efficiently and effectively provide to their farmers and businesses innovations and technology-based solutions to their agricultural problems. In FY2013, a series of workshops will be held in the US and Egypt to implement an ATIP like structure in Egypt.

USDA 6: Explore expanded use of Enhanced Use Lease authority as technology transfer tool to promote longer term relationships with key customer groups

Enhanced Use Lease (EUL) is an authorization that allows non-government entities to access and invest in underutilized federal facilities, and in exchange for their investment, can lease the facility for up to 30 to 50 years at fair market value. The length of the lease varies by specific congressional authorization. ARS currently has EUL pilot authority for only for the Beltsville Area. ARS developed a policy and procedure (P&P) for using EUL strictly as a technology transfer tool; no other agency with EUL authority (e.g., VA, DoD, NASA) has used it in this manner. The EUL authority expired. We are waiting for renewed authority in the new Farm Bill.

USDA 7: Beginning in FY 2012 / 2013, roll out a nationwide series of regional forums to identify issues and deliver solutions

Our ATIP Partner, Maryland Technology Development Corporation (TEDCO) established the Rural Business Innovation Initiative (RBI²) program to enhance commercialization activities and provide technical and business assistance to small early-stage, technology-based companies in the rural areas of Maryland as defined by the Rural Maryland Council. Through this program, TEDCO and USDA-ARS partnered to hold a number of regional events, called "Maryland Rural Agriculture and Business Innovation Forums." The goal of these forums was to provide to rural farmers and businesses innovations and technology-based solutions to their regional agricultural problems. The forum approach entailed several steps: (1) A series of regional listening sessions comprised of businessman, farmers, economic development, regulatory and extension personnel were held to identify a broad list of regional issues. (2) From the list of rural issues, TEDCO and ARS selected those issues that were related to agriculture and had an existing research-based solution, or represented researchable issues that could be addressed by ARS. (3) ARS & TEDCO selected a smaller group from those that attended the first listening session for an in-depth discussion of the vetted list of rural issues. (4) Based upon the in-depth discussion, the forum was convened as a roundtable discussion to address the topic issues with farmers, agri-business

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professionals, university and ARS researchers, extension service personnel, rural development personnel, NIST-MEP, and funding and regulatory agency personnel.

The goal of this initiative is roll out the forums nationwide. One forum has held in MD on Aquaculture and Water Management. Two forums were held in OH for specialty crops farmers and food producers. These forums are described in detail in the ATIP FY2012 accomplishments described above.

USDA 8: Provide opportunities for applicants to the USDA Small Business Innovation Research (SBIR) program to partner with ARS scientists to further develop science necessary for business success

This initiative is operated jointly with NIFA, who manages the SBIR program for USDA. This initiative includes both funded and unfunded SBIR applications. SBIR applicants (post award announcements) would be provided with information on partnering with ARS, and would receive information from the ATIP Foundation and the ATIP member proximal to applicant to help facilitate partnering with ARS.

In FY2012, OTT and SBIR created letters that were sent to ARS CRADA partners and SBIR applicants. In the one letter, ARS encouraged their CRADA partners to submit SBIR grant proposals. In the other letter, SBIR encourage their FY2012 applicants that needed research expertise to contact ARS for help.

USDA 9: Provide Cooperative Research and Development Agreement (CRADA) partners opportunity to link to local MEP resources to assist in commercialization efforts

This initiate will begin in FY2013. In partnership with NIST MEP, all CRADA partners of ARS would be provided local / regional MEP service provider for consultation on issues of scal-up and product improvement.

USDA 10: Partner with the University of Mississippi’s “Insight Park” for extraction, chemical analysis, and scale up of natural products for production agriculture and pest / pathogen / disease vector management

This initiative would directly address Section 4 of the Presidential Memorandum in establishing joint partnerships with university research parks, incubators, and other state / community economic

development organizations. Similarly, such efforts could be piloted at ARS facilities should an expansion of EUL authority be granted to USDA. DoD’s Armed Forces Pest Management Board, and the Office of National Programs, USDA ARS, have identified development of next generation insect repellents as the priority project.

A three way CRADA was signed to combine the research expertise of ARS in entomology and the University in chemistry with a small business to develop a new biobased pesticide. The small business submitted an USDA-SBIR proposal on this research. Once the SBIR research is accomplished, the University’s incubator facility will be used for commercial scale up.

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USDA 11: Partner with the National Cancer Institute (NCI) on “Enhancing translation of nutrition science from bench to food supply”

At an escalating pace, scientific discovery reveals multiple approaches with the potential for exploration and eventual application to benefit society. At the same time, human, financial, and natural resources are severely constrained. This initiative is directed at developing public / private partnerships with the federal science agencies and food industry to translate research outcomes into the food supply. Joint USDA / NCI sponsored workshops have established priorities.

Discussions with the ATIP Foundation and Foundation of the National Institutes of Health were held to determine how these organizations might be able to support the initiative. More extensive discussion will be held to develop a plan on how these foundations may be able to obtain funds to support the initiative.

USDA 12: Evaluate various options for reducing license negotiation transaction costs

The Licensing Section is currently reviewing several proposals for establishing standard pre-commercialization license terms for all CRADA Subject Inventions. The possible benefits include: creating business certainty for CRADA partners; providing an additional incentive to enter into a CRADA with ARS; and reducing transaction costs for both the CRADA partner and ARS.

There are, however, some serious considerations to this proposal. For example, some inventions have much greater market potential than others and would therefore ordinarily command larger license fees. If standard terms are applied to all inventions regardless of the size of the potential market, then the standard payment amounts must necessarily be sufficiently low to be reasonable for smaller market opportunities. This may result in a reduction in license revenues over time. Because technology transfer is an unfunded mandate, ARS uses license revenues to help support technology transfer activities, including the payment of patent filing and maintenance costs, negotiation of CRADAs and other collaborative research instruments, training of scientists and engineers, etc. Consequently, a reduction in license revenues would negatively impact ARS technology transfer efforts broadly. Therefore, proposals for the establishment of standard pre-commercialization license terms for all CRADA Subject Inventions will be evaluated based on both effectiveness in reducing transaction costs and impact on projected future license revenues. Several different models were developed for further evaluation.

USDA 13: Develop Material Transfer Research Agreement (MTRA) as a new instrument to promote development and commercialization of materials from USDA

USDA scientists create new materials that may have value in further research and development with the private sector. Current Material Transfer Agreements (MTA), widely used by USDA, only allow the transfer of materials, but not engagement in joint research between the provider and the recipient of the materials. This new agreement will serve as the authorization to conduct some joint research on the materials transferred. Because this instrument would not convey rights to negotiate exclusive licenses to any intellectual property arising from the research, it is intended as an early stage opportunity for proof of concept that may lead to more extensive research that would be conducted under a CRADA.

The MTRA was created by combining the Material Transfer Agreement and the Trust Fund Cooperative Agreements authorities. MTRA templates were created and integrated into the agreement process.

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3.7. Metric Tables

Table 3. Collaborative Relationships for Research and Development (R&D)

Ref #	Agricultural Research Service (ARS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
1	• CRADAs, total active	230	233	262	275	243
2	- Newly executed	69	69	83	78	53
	▪ Amendments ¹ , newly executed	76	74	91	91	82
3	▪ Traditional CRADAs, total active	202	191	208	190	180
4	- Newly executed	63	51	59	57	39
7	▪ Non-traditional CRADAs, total active	28	42	54	85	63
8	- Newly executed	6	18	22	21	14
	▪ Material Transfer - CRADA, total active	3	10	16	29	14
	- Newly executed	1	7	10	10	8
	▪ Master, total active	1	1	1	1	1
	- Newly executed	0	0	0	0	0
	▪ Multiple Cooperators, total active	12	15	18	32	34
	- Newly executed	3	5	7	9	3
5	▪ Small Business Cooperators, total active	ND	ND	ND	ND	125
6	- Newly executed	ND	ND	ND	ND	20
	▪ Foreign Cooperators, total active	12	16	19	23	14
	- Newly executed	2	6	5	2	3
	• Other Collaborative R&D Relationships					
	▪ Confidentiality Agreements, newly executed	270	251	246	309	317
	▪ Material Transfer Agreements, newly executed	884	784	885	1038	970
	-Outgoing materials	648	550	633	672	661
	▪ Material Transfer Research Agreements, total active	ND	ND	ND	ND	12
	- Newly executed	ND	ND	ND	ND	12
9	▪ Other Agreements ² , total active	5,466	9,960	11,214	13,007	13,835
10	- New executed	1,729	1,381	1,273	1,525	1,119
	• Publications, total	13,996	11,300	11,459	11,260	10,450
	-Peer-Reviewed Scientific Publications	6,335	5,085	5,083	5,279	5,027
	-Trade Journal Publications	104	96	79	83	86
	-Abstracts	4,669	3,943	4,076	3,773	3,582

¹ Amendments extend existing CRADAs for additional years to a maximum of 5 years, and/or change Statements of Work, and/or change funding levels.

² Includes mostly Trust Fund Cooperative Agreements, Reimbursable Agreements, Material Transfer Research Agreements, Specific Cooperative Agreements and Non-Funded Cooperative Agreements.

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Table 4. Invention Disclosures and Patenting

Ref #	Agricultural Research Service (ARS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
11	● New invention disclosures in FY, total	100	141	131	126	137
	-University-ARS Co-owned in FY, total	35	35	42	22	66
12	▪ Life Sciences	50	60	68	61	59
	-University-ARS Co-owned	17	17	24	13	21
12	▪ Chemical	40	52	36	36	53
	-University-ARS Co-owned	13	13	11	3	13
12	▪ Mechanical & Measurement	8	25	24	28	14
	-University-ARS Co-owned	4	4	4	5	4
12	▪ Plant Cultivars	2	6	5	7	17
	-University-ARS Co-owned	1	1	3	1	11
13	● Patent applications filed in FY, total	114	117	106	110	108
	▪ Non-Provisional	74	86	73	96	56
	▪ Provisional	40	31	32	37	29
14	● Patents issued in FY, total	27	21	42	46	60

Table 5. Profile of Active Licenses

Ref #	Agricultural Research Service (ARS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
16	● All licenses, total active in FY	315	316	323	337	363
17	-New, executed in the FY	27	25	22	33	31
	-Newly executed to small business	ND	ND	ND	ND	15
19	-Total executed to small business	ND	ND	ND	ND	118
	-Newly executed to universities	ND	ND	ND	ND	12
	-Total executed to universities	ND	ND	ND	ND	142
	▪ Patent licenses, total active in FY	291	288	292	301	321
	-New, executed in the FY	23	21	18	27	25
	▪ Material transfer licenses, total active in FY	24	28	31	36	42
	- New, executed in the FY	4	4	4	6	6

Table 6. Income Bearing Licenses

Ref #	Agricultural Research Service (ARS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
36	● All income bearing licenses	313	314	321	335	360
37	- Exclusive	223	222	230	239	259
38	- Partially exclusive	20	20	16	16	14

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39	- Non-exclusive	70	72	75	80	87
44	▪ Patent licenses	289	286	290	299	318
45	- Exclusive	220	218	226	234	252
46	- Partially exclusive	20	20	16	16	14
47	- Non-exclusive	49	48	48	49	52
48	▪ Material transfer licenses	24	28	31	36	42
49	- Exclusive	3	4	4	5	7
50	- Partially exclusive	0	0	0	0	0
51	- Non-exclusive	21	24	27	31	35
	● All royalty bearing licenses¹	112	129	125	130	128
	▪ Patent licenses	104	120	113	119	114
	▪ Material transfer licenses	8	9	12	11	14

Table 7. Licensing Management: Elapsed Execution Time

Ref #	Agricultural Research Service (ARS)	FY 2008 ¹	FY 2009 ²	FY 2010 ³	FY 2011 ⁴	FY 2012 ⁵
63	● All licenses					
64	- average (months)	4.8	6.7	6.6	5.9	5.8
	- median (months)	5	6.8	6.4	3.3	4.2
65	- minimum (months)	0.5	0.7	0.7	0.6	0.3
66	- maximum (months)	11.4	18.4	18.5	18.2	19.7
	- Exclusive and partially licenses					
	- average (months)	7.3	9.7	5.7	10.3	10.4
	- median (months)	6.6	7.9	5.6	9.9	8.6
	- minimum (months)	3.9	5.5	2.3	5.1	4
	- maximum (months)	11.4	18.4	9.2	18.2	19.7
	- Non-exclusive licenses					
	- average (months)	2.3	3.2	8.3	2	2.8
	- median (months)	1	1.8	9.4	2	2.1
	- minimum (months)	0.5	0.7	1	0.6	0.3
	- maximum (months)	6	8	18.5	3.3	8.1
	▪ Patent licenses					
67	- average (months)	7.2	8.2	6.1	8.6	8.4
	- median (months)	6	7.3	5.6	6.2	7.3
68	- minimum (months)	3.9	1.2	2.3	1	0.5
69	- maximum (months)	11.4	18.4	11.9	18.2	19.7
	- Exclusive and partially exclusive patent licenses					
	- average (months)	7.3	10.1	5.3	11.3	10.4
	- median (months)	6.6	8.4	4.8	13.5	8.6

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	- minimum (months)	3.9	5.5	2.3	5.1	4
	- maximum (months)	11.4	18.4	9.2	18.2	19.7
	- Non-exclusive patent licenses					
	- average (months)	6	1.3	11.9	1.9	1
	- median (months)	6	1.3	11.9	1.9	0.6
	- minimum (months)	6	1.2	11.9	1	0.5
	- maximum (months)	6	1.4	11.9	2.3	2.1
	▪ Material transfer licenses					
	- average (months)	1.8	4.4	7.6	2.6	3.5
	- median (months)	0.6	4.7	8.5	2.3	2.9
	- minimum (months)	0.5	0.7	1	0.6	0.3
	- maximum (months)	5.8	8	18.5	5.4	8.1
	- Non-exclusive material transfer licenses					
	- average (months)	1.8	4	7.4	2.1	3.5
	- median (months)	0.6	3.7	5.3	2	2.9
	- minimum (months)	0.5	0.7	0.7	0.6	0.3
	- maximum (months)	5.8	8	18.5	3.3	8.1
	• Licenses terminated for cause, total					
71	▪ Patent licenses	0	0	0	0	0
	▪ Material transfer licenses	0	0	0	0	0

¹ During FY 2008, USDA received 30 new invention license applications, for which 7 new licenses were granted, 20 license agreements are currently in negotiation, 5 applications were withdrawn by the applicant. The FY2008 data is based upon 16 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e) such licenses are granted for the purpose of consolidation rights in the invention, and therefore license applications are not required.

² During FY 2009, USDA received 31 new invention license applications, for which 7 new licenses were granted, 14 license agreements are currently in negotiation, 5 applications were withdrawn by the applicants, and 5 applications are on hold by request of the applicants. The FY 2009 data is based upon 15 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required.

³ During FY 2010, USDA received 24 new invention license applications, for which 4 new licenses were granted, 16 license agreements are currently in negotiation, 3 applications were withdrawn by the applicants, and 1 application is on hold by request of the applicant. The FY 2010 data is based upon 14 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required.

⁴ During FY 2011, USDA received 29 new invention license applications, for which 4 new licenses were granted, 21 license agreements are currently in negotiation, 0 applications were withdrawn by the applicants, and 4 applications are on hold by request of the applicant. The FY 2011 data is based upon 13 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required.

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⁵ During FY 2012, USDA received 16 new invention license applications, for which 7 new licenses were granted, 9 license agreements are currently in negotiation, 0 applications were withdrawn by the applicants, and 0 applications are on hold by request of the applicant. The FY 2012 data is based upon 18 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required.

Table 8. License Income

Ref #	Agricultural Research Service (ARS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
72	• Total income, all active licenses	\$3,953,415	\$5,376,463	\$3,641,476	\$3,989,228	\$3,806,164
73	▪ Patent licenses	\$3,883,922	\$5,318,483	\$3,566,048	\$3,854,820	\$3,670,692
	▪ Material transfer licenses	\$69,493	\$57,980	\$75,428	\$134,408	\$135,472
	▪ Other IP Licenses	\$0	\$0	\$0	\$0	\$0
	• Total Earned Royalty Income (ERI)	\$3,009,774	\$4,422,023	\$3,075,199	\$3,136,813	\$3,059,989
75	- Median ERI	\$4,258	\$4,485	\$4,911	\$4,748	\$5,000
76	- Minimum ERI	\$7	\$12	\$2	\$6	\$44
77	- Maximum ERI	\$761,553	\$1,715,890	\$331,674	\$630,847	\$757,219
78	- ERI from top 1% of licenses	NA ¹				
79	- ERI from top 5% of licenses	\$1,657,059	\$2,756,811	\$1,493,456	\$1,932,197	\$1,752,367
80	- ERI from top 20% of licenses	\$2,543,565	\$3,874,292	\$2,540,101	\$2,672,414	\$2,604,008
	▪ Patent licenses, total ERI	\$2,982,281	\$4,386,042	\$3,014,771	\$3,067,390	\$2,969,517
87	- Median ERI	\$4,579	\$4,612	\$5,000	\$4,800	\$5,000
88	- Minimum ERI	\$45	\$117	\$2	\$6	\$44
89	- Maximum ERI	\$761,553	\$1,715,890	\$331,674	\$630,847	\$757,219
90	- ERI from top 1% of licenses	NA ¹				
91	- ERI from top 5% of licenses	\$1,544,031	\$2,756,811	\$1,493,456	\$1,855,388	\$1,752,367
92	- ERI from top 20% of licenses	\$2,485,319	\$3,819,292	\$2,485,208	\$2,628,537	\$2,529,658
	▪ Material transfer licenses, total ERI	\$27,493	\$35,980	\$60,428	\$69,423	\$90,472
	- Median ERI	\$1,003	\$3,186	\$1,705	\$2,000	\$2,844
	- Minimum ERI	\$7	\$12	\$42	\$37	\$82
	- Maximum ERI	\$9,508	\$13,690	\$17,988	\$22,867	\$27,847
	- ERI from top 1% of licenses	\$9,508	\$13,690	\$17,988	\$22,867	\$27,847
	- ERI from top 5% of licenses	\$9,508	\$13,690	\$17,988	\$22,867	\$27,847
	- ERI from top 20% of licenses	\$18,573	\$21,282	\$32,711	\$42,241	\$59,075
	▪ Total ERI from Universities					\$643,542

¹ Represents a single license.

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Table 9. Disposition of License Income

Ref #	Agricultural Research Service (ARS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
105	• Income distributed, total	\$3,013,522	\$3,673,922	\$3,137,670	\$3,220,920	\$3,550,930
106	- To Inventors	\$756,458	\$1,371,346	\$1,370,296	\$1,391,111	\$1,206,713
107	- To Others	\$562,427	\$1,633,536	\$1,179,579	\$1,181,859	\$1,686,521
108	▪ Patent licenses, total	\$2,958,996	\$3,631,660	\$3,084,726	\$3,202,394	\$3,474,591
109	- To inventors	\$729,892	\$1,346,512	\$1,341,289	\$1,343,366	\$1,152,848
	- Salaries of some technology transfer staff	\$1,535,437	\$1,616,108	\$1,155,642	\$1,166,333	\$1,664,047
	- Patent filing preparation, fees, & annuity payments	\$694,667	\$669,040	\$587,795	\$647,950	\$657,696
	- Other technology transfer expenses	\$0	\$0	\$0	\$0	\$0
	▪ Material transfer licenses, total	\$54,556	\$42,262	\$52,944	\$63,271	\$76,339
	- To inventors	\$27,566	\$24,834	\$29,007	\$47,745	\$53,865
	- Salaries of some technology transfer staff	\$26,990	\$17,428	\$23,937	\$15,526	\$22,474
	- Patent filing preparation, fees, & annuity payments	\$0	\$0	\$0	\$0	\$0
	- Other technology transfer expenses	\$0	\$0	\$0	\$0	\$0

3.8. Downstream Outcomes

Sustained Food Production

- 361 Research Projects
- 71 Locations
- 777 Scientists

Cover Crop Residue Conserves Soil Moisture and Enhances Weed Control And Grape Vine Root Growth



Cover crops have been shown to improve soil structure and weed control. It was unknown which cover crop practices are best suited for young vineyards in the Pacific Northwest. ARS scientists and collaborators at Oregon State University examined five different vineyard floor management schemes. One included the use of winter cover crop residue grown in alleyways as mulch within vine rows in a young vineyard. The use of the mulch in the vine row increased vine shoot and root growth, suppressed numerous weeds, reduced soil compaction, and maintained higher soil moisture over two growing seasons, as compared to a clean-cultivated control

without mulch. The findings suggest that the use of cover crop residues as a mulch can improve vine establishment and conserve soil resources and soil quality when establishing new vineyards in the Pacific Northwest region. *Horticulture Crops Research Lab, Corvallis, OR*

Brown Marmorated Stink Bug Working Group

ARS researchers initiated formation of the Brown Marmorated Stink Bug (BMSB) Working Group. This group brings together research personnel from USDA, ARS and Land Grant Universities from over 10 states as well as extension personnel, stakeholders, industry representatives, and regulatory officials from the USDA, APHIS and the EPA. This group has formulated research, extension, and regulatory priorities for the BMSB and coordinated collaborative projects aimed at developing effective monitoring and management tools for this invasive species. *Appalachian Fruit Research Station, Kearneysville, WV*



Nitrogen Alters Cold Hardiness of Nursery Trees

Stem and bud dieback due to winter injury causes economically important losses in nursery tree production and it is unknown whether plant nitrogen status or the type of fertilizer used influences cold hardiness. Using deciduous bareroot nursery trees, ARS researchers, and university collaborators

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determined that both nitrogen rate and nitrogen form influenced the cold tolerance of buds and stems of nursery trees. Trees with a similar nitrogen status withstand different levels of cold depending on the rate or form of fertilizer used during production. When developing nutrient management strategies for nursery production of trees in climates prone to winter injury, fertilizer component selection is an extremely important factor that growers should consider. *Horticulture Crops Research Unit, Corvallis, OR*

Early Detection of the Onset of Crop Stress for Effective Crop Production Management



Hyperspectral imaging provides a technique for great potential for early detection of crop injury. A visible near infrared hyperspectral imaging system was successfully employed by ARS researchers in collaboration with Geosystems Research Institute of Mississippi State University, to determine herbicide-induced crop response to glyphosate applied at different application rates. Use of this system will allow the determination of the specific spectral bands that indicate onset of crop stress due to herbicide induced damage, nutrient deficiency, and water

deficiency. *Crop Production Systems Research Unit, Stoneville, MS*

Research on Bee Feed Demonstrates Effects on Bee Health



Beekeepers feed high fructose corn syrup or sucrose to colonies as a carbohydrate source when flowering plants are not available; protein is fed when pollen is scarce. ARS scientists demonstrated that colonies fed during the winter with sugar syrup made with sucrose had greater brood production in the spring compared with colonies fed high fructose corn syrup. A high rate of brood production in the spring is important for building strong colonies for the pollination of early season crops such as almonds.

Similarly, ARS scientists in Baton Rouge, Louisiana, found that continual feeding of protein and sugar syrup and feeding protein enriched with pollen in mid- winter produces colonies that far exceed the sizes needed for almond pollination. This effect is enhanced if beekeepers use eight-frame equipment. *Carl Hayden Bee Research Center, Tucson, AZ*

Improved Techniques and Protocols for Spray Applications in Pest Control



Effective control of mosquitoes and other insects that vector human diseases requires precise spray application techniques. New technologies are needed to efficiently monitor the dispersal of very small droplets over large sampling areas and to evaluate the efficacy of insecticide treatments using caged insects in the field. ARS researchers established the collection efficiency of two commonly used rotary slide spray samplers under multiple wind speeds and spray droplet sizes and developed correction factors that estimate actual spray droplet size and aerial concentration. The research also established the impact of insect bioassay cages on airspeed, spray droplet size, and spray concentration inside the cages, and developed correction factors that estimate actual spray concentration presented to caged mosquitoes. The sampling techniques and protocols developed by this research provide major advancements in the predictive value of laboratory and field test data that guide real world spray application for control of major pest and disease-transmitting arthropods. *Areawide Pest Management Research Unit, College Station, TX*

Tools Developed for Tracking and Understanding Colony Collapse Disorder



Efforts to improve bee health have suffered from an inability to accurately assess disease caused by viruses and other pathogens. ARS scientists have improved methods for collecting honey bees from representative populations, shipping them for genetic analyses, stabilizing and extracting RNA, conducting high-throughput genetic screens for viruses and other pests, collecting embryos from established colonies, and carrying out controlled experiments on adult bees. These methods are being used in national surveys in the United States in order to establish cell lines and other genetic techniques and to better determine interactive effects. *Bee Research Laboratory, Beltsville, MD*

Ovicidal and Neonate Activity of Insecticides Demonstrated for Navel Orangeworm

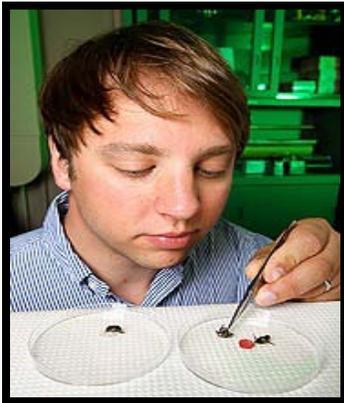


Almonds are the largest California nut crop, with greater than 1.7 billion pounds produced annually. However, production and nut quality can be severely affected by the navel orangeworm (NOW) caterpillar. Optimal insecticide levels for NOW moth eggs and larvae have not yet been established for newly registered insecticides in almonds. ARS researchers showed that two new classes of

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insecticides, anthranilic diamide and diacyl hydrazine are toxic to NOW eggs and newly hatched larvae, with up to a 97 percent kill rate. Their use will replace broad spectrum insecticides and they are compatible with pheromone-based strategies that disrupt moth mating. As these new insecticides have ovicidal activity and are more selective than broad spectrum insecticides currently used, their use would result in improved navel orangeworm control with reduced non-target effects. *Commodity Protection and Quality Research Unit, Parlier, CA*

Japanese Beetles, a Key Pest of Horticultural Crops, Paralyzed by a Chemical from Zonal Geranium



The Japanese beetle is a highly destructive plant pest that can be very difficult and expensive to control. Adults attack the foliage, flowers, or fruits of more than 300 different ornamental and agricultural plants. Zonal geraniums have been known since the 1920s to be toxic to Japanese beetles; however, until recently the chemical responsible for the toxicity remained unknown. ARS researchers isolated and identified quisqualic acid from flower petals of zonal geranium and demonstrated its role in paralyzing adult Japanese beetles. This discovery will provide a new line of plant-derived and synthetic chemical controls for Japanese beetles and possibly many other important insect pests. *Application Technology Research Unit, Wooster, OH*

New Genes for Lethality in Fruit Flies



Mass releases of sterile males are a widely used means to control pest fruit flies, but the radiation that sterilizes males often damages their sexual performance. Conditional-Lethality, where a released insect's offspring die when certain environmental conditions prevail, is a promising substitute for traditional sterility. A successful conditional-lethality strain for the Caribbean fruit fly was created that survives on a diet supplemented with an antibiotic, tetracycline, but suffers 100 percent embryonic lethality in the absence of the antibiotic. The genes involved will serve to improve the efficacy of control programs that protect U.S. agriculture from not only fruit flies but also from other potentially invasive insect pests. *Insect Behavior and Biocontrol Research Unit, Gainesville, FL*

High Speed Wind Tunnel Supports Aerial Application Industry

Modern aerial application aircraft make spray applications at speeds up to 220 MPH, which exceeds the capability of current wind tunnels used to develop spray models. ARS researchers developed a new high-speed wind tunnel testing facility capable of generating airspeeds in excess of 220 MPH, and developed and implemented testing protocols for the new wind tunnel. This facility has already been utilized to extend the airspeed range of the ARS spray atomization models, including the first-ever documented

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atomization data for U.S. Air Force C-130 aircraft spray application at airspeeds exceeding 200 MPH. These new high-speed models are critical in helping aerial applicators make effective spray applications that meet regulatory requirements and that are in full compliance with agrochemical product use labels. *Areawide Pest Management Research Unit, College Station, TX*

Comprehensive Application Technology and Strategy to Reduce Pesticide Use



Pesticide applications are critical to ensure healthy, unblemished ornamental nursery plants. Conventional spray application practices recommend the modification of carrier volume for preparations of spray mixtures, but not the amount of active ingredients per unit area. ARS researchers demonstrated that growers could use their existing spray equipment to reduce pesticide and water use by 50 percent by properly changing spray nozzles at no extra cost and still achieve effective pest and disease

control. This equates to doubling the pesticide application efficiency while reducing pesticide costs, reducing health risk to applicators, and diminishing adverse impact to the environment. Other benefits accrued with this approach included increased operational efficiency (the area sprayed is doubled thus the frequency and travel time required for the tank refilling times are reduced) and reduced costs for energy consumption and new equipment, as well as reduced risk of pesticide exposure of workers. By using the half-rate practice, growers reported savings of over \$200-\$500 per acre. *Application Technology Research Unit, Wooster, OH*

Potential Major Cause of Reproductive Failure in Beef Cattle Found



Feed and care for unproductive cows that fail to achieve pregnancy is a major cost in beef Production. A test capable of identifying young cows with low likelihood to conceive and produce a live calf would have a substantial impact on the efficiency of beef production. During a study to identify genes producing variation in reproductive efficiency, ARS researchers discovered that as many as 30% of cows that had low success achieving pregnancy appeared to carry portions of the male-specific Y chromosome. Since only bulls are expected to have the Y chromosome, this research suggests transmission of Y chromosome to female offspring (via a chromosomal crossover event) may be a significant contributor to reproductive failures. This discovery will now be used to develop a test that identifies beef heifers and cows which should not be used for breeding. A robust test for Y

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chromosome in beef cattle breeding herds that improves reproductive efficiency will lead to improved reproductive efficiency and lower production costs that will increase economic returns to producers, lower beef prices, and enhance beef exports. *Genetics, Breeding and Animal Health Research Unit, Clay Center, NE*

Replacing Antibiotics in Young Swine Feed with Natural Alternatives



Antibiotics have been fed at sub-therapeutic levels as health, growth, and efficiency promoters for more than 50 years and much of the swine produced in the United States receives antibiotics in their feed at some point during the production process. However, because of concerns over antibiotic resistance, alternatives to antibiotics are a high priority for United States swine producers. ARS researchers determined that feeding a natural antimicrobial agent called lysozyme to young pigs consuming a liquid diet was as effective as antibiotics in increasing growth performance, improving gastrointestinal health, and decreasing pathogen shedding in feces. This natural antimicrobial agent is a suitable alternative to antibiotics for young pigs consuming manufactured liquid diets. The identification of suitable alternatives to antibiotics will enable the swine industry to effectively transition away from dietary antibiotic use. *Nutrition Research Unit and Meat Safety & Quality Research Unit, Clay Center, NE*

A Salmon Line for Faster Growth and Greater Weight



Increasing harvest size and reducing the time to harvest of Atlantic salmon are two goals of the salmon producers in North America. Commercial salmon producers in the United States utilize stocks that are not many generations removed from wild, unselected stocks and are legally required to culture stocks certified to be of North American origin. ARS researchers evaluated the growth of salmon from their breeding program in commercial sea cages in collaboration with industry. A salmon line selected for faster growth and greater weight was produced and germplasm was released to commercial producers. Utilization of improved germplasm will reduce the time to harvest, increase the profitability and sustainability of coldwater marine aquaculture in the United States, and provide a quality seafood product to U.S. consumers. *National Cold Water Marine Aquaculture Center, Franklin, ME*

Alternative Feeding Ingredients

Prices of soybean meal and corn, the two most commonly used traditional feed ingredients in channel catfish diets, have increased dramatically in recent years. Using less-expensive alternative feed ingredients to partially replace soybean meal and corn will reduce feed cost. ARS scientists investigated

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the use of corn gluten feed and cottonseed meal, two promising alternative feedstuffs, as replacements for soybean meal and corn in diets for pond-raised channel catfish. The study showed that a maximum of 50% of the soybean meal in channel catfish diets may be replaced (soybean meal was reduced from 51.4% to 25.7%) by a combination of corn gluten feed and cottonseed meal (up to 20% of each in the diet) without markedly affecting the physical quality of feed pellets, fish growth, processed yield, and body composition. Results are being used by catfish feed mills to reduce feed costs while providing a nutritionally complete feed

for commercial catfish farming. *Thad Cochran National Warmwater Aquaculture Center, Catfish Genetics Research Unit, Stoneville, MS*

Ovine Progressive Pneumonia in Sheep



Ovine progressive pneumonia is an incurable, slow-acting, wasting disease that affects the health and productivity of millions of U.S. sheep. It is also one of the most costly sheep diseases in the world. ARS researchers have discovered a gene that protects sheep from this disease and collaborated with a company to provide a genetic test for breeding better sheep. As a consequence, producers can improve health and increase profitability of their sheep by selecting those that are less susceptible to infection. *Genetics, Breeding, and Animal Health Research Unit, Clay Center, NE*

Dramatic Production Improvements through Pond Oxygen Management

Dissolved oxygen is the most critical water quality parameter in warm water aquaculture but controlled studies of the impact of this diurnally-fluctuating parameter on channel catfish have been lacking. ARS researchers examined the impact of pond dissolved oxygen (DO) concentrations on catfish growth, yield, food consumption, and food conversion. A computer-controlled pond oxygen monitoring system maintained precise DO set-points. Results showed that for optimum food conversion and growth, DO levels of 2.5 to 3.0 mg/L are required and this is higher than common practice for the industry. With higher levels of DO, improved growth will significantly shorten the production cycle and reduce fish losses to all causes, significantly improving food conversion. Increased growth resulting from improved DO management can reduce food conversion ratios (weight of feed input/fish weight gain) from an estimated industry-wide 2.5-3 to 2, reducing production costs by \$0.10-0.20/lb., greatly improving the profitability of catfish farming. *Thad Cochran National Warmwater Aquaculture Center, Catfish Genetics Research Unit, Stoneville, MS*



High Speed Sorting of Grains

New technologies have been developed for automated separation of seeds that are discolored, blemished, infected by fungi, or from different species such as wild grass seed from noxious weeds. This technology uses a “smart” camera developed by an ARS researcher. The camera enables high speed image capture and digital processing of images from each individual seed as they drop off the end of a chute. This camera has been integrated into a complete sorting system. Seeds are separated by a short burst of air



from an air nozzle placed near the falling stream of seeds. For wheat, the system has a throughput of approximately 20Kg/hr. and has been used extensively by breeders and seed foundations for separating red and white wheat classes, scab damaged wheat, and removal of other crop seeds, such as barley from wheat. The image can be used to identify small blemishes on seeds that are not large enough to be detected by traditional color sorters. While the throughput of the image based system is not as large as commercial color sorting machines, the cost is much lower, making the technology accessible to most seed breeders and seed foundations. The technology has been commercialized through a Cooperative Research and Development Agreement. *Engineering and Wind Erosion Research Unit, Manhattan, KS*

Economical Proactive Solutions to Invasive Fruit Fly Threats



Foreign fruit flies (for example, the Mediterranean fruit fly) that attack a wide range of fruits threaten US agriculture. Periodically they are discovered in fruit producing states like California and Florida. Until they are eradicated after discovery (which may take years) fruit may not be shipped out of quarantined areas, resulting in economic loss. Also, lack of economical treatments encourages smuggling, which carries a high-risk of invasive species. Research on these flies in the countries where they are found is costly and slow. An ARS scientist proposed developing treatments at the Food and Agriculture Organization of the United Nations/International Atomic Energy Agency laboratories in Austria where any foreign fruit fly may be brought in and reared by comparison with species for which treatments are already available. That quick and economical method using resources and personnel from various countries has developed treatments for invasive flies, thus, providing solutions to quarantine barriers to trade. *Stored Product Insect Research Unit, Manhattan, KS*

Broad Treatment Solutions to Invasive Species Threatening Trade



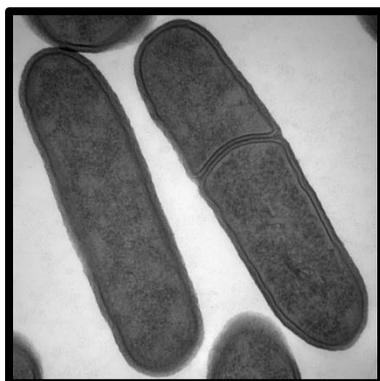
The US is a major equipment supplier and user of irradiation to safely disinfest traded commodities of invasive pests. An ARS scientist is a key player in a large international effort coordinated by the United Nations Food and Agriculture Organization and the International Atomic Energy Agency to develop broad irradiation treatments that cover most commodities and pests, thus removing numerous barriers to trade in US exports and imports. This is being accomplished at little cost to the ARS and the US as most of the research is done elsewhere. Currently over 20 thousand tons of fresh fruits and vegetables are traded using this technology with the amount, number of commodities, and countries involved steadily increasing. *Stored Product Insect Research Unit, Manhattan, KS*

Management of Psocid Pests of Stored Products



Psocids, or booklice have become important pests of stored products in the U.S. in the last decade, but we know little about them. ARS scientists are investigating their biology and control to acquire information to help stored-product industries, such as flour mills and warehouses make decisions about psocid management. These are very small insects, usually less than 1 mm in length, which makes them difficult to identify. Most people had assumed that psocids only develop at high humidity or in wet grain, but scientists have showed that some species of psocids developed fastest at lower relative humidity. It was also assumed that psocids can't feed on whole grain, but studies show that they feed on and damage whole grain. Heat is being used more often to disinfest flour mills and studies show psocids are susceptible to heat. All insecticides registered for stored wheat, rice, and corn in the U.S. were tested for effectiveness against psocids. Research shows the organophosphate class of insecticides was most effective for psocid control. This information is helping managers of stored product facilities make better pest management decisions. *Stored Product Insect Research Unit, Manhattan, KS*

Detection of a Novel Pathogen of Farmed Rainbow Trout and Potential to Control by Vaccination



An ARS Researcher isolated a novel Gram-positive bacterial pathogen causing significant loss of farmed rainbow trout in North Carolina. The pathogen identified was similar to the *Weissella* sp. Strains associated with recent disease outbreaks in farmed rainbow trout in both China and Brazil and represents the first report of this pathogen in the US. In response to a request from North Carolina Stakeholders, Dr. Welch developed and validated an effective autogenous *Weissella* sp. Vaccine that can be delivered by injection. The *Weissella* sp. Vaccine was shown to be effective when mixed with another vaccine that is currently used in North Carolina thus showing that these vaccines can be

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delivered together minimizing the increased production costs and negative effects caused by multiple injections. Early pathogen detection and rapid development and implementation of this vaccine will aid control efforts and reduce the likelihood of further pathogen dissemination in the US. *National Center for Cool and Cold Water Aquaculture, Kearneysville, WV*

Tick Vaccine Candidates



Significant progress was made toward evaluating vaccine candidates selected through a science-based approach intended to deliver a tick vaccine that will elicit an immune response protecting cattle from cattle fever tick infestations. A patent application covering two novel vaccine antigens discovered in this project has been filed. Sufficient vaccine antigen for 200-head field trials for three antigens was prepared, including the two covered by the patent application. A vaccine trial to evaluate the immune response of white-tailed deer vaccinated with two vaccine candidate antigens, including one of the antigens covered in the patent application, is in its final stages. Three additional vaccine candidate antigens have been successfully produced and are available for small group cattle trials. A productive

partnership with stakeholders and collaborators from the animal health industry resulted in plans to deliver a tick vaccine for the Cattle Fever Tick Eradication Program. *Tick & Biting Fly Research Unit, Kerrville, TX*

Cattle Fever Tick Eradication



Cattle fever ticks that transmit the potentially fatal Texas fever, or bovine piroplasmiasis, to cattle were declared eradicated from the U.S. after a nationwide campaign lasting from 1907 to 1943. This was possible to a large extent because of minimal to non-existent populations of white-tailed deer that could not be treated and would have acted as alternate hosts for the ticks. The campaign to prevent ticks from being reintroduced across the border from Mexico continues today; however, populations of white-tailed deer have drastically increased, and as alternate hosts they are compromising eradication

effort. Currently, deer are being self-treated as they are attracted to bait in treatment stations, however, feral swine, raccoons, and possums are damaging the feeders, consuming the bait, and preventing deer from being treated for ticks. The short electrified exclusion fence described in this paper has been shown to be essentially 100% effective in preventing the unwanted animals from accessing the bait stations while allowing free access by deer, thus dramatically increasing the efficiency, efficacy, and economy of treatments. *Livestock Insects Research Laboratory, Kerrville, TX*

Red River Runner Peanut Variety Released



RED RIVER RUNNER (RRR) is the latest high value peanut variety released by the USDA-ARS peanut breeding program at the Plant Science Research Unit in Stillwater, Oklahoma. Cooperators on this variety release include Texas AgriLife Research and Oklahoma State University. RRR offers producers in the Southwestern U.S. three qualities necessary in a peanut variety for sustainable production: high-oleic fatty acid oil content, high yield, and superior grade.

Beyond those important traits, RRR also offers moderate resistance to Sclerotinia blight, a fungal disease of peanut which can result in devastating yield and profit loss for producers. The superior grade potential of RRR is certainly the trait that makes peanut producers desire its production. In trials conducted in Oklahoma and Texas, RRR, when compared to all other runner varieties grown in the Southwestern U.S., averaged a significantly higher return by \$80/acre or more. RRR is quickly becoming the most highly coveted runner peanut variety grown in the Southwestern U.S. with production limited only by seed availability. *Wheat, Peanut and Other Field Crops Research, Stillwater, OK*

Efforts to Control Horn Flies



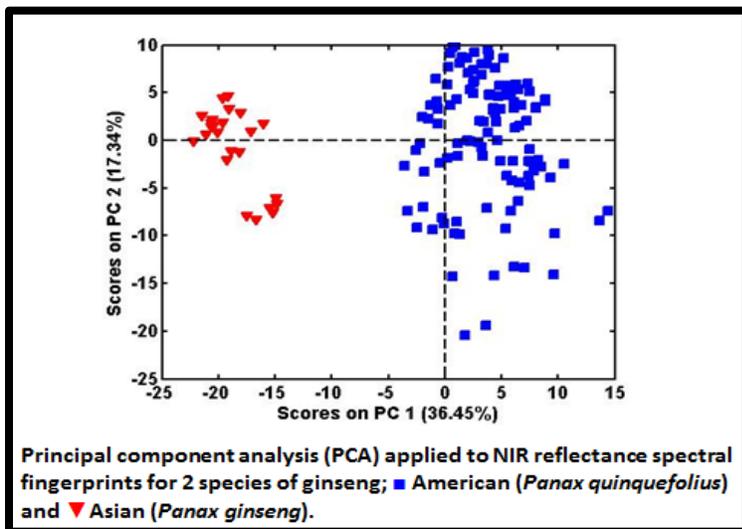
Horn flies are a serious and economically significant pest of cattle. Efforts to control horn flies using chemical pesticides are increasingly difficult due to development of pesticide resistance in fly populations. Diazinon is a member of the organophosphate (OP) class of pesticides that disrupts the fly nervous system by targeting the enzyme acetylcholinesterase (AChE). Diazinon-resistant flies were previously shown to contain a mutation (G262A) in AChE predicted to alter the structure of the enzyme so that it would be less sensitive to OP insecticides. A new study

used recombinant DNA technology to clone and express a recombinant form of the horn fly AChE with and without the G262A mutation to characterize biochemical properties of the horn fly AChE enzyme and the effects of the G262A mutation. Results of the study determined the biochemical properties of the horn fly AChE and confirmed that the G262A mutation significantly reduced sensitivity of the enzyme to OP insecticide. This study substantiates previous work and suggests that two additional AChE mutations may also contribute to insecticide resistance in horn flies. Elucidation of the mechanisms of fly resistance will allow development of rapid tests to identify mutations present in fly populations that will help guide selection of effective means of pest control. *Livestock Insects Research Laboratory, Kerrville, TX*

Food Safety and Nutrition

- 107 Research Projects
- 19 Locations
- 258 Scientists

Fingerprinting Identifies Plants



ARS Scientists have developed methods to generate fingerprints of plant chemical constituents and metabolites that identify plants with 100% accuracy. Examples using the method included green tea and ginseng; different species and growing locations were determined with a relatively easy to perform assay. This has application for regulatory agencies to identify the type of plants used in processed foods and dietary supplements in addition to discovering adulteration or misbranding of products. *Food Composition Laboratory, Beltsville, MD*

Maternal Obesity Affects Energy Metabolism in Offspring



It is known that children of obese mothers are more likely to be obese. While shared behaviors contribute to this observation, there are inherited biological differences that also affect energy balance. Using a rat model of obesity, ARS-supported scientists found that obesity in mothers led to epigenetic changes in some genes, dysfunction of the mitochondria, organelles that control energy metabolism in the cell, and to impairment of burning fatty acids for fuel. These data help explain how and why maternal obesity can be passed on to offspring who are more likely to develop obesity, insulin resistance, and nonalcoholic fatty liver disease. *Department of Pediatrics, University of Arkansas for Medical Sciences, Little Rock, Arkansas; Department of Pharmacology and Toxicology, University of Arkansas for Medical Sciences, Little Rock, Arkansas; Department of Physiology and Biophysics, University of Arkansas for Medical Sciences, Little Rock, Arkansas; and Arkansas Children's Nutrition Center, Little Rock, AR*

Continuous Monitoring of the Nutritional Content of Common U.S. Foods



Monitoring the nutritional content of the U.S. food supply has been a USDA priority since 1891. The nutrient data compiled by this USDA program is used as the basis for national and international food policy decisions that link food or nutrient intake to health or disease risk and is also the basic data used for many private food databases. ARS researchers from Beltsville, Maryland, have released the 24th version of the National Nutrient Database for Standard Reference. In addition to a focus on 7,500 foods and up to 140 nutrients, a special interest database on flavonoid content of foods was released that will allow researchers to study the potential health benefits of these compounds found in fruits, vegetables, tea, and cocoa. These databases will update nutritional assessment of the U.S. food supply and will ensure that nutritional policy is made using the most up-to-date information. *National Data Laboratory, Beltsville, MD*

Nanoparticles to Inactivate Foodborne Pathogens

Nanoparticles can be effective antimicrobial agents against foodborne pathogens. ARS researchers investigated the antimicrobial activities of two nanoparticles (magnesium oxide and zinc oxide) against three major foodborne pathogens: *Escherichia coli* O157, *Salmonella* spp, and *Campylobacter jejuni*. The



results demonstrated that these nanoparticles dramatically killed those pathogens and, therefore, potentially can be added directly in foods or incorporated in packaging materials to improve microbiological safety. This research explores a new application of nano-technology and inorganic antimicrobial compounds in the food safety area, and provides useful information to the food and packaging industries. The impact of nanoparticles on environment and human health is not clear. Currently nanotechnology is being evaluated in the Food and Drug Administration Critical Path Initiative. Further toxicological studies are needed to determine the potential risks to humans which is a concern expressed by various international bodies. *Residue Chemistry and Predictive Microbiology Research Unit, Wyndmoor, PA*

Pharmacokinetics of Perfluorooctanoic Acid

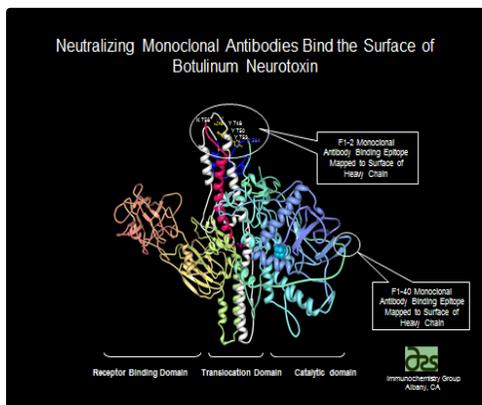
Perfluorooctanoic acid (PFOA) is a “nonstick” compound used in many industrial, commercial, and consumer products. Due to its extensive use, PFOA is widely found in humans, wildlife, and the environment. Cattle are exposed to PFOA while grazing in contaminated areas, but the extent to which PFOA accumulates in their meat is not known. ARS researchers together with scientists at USDA-FSIS, conducted a study to determine to what degree PFOA concentrates in the edible tissues of



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beef cattle and whether this may be a concern for human exposure. Beef cattle were fed a single dose of radiolabeled PFOA which could easily be tracked in the animals. The PFOA was quickly excreted in animal's urine and no detectable amounts were left in the animals after 8 days. This study showed that PFOA was not likely to accumulate in beef and that consumption of beef should not be a significant source of exposure to PFOA. *Animal Metabolism-Agricultural Chemicals Research Unit, Fargo, ND*

Neutralization of Botulinum Neurotoxin



Clostridium botulinum neurotoxins (BoNTs), responsible for botulism food poisoning, are rapidly absorbed in small amounts. Even though lethal they are concomitantly very difficult to detect. Scientists developed monoclonal antibodies specific for BoNTs and tested them for their ability to provide protection against botulism exposure in a mouse model system. Following intravenous and oral exposures to lethal levels of toxin, the timing of antibody neutralization of the toxin was determined. The results provided new information on the toxicity of BoNTs and revealed windows of opportunity for human therapeutic treatment with antibody. A better understanding of the biology of toxins, the factors that affect

their toxicity and toxin neutralization are valuable tools for advancing food safety and defense. *Foodborne Contaminants Research Unit, Albany, CA*

Organic Acids Reduce Salmonella in Swine and Poultry

Salmonella bacteria are human pathogens that can reside in the gut of food animals such as swine, cattle, and poultry; these bacteria can contaminate meat products reaching the consumer and thus cause illness or even death. Organic acids are a dietary additive that can improve animal growth efficiency and change the microbial population of the intestinal tract. ARS researchers demonstrated that including specific organic acids in the diets of pigs and chickens could reduce populations of Salmonella from 10 to 100 fold in the live animals. This work has important food safety implications because it identifies another tool to help producers reduce the carriage of foodborne pathogens in meat-producing animals. Reduced pathogen loads in animals at slaughter will result in microbiologically safer meat products reaching the consumer. *Food and Feed Safety Research Unit, College Station, TX*



Irrigation Pipelines as Microbial Reservoirs

In a primary study on the impact of biofilms, ARS scientists showed that pathogen and indicator microorganisms associated with biofilms on internal pipe walls could alter the microbial quality of irrigation water used to produce fresh produce. This study showed that it is imperative to monitor water quality at fields, rather than just at the intake. This study strongly suggests that back-flushing the irrigation system or disinfecting irrigation pipelines have to be considered as viable management practices

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by producers to improve the safety of irrigated produce. Such decisions would have to be included within produce related good agricultural practices (GAPs). *Environmental Microbial and Food Safety Laboratory, Beltsville, MD*

Sites of Virus Persistence in Shellfish

Virus contamination of shellfish has led to frequent outbreaks of hepatitis A and norovirus illnesses. Once contaminated, shellfish retain high levels of these viruses for extended periods. ARS researchers identified primitive blood cells of oysters, known as hemocytes, as the site of virus accumulation and persistence. Research led to the development of simple and effective procedures to extract and test for viruses within the hemocytes. This technology is a dramatic improvement over traditional testing methods for viruses in shellfish which rely on tedious dissection and testing of intestinal tissues that contain only a portion of the viral contaminants. Improved assay methods will significantly enhance monitoring efforts and support regulatory agencies such as the Food and Drug Administration and the Centers for Disease Control. *Food Safety and Intervention Technologies Research Unit, Dover, DE*



Host Response to Campylobacter in Poultry



Food-poisoning bacteria such as Campylobacter are significant causes of human disease; these pathogens can often be found as contaminants in poultry meat products. New non-antibiotic therapeutics are needed to reduce or prevent colonization of poultry by these harmful bacteria; which will largely translate into pathogen-free meat products reaching the consumer. ARS scientists used modern molecular biological techniques (microarray analysis and real-time RT-PCR) to define gene expression changes in the avian spleen during an active Campylobacter infection. This work is the first to develop a solid foundation for defining the complex mechanisms involved in innate immunity of poultry to Campylobacter infections, and in Campylobacter adaptation to the intracellular environment. The work has broader impact in that it provides a valuable means for accessing unique information on host-pathogen interactions. More definitive understanding of these molecular mechanisms will facilitate development of new and more effective intervention strategies for minimizing or even eliminating the occurrence of food-borne pathogens in commercial poultry. *Food and Feed Safety Research Unit, College Station, TX*

Reducing the Risk of Pathogenic *E. coli* in Beef



The agar plate is used to confirm the identity of one of the newly regulated *E. coli* strains.

The beef industry has been dealing with *E. coli* O157:H7 since 1994. Now six additional strains of *E. coli*, that produce Shiga-toxin like *E. coli* O157:H7, have been identified as a potential risk to human health and are regulated in certain beef products. ARS scientists have provided the beef industry with three important findings that will help them in their battle against these pathogens. First, they determined that the antimicrobial interventions currently used by the beef processing industry against *E. coli* O157:H7 work equally well against these new *E. coli* strains. Secondly, numerous commercial testing companies were racing to develop tests that would enable industry to accurately, quickly, and affordably identify whether their products contain any of these six strains of *E. coli*. To assist industry with testing, scientists identified genetic markers that are currently being used in commercial rapid tests to accurately identify these strains of *E. coli*. Lastly, scientists evaluated all the new pathogen

tests coming to market to provide industry with accurate information about how well each of them worked. *Meat Safety and Quality Research Unit, Clay Center, NE*

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Natural Resources and Sustainability

- 167 Research Projects
- 71 Locations
- 519 Scientists

New Decision Tool Targets Rangeland Erosion to Save Money and Conserve Soil



Soil erosion from agricultural lands and deposits of sediment into rivers and lakes is a persistent environmental challenge that costs the United States over \$6 billion every year. In collaboration with ARS scientists in Boise, Idaho, and Tucson, Arizona, and scientists at the Great Basin Rangelands Research Unit in Reno, Nevada developed a new soil prediction tool for rangelands that helps land managers to predict long-term soil loss after individual storms. This new tool provides a way for land managers to predict where erosion will occur, and provides a way to assess the

possible effectiveness of different conservation practices before soil degradation occurs. The tool has been adopted by the Natural Resources Conservation Service and is being used to evaluate existing conservation programs and how they can be enhanced and improved deliver of conservation in a more cost-effective manner by targeting areas of concern. This research contributes to the USDA Conservation Effects Assessment Project for western rangelands. *Great Basin Rangelands Research Unit, Reno, NV*

Accurate Cost and Risk Estimates for Fencing Rangeland Pastures



One of the most common management practices used on rangelands is subdividing pastures by adding additional fences to provide flexibility for increasing grazing intensity to uniformly use pastures. ARS scientists in Cheyenne, Wyoming and Fort Collins, Colorado, in cooperation with the Environmental Defense Fund, determined how fencing materials and installation costs, longer-term maintenance costs, and the influence of Farm Bill financial incentives affect financial risk to the land manager. Researchers estimated livestock stocking rates would need to be increased 9-16% over twenty years to maintain break-even conditions. These

increased stocking rates could reduce the health of rangelands and decrease animal and plant productivity. This kind of integrated science and policy analysis is necessary to determine the most economic options for achieving realistic conservation outcomes based on the actual grazing capacity of the rangeland.

Rangeland Resources Research Unit, Fort Collins, CO and Cheyenne, WY

New Gene Inserted in Alfalfa Could Save Dairy Producers \$100 Million Annually

More efficient food production will be required to meet increasing demands by a growing population. Reducing protein nitrogen losses in dairy operations is one strategy to improve production efficiency. ARS researchers identified a novel red clover enzyme and transferred the gene that encodes this enzyme to alfalfa. If red clover phaselic acid protection can be reconstituted in alfalfa, it is estimated that improved protein and nitrogen utilization would save farmers more than \$100 million annually by reducing the need for purchased supplemental feed proteins. Improved efficiency could also substantially reduce nitrogen waste from cattle on dairies which would end up in surface and ground waters. Plants with higher levels of phaselic acid may also be more resistant to ultraviolet light and ozone pollution stresses, as well as stresses from insect pests and plant pathogens. *U.S. Dairy Forage Research Center, Madison, WI*



Herbicide Volatilization Exceeds Herbicide Runoff Losses



Surface runoff was thought to be the major off-site transport mechanism for herbicide. However, until recently no field investigations monitored both surface runoff and turbulent volatilization fluxes simultaneously. An 8-year, field-scale experiment was conducted where herbicide (atrazine and metolachlor) volatilization and surface runoff losses were simultaneously monitored and evaluated. Results demonstrate that regardless of weather conditions, volatilization losses consistently exceeded surface runoff losses. Surprisingly, herbicide volatilization losses were up to 25 times larger than herbicide surface runoff losses. The research will affect USDA and USEPA policy with regard to herbicide behavior and the data will be used to develop or improve pesticide behavior models. *Hydrology and Remote Sensing Laboratory, Beltsville, MD and National Laboratory for Agriculture and the Environment, Ames, IA*

Environmental Impacts of Biofuel Feedstock Production Systems

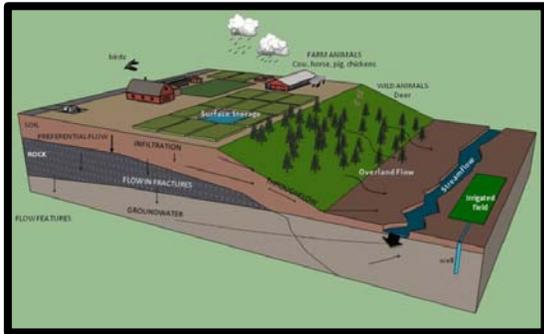


The Energy Independence and Security Act of 2007 mandates increased production of energy from alternate fuel sources such as biomass. ARS Researchers used field data from biofuel feedstock plots in the central and eastern US to verify the ability of a commonly used computer model called DAYCENT to represent the ethanol yields and greenhouse gas emissions for different crops. They then used the model to quantify yields and greenhouse gas emissions for lands currently used for corn

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ethanol production and to project yields and emissions if this land was converted to cellulosic ethanol production using perennial crops. Results suggest that if land currently used for corn ethanol production were converted to perennial crops, ethanol production could increase from 7 to 12 billion gallons while greenhouse gas emissions from soil would decrease by approximately 400%. These findings are critical for efficient energy production from plant feedstocks for the United States. *Soil Plant Nutrient Research Unit, Fort Collins, CO*

Mathematical Model for Pathogen Transport and Retention



Existing mathematical models to simulate the movement of pathogens through agricultural soils and groundwater do not provide reliable predictions even under relatively simple, well defined conditions. Researchers at USDA-ARS and the University of California at Riverside have developed a mathematical model for pathogen transport and retention. The model provides a clear conceptual explanation for many incompletely understood observations of pathogen transport and retention in soils, and helps to identify areas where additional research and

theory development are still needed. This information will be of interest to scientists and engineers concerned with predicting the fate of pathogens in soils and aquifers. *United States Salinity Laboratory, Riverside, CA*

Climate Change and the U.S. Western Rangelands



As the greenhouse gas carbon dioxide (CO_2) continues to increase in Earth's atmosphere and temperatures rise, many are moving beyond wondering about the possibility of climate change to considering what its consequences will be. Answers to this question relevant to the wide expanses of US western rangelands are beginning to emerge in a unique field experiment which is evaluating the combined effect of higher CO_2 and temperatures on native mixed-grass prairie. The news is not all bad. While the warmer temperatures of future environments will tend to dry out these already dry grasslands, the higher CO_2

concentrations may off-set, at least temporarily, this negative effect of warming through improved plant water use efficiency. As a result, productivity in the next few decades in many western rangelands may remain relatively unchanged from current levels. However, there is also evidence that several invasive plant species, including Dalmatian Toadflax, diffuse knapweed, and Cheatgrass, may be favored under future climatic conditions, adding to the growing concern that invasive plants are becoming increasingly difficult to control in many western rangelands. Results suggest that weed invasions may be a high-priority area for developing adaptive management strategies to deal with climate change on rangelands. Results are being used by modelers and other climate change scientists to forecast the impact of climate change on ecosystems around the world, and are being featured in national and international climate change assessments. *Rangeland Resources Research Unit, Cheyenne, WY and Fort Collins, CO*

Release of a Tall-Statured Forage Kochia, Snowstorm



Winter feeding can account for 50 to 70% of the yearly input costs for livestock production in the western United States. Extending grazing into the fall and winter on western rangelands increases the sustainability of livestock and wildlife. Winter grazing of rangeland grasses, however, does not meet minimum protein requirements for ruminant livestock. Grazing of rangeland shrubs helps meet this protein requirement, but most shrubs are not palatable and/or are covered by winter snow pack. Forage kochia is a drought and salt resistant perennial shrub that remains green and succulent during the heat of the summer, and on snowy days, the leaves and stems provide a high protein snack for cattle and wildlife. However, the only previously released “Immigrant” forage kochia is short-statured at 10-16 inches and is often covered by snow. The USDA collected (Uzbekistan), bred for the past 10 years, and recently released a tall-statured forage kochia, “Snowstorm” at 24-36 inches that provides cattle and wildlife with more abundant highly digestible forage with higher protein. *Forage and Range Research Laboratory, Logan, UT*

Wheat Straw as an Alternative to Pine Bark in Container Substrates



ARS researchers engineered an effective substrate composed primarily of locally produced wheat straw to replace imported pine bark in nursery container substrates. Pine bark is currently used as the primary potting substrate in the nursery industry, but its cost is increasing, its availability is decreasing, and it must be transported over long distances from the southern United States. ARS scientists developed a new potting substrate comprised primarily of wheat straw and low levels of pine bark. On-farm trials have shown that these substrates are effective in a variety of production systems. Adoption of these substrates would reduce dependency on pine bark imported from distant southern states; using instead locally sourced wheat straw biomasses for nursery crop substrates. *Application Technology Research Unit, Wooster, OH*

Clear Invasive Eastern Red Cedar to Produce Jet Fuel



Eastern red cedar trees are native but have invaded formerly productive eastern Great Plains rangeland over the past 100 years due to fire exclusion and other human activities. ARS scientists have developed a remote sensing technique to accurately estimate the amount of red cedar biomass in Oklahoma that can be harvested. Working with NRCS, the team estimates that the 12 million tons of red cedar growing in the 17 highest impacted counties is enough to produce 800 million gallons of biofuel or 9-million megawatt hours of electricity. Clearing the red cedar will also restore the rangeland productivity for native wildlife habitat and cattle grazing.

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Commercial business developers are proposing to use this feedstock resource and are pursuing capital to build a first-of-a-kind jet fuel biorefinery in Oklahoma. The accomplishment is also a contribution to the western and northwestern regional USDA Biomass Research Centers. *Forage and Livestock Production Research Unit, El Reno, OK*

New Energy Cane Variety Developed



ARS scientists and their collaborators have developed a new sugarcane variety with fiber-rich stalks that could help set the stage for producing biofuels from cellulose. Millions of acres of dedicated feedstocks will need to be produced to help meet legislated biofuel targets, and energy cane is one of the crops that will be needed for the southeastern region of the United States. The new cane variety *Ho 02-113* was bred with biofuel use in mind, and is one of four high-fiber varieties that have been released in anticipation of biorefinery needs for Gulf-Coast specific crops. *Ho 02-113* produces dense

stands of high-fiber stalks, making it more adaptable to a wider range of environments than typical cane intended for sugar production. In addition to being able to produce new growth from un-harvested stalk material, it also survived natural outbreaks of brown rust, smut, leaf scald and mosaic disease. ARS researchers publically released *Ho 02-113* in cooperation with Louisiana State University and the American Sugar Cane League. This effort is a product of the Southeastern Regional USDA Biomass Research Center. *Sugarcane Research Unit, Houma, LA*

Rapid Estimation of Cellulosic Ethanol Yield



ARS and the Near Infrared Spectrophotometry Consortium (NIRSC) established a cooperative agreement for transferring switchgrass composition NIRS calibrations to public and private laboratories and industries developing switchgrass as a biofuel biomass crop. The NIRSC is an association of commercial analysis laboratories, universities, government agencies, plant research companies, and instrument companies that collaborate to develop standardized NIRS methods, and disseminate information about the accuracy and application of NIRS technologies. ARS scientists led this new effort that has provided a rapid method to mass screen the quality of switchgrass genetic lines for improved performance, and for biorefiners to accurately assess the expected ethanol yields from biomass produced across a wide range of production field conditions. This effort is a product of the Central-East Regional USDA Biomass

Research Center. *Grain, Forage and Bioenergy Research Unit, Lincoln, NE*

Corn Gene Enhances Switchgrass Biofuel Production



ARS scientists have increased starch production in switchgrass by up to 250 percent using a novel form of the corn gene *cg1* (*corngrass1*). Starch produced by *cg1* switchgrass was converted into simple sugars such as glucose and without energy-intensive and expensive pretreatment of biomass. Moreover, *Cg1* switchgrass does not produce seeds or pollen, thus preventing the inadvertent movement of this gene by pollen to native switchgrass populations, thus protecting natural sources of genetic variation. The *cg1* switchgrass represents a new model to genetically improve feedstocks for the biofuel production industry. The research collaboration is between ARS scientists, the Department of Energy, Energy Biosciences and Joint BioEnergy Institutes. This effort is a product of the Central-East Regional USDA Biomass Research Center. *Plant Gene Expression Center, Albany, CA*

Novel Bacteria for Wastewater Treatment



Investigators discovered a novel bacterium having the characteristics of oxidizing ammonia and releasing nitrogen gas under anaerobic conditions. The novel bacterial strain *Candidatus Brocadia caroliniensis* may be used for the treatment of wastewater having undesirable levels of ammonia, including agricultural, industrial, or municipal wastewaters. Compared to conventional biological nitrogen removal methods, this microbial method uses 60% of the energy normally required for aeration and does not require external carbon addition. In addition, by-products do not include greenhouse gases (methane and nitrous oxide). This leads to a significant decrease in operational costs and provides possible environmental credit benefits for the users of this new technology. *Coastal Plains Soil, Water, and Plant Research Center, Florence, SC*

Agricultural Fibers Make Eco-Friendly Packaging



Expanded Polystyrene (EPS) is used to make non-biodegradable protective packaging materials, a \$2.2 billion industry. Engineers at Lubbock, TX, discovered optimal blends of agricultural biomasses that maximize performance of 100% biodegradable packaging composites, produced using cooperators technology, which outperformed EPS and opened additional markets for the product. As a result of this research, the agricultural biomass protective packaging material has been successfully evaluated for other uses such as acoustic tiles, insulation panels, furniture cores, and footwear. Several Fortune 500 companies are now using the product. *Cotton Production and Processing Unit, Lubbock, TX.*

Biochars Made from Manures and Crop Residues Improve Soil Carbon Sequestration, Water Storage, Fertility, and Remove Harmful Chemicals



Investigators produced biochars, a charcoal-like product, during carbonization of manure and plant waste materials using both thermal and hydrothermal processing. Both of these processes were optimized to produce biochars with diverse chemical and physical properties. Laboratory research showed that biochars made from nut shells were effective at increasing soil carbon sequestration while biochar made from grasses increased soil water storage. Manure biochars contained plentiful plant nutrients such as nitrogen, phosphorus, and potassium, but were blended with other plant-based biochars to produce a more nutrient balanced fertilizer-like product. Location scientists also

discovered that hydrochar, the biochar made from hydrothermally processing poultry litter, can be used as an environmental adsorbent for effectively removing harmful chemicals such as endocrine disrupting chemicals and estrogens. Production of these biochars and their blends leads to an alternative use of agricultural byproducts that can increase soil carbon sequestration and water storage, provide essential plant nutrients and reduce levels of contaminants in soils. *Coastal Plains Soil, Water, and Plant Research Center, Florence, SC*

Biomass Production in Urban Areas



Biomass yield from urban landscapes is an untapped resource. Utilization of urban landscapes for biomass-for-energy production would free agricultural landscapes for food production. In 2007 and 2008, biomass production was estimated from a typical urban landscape in Woodward, Oklahoma. The harvested biomass production included: lawn thatch, lawn clippings, fallen leaves, and tree and shrub prunings. The data suggests that during a high precipitation year it was possible to harvest 6.0-to-8.5 tons of dry biomass from an acre of urban green space and 3.5-to-5.5 tons of dry biomass per acre in a normal

precipitation year. Similarly, the City of Woodward, Oklahoma could generate approximately 4,100 tons of dry biomass in a normal rainfall year and about 6,700 tons in a high rainfall year. In the United States, there is an estimated 36 million acres of land cultivated to grasses, trees, and shrubs. At an average yield of 5.0 tons per acre, urban areas in the United States have the potential to generate an estimated 180 million tons of dry biomass. This number could be larger if debris from natural disasters, such as, ice storms, tornados, hurricanes, and floods were added. Lawn clippings, fallen leaves, and tree limbs are all potential sources of biofuels and most cities already collect and transport these materials to disposal/recycling sites. However, if every urban landholder provided their green biomass for energy production; cities could alternatively collect and transport these biomass materials to a local biomass fueled energy conversion plant where they could be used to produce electricity or converted into other energy forms. *Southern Plains Range Research Station, Woodward, OK*

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ARS Germplasm Distribution

The National Genetic Resources Program (NGRP) is responsible for acquiring, characterizing, preserving, documenting and distributing to scientist, germplasm of all life forms important for food and agricultural Production. This table lists the number of distributions from each NGRP repository to different organizational categories. Distributions occurred throughout the world.

Repository	Organizational Category												
	UARS	UFED	STA	UCOM	UPRU	UIND	UAID	INT	FGEN	FCOM	FPRU	FIND	Total
BRW	-	-	-	-	-	-	-	-	-	-	-	-	141*
COR	821	3	1252	694	151	1692	0	0	0	19	834	3	5469
COT	1492	0	382	462	2	192	0	2	0	100	180	0	2812
DAV	88	0	6063	230	35	265	0	0	7	15	20	0	6723
GEN	-	-	-	-	-	-	-	-	-	-	-	-	-
GSOR	1373	0	3493	597	278	1769	0	0	0	0	111	150	7771
GSPI	1427	2	1033	101	5	444	0	0	432	35	6038	3	9520
GSZE	1	0	30	1	8	0	0	0	0	0	471	2	513
HILO	-	-	-	-	-	-	-	-	-	-	-	-	8305*
MAY	123	2	23	26	0	3	0	0	6	7	4	1	195
MIA	46	17	91	78	25	276	0	0	0	5	30	0	568
NA	101	2	159	48	7	9	0	0	0	0	9	0	335
NC7	-	-	-	-	-	-	-	-	-	-	-	-	184*
NE9	2016	299	14129	5957	809	1516	0	0	5434	4599	7728	42	42529
NR6	49	8	1330	1538	210	1375	0	0	2649	375	749	90	8373
NSGC	675	0	1077	2279	115	647	0	47	0	26	1115	6	5987
NSSL	13472	16	10687	1547	2448	1116	0	5232	40189	1056	19903	28	95694
NTSL	606	33	245	60	3	4	0	0	15	224	10	24	1224
OPGC	395	0	26	0	0	0	0	0	0	0	0	0	421
PALM	15	3	221	127	14	67	0	0	503	55	96	0	1101
PARL	-	-	-	-	-	-	-	-	-	-	-	-	-
RIV	10	50	41	133	29	119	0	0	6	29	86	0	503
S9	0	0	73	5	0	67	0	0	0	0	18	25	188
SOY	5736	8	10092	6501	204	1613	0	0	6791	5588	3924	16	40473
TGRC	6083	0	12462	8573	49	802	0	0	1764	89	1492	0	13314
W6	-	-	-	-	-	-	-	-	-	-	-	-	6206*
Total	36341	561	67796	30596	4867	15165	0	5562	59304	15237	54876	439	305,580

*These repositories did not distinguish the distribution category.

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ARS GERMPLASM DISTRIBUTION KEY

ORGANIZATIONAL CATEGORIES: **FCOM**=Foreign commercial company, **FGEN**=Foreign genebank/resources unit, **FIND**=Foreign individual no affiliation, **FPRU**=Foreign non-commercial organization, **INT**=CGIAR International Agr. Res. Center, **STA**=U.S. state agencies and all universities, **UAID**=US agency for International Development, **UARS**=Agricultural Research Service, **UCOM**=U.S. commercial company, **UFED**=U.S. Federal agency (not ARS or AID), **UNID**=U.S. individual no affiliation, and **UPRU**=U.S. non-profit organization.

REPOSITORIES:

BRW Natl. Germplasm Repository - Brownwood
COR Natl. Germplasm Repository - Corvallis
COT Cotton Collection
DAV Natl. Germplasm Repository - Davis
GEN Natl. Germplasm Repository - Geneva
GSOR Rice Genetic Stock Center
GSPI Pea Genetic Stock Collection
GSZE Maize Genetic Stock Center
HILO Natl. Germplasm Repository - Hilo
MAY Natl. Germplasm Repository - Mayaguez
MIA Natl. Germplasm Repository - Miami
NA National Arboretum
NC7 North Central Regional PI Station
NE9 Northeast Regional PI Station
NR6 Potato Germplasm Introduction Station
NSGC National Small Grains Collection
NSSL National Center for Genetic Resources Preservation
NTSL Forest Service National Seed Lab
OPGC Ornamental Plant Germplasm Center
PALM National Arctic Plant Genetic Resources Unit
PARL National Arid Land Plant Genetic Resources Unit
RIV Natl. Germplasm Repository - Riverside
S9 Southern Regional PI Station
SOY Soybean Collection
TGRC C.M. Rick Tomato Genetics Resource Center
TOB Nicotiana Collection
W6 Western Regional PI Station

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3.9. Technology Transfer Outreach, Workshops, Field Days & Forums



Alabama:

National Soil Dynamics Laboratory (Auburn, AL)

- Hosted 16 students from the National University of Agriculture in Honduras on learning about agriculture systems and practices of the southeastern United States (10/21/2011).

Arizona:

U.S. Arid Land Agricultural Research Center (ALARC), Maricopa

- Hosted 60 irrigation engineering students and faculty from the University of Chapingo, Mexico. Center scientists discussed ongoing research in irrigation modeling, irrigation management, and remote sensing in irrigated agriculture. (11/2011)
- Representatives from the Maricopa Community College District visited and toured ALARC to learn about our research programs and the potential for developing partnership/collaboration with community colleges throughout Arizona. (11/2011)
- Hosted annual Focus Group meeting of industry, university and grower representatives from the local, regional and national level. (11/2011)
- Hosted a visit from the Economic Development Director for the City of Maricopa and representatives of the Canadian Consulate. (11/2011)
- Hosted 30 students and faculty from Estrella Mountain Community College. Provided tour and presented on-going research in agricultural biotechnology. (11/2012)
- Hosted a tour in coordination with 30 members of the Arizona Farm Bureau for the Agriculture Air Quality Task Force-NRCS to learn more about agriculture in the Arizona Region and research being conducted at our center (2/6/2012).
- Hosted the Cotton Incorporated Risk Management Seminar, sponsored by Cotton Incorporated and Calcot Ltd., to discuss Market-based Strategies on “How to manage your Price Risk for the 2012 Crop Season, and Integrate Crop and Revenue Insurance.” About 20 people attended. (2/29/2012).

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- Hosted a tour for the Summer Ag Institute, a group of about 30 educators from Elementary and High Schools from all over the State of Arizona. (6/4/2012).
- Hosted tour of ALARC for 40 people in coordination with the City of Maricopa and Arizona BioIndustry Association (AZBio). (7/25/2012).
- Center scientists attended the Maricopa County Community College District – STEM Internship Expo at the Phoenix College located in Phoenix, AZ. (9/29/2012)
- Hosted weekly Seminars providing the agricultural community with a forum for keeping abreast of research developments on a wide range of topics. (10/2011-5/2011)

Southwest Watershed Research Center, Tucson and Tombstone

- Hosted a tour of the Walnut Gulch Experimental Watershed for 16 graduate students from Arizona State University (3/15/2012).
- Outreach event with five of the ranching families operating on the Walnut Gulch Experimental Watershed to show the impact of research **on the watershed to cooperators that allow us to work** on their land (5/30/2012).
- Hosted three visitors from the University of Talca and the government of Chile for a tour of the Walnut Gulch Experimental Watershed (5/10/2012).
- Hosted 22 undergraduate students from the University of Chapingo URUZA (Unidad Regional Universitaria de Zonas Áridas de la Universidad Autónoma Chapingo) in Bermejillo, Durango for a tour and demonstrations of soil and water management tools and research. (5/10-11/2012).
- Hosted 23 water resource professionals from Germany for the tour of the Walnut Gulch Experimental Watershed (9/29/2012).

Arkansas:

Harry K. Dupree Stuttgart National Aquaculture Research Center (Stuttgart, AR)

- Hosted a delegation from Embrapa, the Brazilian agency counterpart to ARS, and the Office of International Research Programs (6/14-6/15/2012).
- Hosted a Direction Setting Workshop with presentations and a roundtable discussion with fish producers and support industry personnel (8/9/12).

Dale Bumpers National Rice Research Center (Stuttgart, AR)

- Participated in the Annual Rice Field Day at Beaumont, TX by presenting research on improving the mineral nutritional content of rice grain and on optimizing organic rice production methods. Attended by about 200 growers and industry representatives (7/12/2012).
- Participated in the 2012 Rice Expo hosted by the University of Arkansas. Attended by about 1100 people (8/3/2012).

Poultry Production and Product Safety Research Unit (Fayetteville, AR)

- Presented research at the Southern Sustainable Agriculture Working Group Annual Conference and Trade Show in Little Rock. Attended by over 1,200 people (1/19-21, 2012).
- Participated in the Farm Foundations: Planning for Success Workshop in Marshall AR by presenting information on business planning, identifying markets and different marketing strategies for sustainable livestock production. Attended by 60 new and beginning farmers including many military veterans (4/21-22, 2012).
- Participated in the Arkansas Women in Agriculture Annual membership meeting by presenting research and information about the University of Arkansas/ARS Beginning Farmer and Rancher program. Attended by over 200 people (4/27/2012).

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Dale Bumpers Small Farms Research Unit (Booneville, AR)

- Hosted a Sheep and Goat Field Day on organic production of small ruminants and control of internal parasites in small ruminants. Attended by 40 producers and extension agents attended (10/8/2011).
- Participated in the Southern Sustainable Agriculture Working Group Annual Conference and Trade Show in Little Rock, AR by presenting research on agroforestry and small ruminants. Attended by over 1200 farmers, ranchers, researchers, and food advocates (1/19-21/2012).
- Participated in the Katahdin Hair Sheep International Expo in Wooster, OH by presenting research on parasite control in sheep. Attended by over 200 producers and industry representatives (8/8-12/2012).
- Participated in the North Carolina State University Precision Agriculture Field Day at Plymouth, NC (6/19/2012) and the North Carolina State University Cooperative Extension Service Field Day at Monroe, NC (6/20/2012) by presenting research on subsurface application of dry poultry litter. Attended by over 200 agricultural producers and extension personnel.

California:

Processed Foods Research Unit, Albany

- Hosted two team meetings with the tomato processing industry in support of research on Development of a Demonstration Infrared Heating System for Tomato Peeling. (8/25/12 and 10/5/12)

Western Regional Research Center (WRRC), Albany

- 25 Representatives from the California Wheat Commission visited WRRC, where ARS data on wheat research were presented. (8/29/12)
- Hosted a weekly Academic Workshop Program was hosted by WRRC researcher Bor-Sen Chiou for 13 students. (weekly in 2012)

National Clonal Germplasm Repository, Davis

- Participated in University of California Picnic Day, where attendees included University staff, students and the public (4/21/12)
- Hosted mulberry and peach tasting at Wolfskill Experimental Orchards (WEO) to Rare Fruit Growers and other stake holders. (6/2/12)
- Hosted a tasting and tour at Wolfskill Experimental Orchards (WEO) for the Culinary Institute of America (CIA). (9/7/12)
- Hosted a fig and grape tasting at Wolfskill Experimental Orchards (WEO) for Rare Fruit Growers and other stakeholders. (9/8/12)

Western Human Nutrition Research Center in Davis, CA

- Hosted or presented at many events to encourage participation in our human studies including UC Davis Picnic Day, Davis Farmers Market, the City of Davis Health and Wellness Day (3/24/12), UCD's Soaring to New Heights event which emphasizes equity and diversity(4/10/12), UCD's Thank Goodness for Staff event (5/9/12), and the UCD Retiree Fair (7/18/12), and the Black Fall Welcome and Chicano/Latino Student Welcome at UC Davis (9/25/12).
- Hosted a visit by Princess Sirindhorn of Thailand and senior government advisors on 5/14/12. The Princess is interested in developing a similar Center in Thailand.
- Hosted an Open House for Stakeholders in conjunction with a Nutritional Phenotyping Symposium held at UC Davis. The Symposium was organized jointly by the WHNRC and the Foods for Health Institute at UC Davis. There were 150 attendees including many stakeholders. (7/11-7/13/12)

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- Presented the main research areas and human studies for 30 students and faculty from Nagoya University, Japan on 8/16/12.
- Hosted and held 3 days of research planning with colleagues from institutions in Denmark, who are working with the WHNRC under an agreement with ARS.
- Hosted Dr. Paul Coates from NIH's Office of Dietary Supplements on 5/30/12.
- Organized 2,621 hours of training in the WHNRC Metabolic Kitchen for UC Davis undergraduate interns between 10/1/11 and 7/31/12.

Crop Diseases, Pests and Genetics Research Unit, Parlier

- Hosted a tour of students and faculty from the University of São Paulo - Luiz De Queiroz College of Agriculture in Brazil (2/17/12)
- Hosted a site tour for a group of faculty from the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) in Italy to discuss ACP/HLB management and diagnostics and post harvest disease problems with tree fruits (8/17/12)
- Hosted three California Table Grape Commission research committee meetings. The audience included fruit growers and research committee members for evaluation of advanced table grape selections in the breeding program. (8/8/12; 9/19/12; and 10/19/12)
- Hosted an informational meeting and tour for several representatives of the raisin industry and discussed the raisin breeding program and progress being made in the program. (10/3/12)
- Hosted a group of seven scientists from Yunnan Academy of Forestry, China, with research interests in fruits/nuts trees and forestry. Discussed issues involving pathogen and insect pest control. (10/23/12)

Commodity Protection and Quality Research Unit, Parlier

- Hosted the postharvest phosphine fumigation meeting. The audience included fresh fruits and tree nuts industry people, researchers and chemical company representatives (9/27/2012).
- Hosted the area wide NOW (Navel Orangeworm) project Stakeholder Meeting. The audience included university researchers, extension agents, insecticide company representatives, professional crop advisers and Area Office (10/2/2012).

National Arid Land Plant Genetic Resource Unit, Parlier

- Hosted a booth at the World Ag Expo, Tulare, CA., The World Ag Expo is the largest annual agriculture exposition of innovative agriculture methods, crops and equipment and is attended by people in agribusiness and the general public (2/14-16/2012).
- Hosted a booth at the Fresno Farm and Nutrition Day, Fresno, CA, for students and the general public (3/23/2012).
- Hosted a booth at the Fresno Water-Wise Plant Exchange, Fresno, CA, for home gardeners and the general public interested in replacing regular landscape plants with water efficient ones (5/5/2012).
- Hosted a site tour for a group of the Future Farmers of America interested in agricultural research (4/23/2011).
- Hosted a site tour for a group of staff from Fresno State and the City of Fresno and Cal Trans employees interested in germplasm adequate for drylands to be used for research or to landscape public areas (6/13/12).
- Hosted a site tour for members of the Chukchansi tribe interested in crops adequate to their tribal lands (5/3/12).
- Hosted a site tour site tour for a group of faculty and students from Chile interested in agricultural research in a climatic zone comparable to their main agricultural region (7/27/12).

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National Clonal Germplasm Repository for Citrus and Dates, Riverside

- Hosted tours of the Repository and facilities during the University of California Riverside Citrus Day. Two hundred stakeholders were registered. (1/26/2012)
- Hosted eight Friends of Citrus groups with 35-50 stakeholders present. (12/13/2011, 1/12/2012, 2/7/2012, 4/26/2012, 5/8/2012, 6/12/2012, 8/24/2012, 9/25/2012)

Crop Improvement and Protection Research Unit, U.S. Agricultural Research Station, Salinas

- Hosted four scientists and administrators from Xinjiang Academy of Agricultural Sciences, Urumqi, China (10/24/2012)
- Hosted Hartnell College Food Safety Course (~ 75 participants) for hands-on field sampling of field irrigation systems and produce cold storage rooms. (10/25/2012)
- Hosted USDA Deputy Under Secretary Anne Bartuska, Congressman Sam Farr, representatives of five local and state agricultural industry organizations for an overview of the Salinas student internship program, “Real World Research Opportunities for Underserved Populations,” and an overview of the Salinas Location organic research program. (10/25/2011)
- Hosted four Hartnell College Deans for discussions about enhancing their student intern program. (11/2011)
- Hosted Barbara Allen-Diaz, incoming Vice President, University of California, Division of Agriculture and Natural Resources, and Bill First, Dir., University of California, Cooperative Extension Research Centers. (2/10/2012)
- Trained two seed industry scientists on the identification of bacterial plant pathogens. (2/13-17/2012)
- Hosted the 2012 AgKnowledge class (~ 20 participants), which is sponsored by the Salinas Valley Grower-Shipper Association. (5/11/2012)
- Hosted a strawberry field day (~ 75 attendees) focused on fumigant and non-fumigant alternatives to methyl bromide (5/24/2012).
- Provided information to a seed industry scientist on pathogenicity and seed testing, molecular identification, and management of bacterial plant pathogens. (6/19/2012)
- Demonstrated western irrigation practices for two sessions (~ 90 participants total) of a food safety training course organized by the Western Institute of Food safety, University of California, Davis. (6/19/2012 and 7/17/2012)
- Hosted incoming Hartnell College President Willard Lewallen and associated STEM administrators to provide an overview of work by Hartnell College Student Interns at the Salinas Location. (7/26/2012)
- Hosted a strawberry field day (~ 20 attendees) focused on non-fume alternatives to methyl bromide (8/9/2012).
- Hosted Congressional delegation that included Congressman Jack Kingston, Chairman, Subcommittee on Agriculture Appropriations; Congressman Sam Farr, Ranking Member, Subcommittee on Agricultural Appropriations; Alec Arago, District Director for Congressman Farr; Jim Bogart, President and General Counsel, Grower-Shipper Association of Central California; Matt McInerney, Executive Vice President, Western Growers; and Dennis Donohue, Mayor, City of Salinas. (8/25/2012)
- Hosted five Serbian scientists funded by USDA-FAS for a training workshop on the identification of bacterial plant pathogens organized by the Salinas Location. (9/15-29/2012)

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Colorado:

Central Great Plains Research Station (Akron, CO)

- Hosted a Field Day on dryland cropping systems research. Attended by farmers, ranchers, and Natural Resources Conservation Service, Agribusiness and Extension personal (6/15/2011).

Sugar Beet Research Unit (Fort Collins, CO)

- Hosted a tour as part of a Western Sugar Cooperative tour to Fusarium research plots in Sterling, CO. Attended by about 35 growers, agriculturalists, and seed company representatives (7/23/2012).

Agricultural Systems Research Unit (Fort Collins, CO)

- Hosted an open house for customers and stakeholders presenting research on agricultural systems models and demonstrated the use of 'Summer crop Selection', 'Colorado Water Optimizer' and 'Rangelands Drought Calculator' decision tools (September 29, 2011).

National Center for Genetic Resources Preservation (Fort Collins, CO)

- Conducted tours for the Potato Growers Association highlighting seed and clonal preservation processes and storage facilities. Attended by 88 growers (3/06/2012 & 8/15/2012).
- Conducted a tour and workshop for Brazilian Agricultural Research Agency EMBRAPA scientists highlighting preservation and research activities of plant and animal genetic resources. Attended by 30 scientists (12/04-06/2011).
- Conducted a tour for members of the Plant Growth Regulator Society highlighting preservation and research activities of both plant and animal genetic resources. Attended by 15 scientists (07/26/2012).
- Conducted tours for the Citrus Growers Association highlighting research on citrus clonal micropropagation techniques to provide disease-free citrus clones for long term preservation and storage. Attended by over 80 people (10/05/2011 & 8/29/2012).
- Conducted a tour to 14 scientists visiting from China (9/14/2012).

Water Management Research Unit (Fort Collins, CO)

- Conducted tours of the Limited Irrigation Research Farm to 50 people from the Colorado Interbasin Compact Committee (9/10/12), 50 people from the Colorado Water Education Foundation Agricultural Water Workshop (10/17/11), and 25 people from the Breeding for Drought Stress class (6/14/12).
- Co-Organized, hosted, and presented an Evapotranspiration Workshop. Attended by 120 people (3/21/12).

Northern Plains Area Office (Fort Collins, CO)

- Hosted a Northern Colorado Technology Transfer Fair along with the Centers for Disease Control (CDC), Animal Plant Health Inspection Service (APHIS), Forest Service (FS), and the National Renewable Energy Laboratory (NREL) to highlight research from the Federal Labs in Northern Colorado. The event was attended by 180 registrants (08/07/12).

Florida:

U.S. Horticultural Research Laboratory (Fort Pierce, FL)

- Hosted the Annual Open House/ Field Day highlighting research on insect biology and behavior, horticultural plant pathogens, water quality enhancement, sensory evaluation of fruits and vegetables,

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postharvest physiology, citrus genetics, utilization of citrus processing by-products, and biological pest management. Attended by over 400 people (4/4-5/2012).

- Hosted the Science Institute of Discovery (6/19, 21, 26, 28/2012).
- Consulted by EPA on the status of research on alternatives to methyl bromide for cut flowers (5/8 & 7/24/2012).
- Presented “Updates on Watermelon and Cucurbit Viruses, and *Groundnut ringspot virus* in South Florida” at the University of Florida Extension’s vegetable growers meeting (2/2012).

Subtropical Horticulture Research Station (Miami, FL)

- Participated in the Miami Dade College’s Children’s Holiday event with presentation of interactive chemistry activities. Attended by over 25,000 children and their families (12/10/2011).
- Hosted members of the California Avocado Commission and the Florida Avocado Growers for presentations on research activities and discussions on industry concerns and strategies for management of ambrosia beetles and their associated fungal pathogens (5/30-31/2012).
- Participated in the Redlands Fruit Festival in Homestead, Florida. Attended by over 2,500 local residents (6/16-17/2012).
- Hosted a tour during Miami Community Day highlighting facilities with educational displays and an interactive area for children that included a butterfly house, biological control insects, hands-on chemistry activities and 4H activities, and taste tests. Attended by over 700 area residents (6/23/2012).
- Organized a symposium “Coupling USDA Research Projects with Student’s Academic Preparation” for over 60 participants from APHIS, the Everglades National Park, Fairchild Tropical Botanic Garden, Florida International University, Miami-Dade College, and St. Thomas University (3/29/2012). Organized a symposium “Coupling USDA Research Projects with Student’s Academic Preparation” for over 60 participants from APHIS, the Everglades National Park, Fairchild Tropical Botanic Garden, Florida International University, Miami-Dade College, and St. Thomas University (3/29/2012).
- Organized field and lab tour for 60 Honduran students and students from local Universities and Colleges (10/19/2012).
- Presented to the Palmetto Bay Garden Club on amaryllis. Attended by 30 people (9/24/2012).
- Presented a history of the Station and ornamental germplasm program to the Gifford Arboretum of University of Miami. Attended by 20 people (11/1/2012).

Center for Medical, Agricultural, and Veterinary Entomology (Gainesville, FL)

- Hosted the 50th Anniversary Celebration for the Center for Medical, Agricultural and Veterinary Entomology (CMAVE) with a formal program on research activities and a tour of the facility. The event was attended by over 40 stakeholders and customers from academia, Florida mosquito control programs, and industry.
- Co-Hosted with Behavior and Biocontrol Research Unit and Mosquito and Fly Research Unit a booth at the Florida State Fair as part of an “Insect Encounters” exhibit at the Fair. Annual attendance at the Fair approaches nearly half a million people with approximately 65,000 passing through the “Insect Encounters” exhibit area (2/8/12 – 2/20/12).

Behavior and Biocontrol Research Unit (Gainesville, FL)

- Co-sponsored the “Grape Harvest Festival” with the Center for Viticulture and Small Fruits at Florida A&M University highlighting current research activities. Attended by over 2,000 people (08/25/2012).
- Presented Workshop highlighting research on conservation biological control on Thrips and Tospovirus management in pepper, eggplant, and tomato as part of the University of Florida In Service Training (3/2012).
- Presented research on biological control of vegetables at the Beginning Farmer and Rancher Workshop, coordinated by the Florida A&M University / University of Florida Cooperative Extension Service (10/14/12).

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- Co-hosted tours and made presentations at the IPM Field Day with Florida A&M Univ. / University of Florida Cooperative Extension Service and Florida A&M University's Center for Viticulture and Small Fruits. Attended by the general public (10/12/2011, 6/14/2012, 6/14/2012).
- Presented research on the invasive cactus moth at a volunteer training symposium at the Guana Tolomato Matanzas National Estuarine Research Reserve, Ponte Vedra, FL. Attended by natural resource managers, college and high school students, local landowners (07/02/ 2012).
- Participated in Entomology Field Day and Workshop with Florida A&M University. Attended by over 100 people (11/1-3/2011).
- Presented research on integrated pest management and biocontrol of major insect pests to organic and sustainable growers organized by the Red Hills Small Farm Alliance, Tallahassee, FL. Attended by general public. (02/12/2012).
- Present research on biocontrol of pests in vegetable and horticultural systems to organic and sustainable growers organized by the Florida A&M Univ. small farm program, Sopchoppy, FL (12/16/2012)

Imported Fire Ant and Household Insects Research Unit (Gainesville, FL)

- Hosted Professor, Taiwan National University and Director of the Taiwan Fire Ant Control Center for 3 months, during which time he became familiar with fire ant biological control techniques developed by Unit Scientists. This will facilitate the adoption of these practices in the fire ant infested areas of Taiwan (June – August 2012).
- Interacted/Consulted with US Parks Service and Nature Conservancy personnel responsible for Santa Cruz Island, CA and the eradication of isolated populations of invasive Argentine ants.
- Hosted, facilitated, participated, and acted as consultants to a film crew that developed a “Discover” style 3-D video entitled “Fire Ants: The Invincible Army.” The video is being marketed and viewed worldwide.
- Conducted a lab tour highlighting biological control of fire ants with insect pathogens to the Univ. Florida biological control class (2/2012).
- Gave a tour of invasive and other pest ants for the International Association of Operative Millers Food Protection (2/2012).
- Arranged tours of fly, mosquito, ant rearing and quarantine facilities to demonstrate aspects of insectary design for the MRI Architectural Group, Inc. (8/2012).
- Gave a presentation for Georgia Pest Control Association Summer Conference in Palm Coast, FL on fire ant biology and management to 30 attendees (7/2012).

Mosquito and Fly Research Unit (Gainesville, FL)

- Participated in the 3rd Annual Educator Open House at the Florida Museum of Natural History for teachers from Alachua County Schools (10/1/2011).
- Presented an orientation about *Aedes aegypti* biology and control to 27 science teachers in the High School Science Teachers Institute at the University of Florida (6/15/2012).
- Hosted tours to for the Navy Entomology Center of Excellence (11/8/2011), University of Florida students and teachers, international students from the University of Miami (7/26/2012), and members of the Georgia Pest Control Association (7/19/2012) on of facilities.

Chemistry Research Unit (Gainesville, FL)

- Writes a monthly column, “Science Buzz”, for the news letter “E-BUZZ” by the American Bee Federation on scientific issues pertaining to beekeeping.

Sugarcane Field Station (Canal Point, FL)

- Co-hosted with the University of Florida field tour of yield trials and presented yield results to sugarcane growers (5/31/2012, 6/1/2012).
- Hosted 18 graduate students and post-doctoral research associates from the Agronomy Department of the University of Florida for a program on sugarcane crossing and the ARS Cultivar Development Program (12/20/2011).

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- Hosted Workshop for 15 Central American and Brazilian agriculturalists/scientists on yields and disease reactions of ARS sugarcane cultivars. These cultivars occupy from 15 to 95 % of the commercial sugarcane production in their 7 countries (1/9/2012).
- Hosted 30 sugarcane agriculturalists from Australia and Brazil and gave presentation on the ARS Cultivar Development Program (2/2/2012).
- Gave presentation on ARS Sugarcane Development Program to 14 members of Florida Farm Bureau delegation (6/13/2012).

Georgia:

Southeastern Fruit and Tree Nut Research Laboratory (Byron, GA)

- Hosted the Triennial Open House/ Pecan Field Day highlighting research on entomology, pathology and horticulture of pecan. Attended by over 425 people (5/2012).
- Hosted Annual Central Georgia Peach and Pecan Updates highlighting research on breeding, nematology, entomology, pathology and horticulture of peach and pecan (2/ 2012)
- Several scientist spoke at 6-10 different state and regional peach and pecan conferences to update farmers on certain specifics of peach and pecan culture.

National Peanut Research Laboratory (Dawson, GA)

- Worked with the engineers from AIC Partners group and scientists from the Department of Industries and Fisheries and the University of Queensland, Australia to developing sensors suitable for both moisture and oil determination in peanuts to be used with the instrument ARS designed (1/10/2012, 3/15/2012, 4/21/2012, 5/11-5/25/2012).
- Hosted tours to researchers from Albany State University (9/19/2012), Annual Georgia Peanut Tour, Georgia Association of Conservation District Supervisors Group IV Summer Meeting (6/19/2012), and drip irrigation distributors (4/2012).
- Participated in workshops to members of the Georgia Young Farmers Association, Georgia Cooperative Extension Service, and growers by presenting, demonstrating, and distributing copies of the ARS FARMSUITE software crop for peanut production management.
- Hosted booths presenting research results at the Georgia Peanut Farm Show (1/19/2012), Alabama/Florida Peanut Farm Show (2/9/2012), and PB&J Day at the Georgia State Capitol (3/6/2012).
- Participated in the Georgia Peanut Commission research meeting providing research results on variety and digging dates (2/8/2012).
- Provided research results on aflatoxin in peanut to NIFA-AFRI Stakeholders meeting in Washington, DC (2/22/2012).
- Participated in meetings hosted by the GA Water Planning and Golden Triangle RC&D (3/3/2012) and the Southwest Georgia Project for Community Education, Inc. (5/10/2012) by demonstrating FarmSuite software for peanut production management and irrigation technology for socially disadvantaged and historically underserved growers.
- Participated in irrigation workshops hosted by Central GA and Ocmulgee Soil and Water Conservation District 29 (3/29/2012) and the Lower Chattahoochee River Soil and Water Conservation District (7/17/2012) presenting research data and demonstrating the ARS Irrigator Pro technology.
- Participated in a workshop with Auburn University on peanut breeding and biotechnology research for CEO's of the peanut industry and leaders of peanut farmer groups (8/20/2012).

Southeast Watershed Research Laboratory (Tifton, Georgia)

- Hosted two visiting scientists from Uruguay and provided tour of research activities associated with biofuels (10/06/2012).
- Conducted tours and made presentations to Soil Science (9/25/2012) and Hydrology (10/30/2012) classes from Abraham Baldwin Agricultural College.

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Plant Genetic Resources Conservation Unit (Griffin, GA)

- Presented research progress at Kiwanis Farm-City Week, Griffin, GA. Attended by 110 people (11/23/2011).
- Conducted tours and made presentations to 10 visitors from China (1/26/2012), Brazil (4/11/2012), and South Africa (9/17/2012).
- Conducted tours and made presentations to Spalding Chamber of Commerce (4/12/2012), University of Georgia External Affairs (7/27/2012) and Dean's Council (8/16/2012), S-009 Multistate committee (8/1/2012), and Tuskegee University (8/28/2012). Attended by 78 people.
- Conducted tours for students from Orrs (10/24/2011), Taylor (3/1/2012), Pike (3/21/2012), Rehoboth Road (5/9/2012), and Life Community (6/22/2012) schools. Attended by 297 students.
- Presented research progress at Peachtree City Library, GA, seed program. Attended by 50 people (8/4/2012)
- Presented research progress at the Experiment Station Directors meeting in Portsmouth, NH. Attended by 35 stakeholders (9/24/2012).

Southeast Poultry Research Laboratory

- Hosted a stakeholders meeting for 22 invited participants representing government agencies, the poultry industry, and university faculty that presented a review of the research programs at the laboratory and invited opportunities for stakeholders to provide input on research priorities at the laboratory (5/16/2012).

Hawaii:

Tropical Plant Genetic Resources and Disease Research Unit

- Hosted a booth about career opportunities at PBARC at the Career Opportunities Expo by Na Leo O Na `Opio and the Department of Education, attended by 427 high school students. (1/26/12)
- Conducted a facilities tour for Hawaii Community College Agriculture Business students. (9/12/12)
- Conducted a facilities tour for University of Hawaii at Hilo, College of Agriculture, Forestry, and Natural Resource Management for freshmen students. (11/15/11)
- Conducted greenhouse tours and discussed research programs with the public and dignitaries at the PBARC Phase II Dedication. (2/24/12)

Tropical Crop and Commodity Protection Research Unit

- Hosted visiting scientist from Brazil to learn about our fruit fly parasitoid rearing operation and establish collaboration to provide the EMBRAPA (research arm of the Brazilian Dept. of Agriculture) with *Fopius arisanus*, a fruit fly parasitoid (8/13-8/18/12)
- Hosted an extension field day in Puna, HI, a cooperative effort with UH PEPS, Extension Service and ARS to demonstrate new technology on SPLAT-ME-spinosad technology to control tephritid fruit flies in papaya orchards. Demo was given to Papaya farmers (8/8/12).

Idaho:

Northwest Watershed Research Center/Reynolds Creek Experimental Watershed, Boise

- Presented training and information at the Ecologically-Based Invasive Plant Management (EBIPM) Field School and Learning Fair in Reno, NV (50 participants, 8/28-29/12) and EBIPM workshop for 60 US Forest Service Employees in Redmond, OR (5/15/12).
- Presented NWRC rangeland restoration research for 30 BLM employees (Including BLM Director Robert Abbey) at the Snake River Birds of Prey National Conservation Area (5/6/12)

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- Co-hosted rangeland seeding equipment demonstration for BLM, NRCS, USFS and USGS employees in the Snake River Birds of Prey National Conservation Area (7/18/12).
- Participated in BLM Desert Discovery Days and presented invasive weed issues for 475 Kuna, Boise and Meridian school district students at the Snake River Birds of Prey National Conservation Area (5/3-4/12).
- Hosted Owyhee Hydrology Camp at the Reynolds Creek Experimental Watershed (RCEW) in the Owyhee Mountains. (4/11-12/12).

Northwest Irrigation and Soils Research Laboratory, Kimberly

- Hosted tour to present research associated with the influence of diseases on storage management in sugarbeet to growers, industry personnel, and scientists (2/13/12).
- Participated in Twilight Tour at the University of Idaho Res. & Ext. Center, Kimberly, ID. Presented poster displays and diseased plant material associated with research to the general public (7/18/12).
- Hosted field tour to present field research on curly top, rhizomania, and Rhizoctonia-bacterial root rot disease management in sugarbeet to growers, industry personnel, and scientists (7/25/12).

Illinois:

Soybean/Maize Germplasm, Pathology & Genetics and Global Change and Photosynthesis Research Units

- Participated in presentations at the University of Illinois' Agronomy Day regarding research on edamame and research activities at SoyFACE. Approximately 1000 attendees, including farmers, farm managers, junior college students, and ag industry personnel (8/16/2012).

National Center for Agricultural Utilization Research

- Hosted the North American Miller's Association/Corn Dry Miller's annual conference and provided updates on related ARS research (5/2012).

Iowa:

North Central Regional Plant Introduction Station

- Hosted Ames IA field day for the Germplasm Enhancement of Maize (GEM) Project. Over 60 people attended the field day, including private sector and university research (09/19/2012).
- Serves the world's plant genetic resource needs. As part of the U.S. National Plant Germplasm System, PIRU staff shipped nearly 40,000 packets of seed or plants to germplasm researchers in the past year.

National Laboratory for Agriculture and the Environment

- Co-organized and held 5 cover crop management workshops/field days at Research and Demonstration Farms across the state. Participation by NRCS field staff, as well as public. Presentations by researchers, farmers, and agricultural industry professionals (03/28/2012).

National Animal Disease Center

- Hosted 2 Midwest Dairy Association Board Meetings and presented updates on selected aspects of dairy cattle health research. In addition, an update was provided on the 2012 California BSE case diagnosed in the U.S. and an overview of ongoing BSE research programs. Over 75 dairy producers, extension agents, and university faculty total attended the meetings (6/19/2012 and 9/26/2012).

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Kansas:

Center for Grain and Animal Health Research (Manhattan, KS)

- Co-hosted with Animal and Plant Health Inspection Service, the Farm Service Agency, the National Agricultural Statistical Service, the Natural Resources Conservation Service, the Risk Management Agency, and Rural Development a USDA 150th Anniversary Celebration at the new Wind Erosion Research Laboratory. In addition to the formal program, the event also included a resource fair. Attended by over 300 stakeholders, customers, the general public, and members of the press (4/10/2012).
- Hosted the Plains Grains Inc. Board of Directors and State Administrators. Attended by 20 wheat commissions and other administrators representing the 12 state Great Plains hard winter wheat growing region (4/11/2012).
- Discussed research needs and opportunities with members of the Sorghum Checkoff program (April 12, 2012).

Louisiana:

Cotton Structure & Quality Research Unit (New Orleans, LA)

- Conducted tours for 54 attendees of the 2012 Southern Cotton Ginners Association Summer Meeting (7/8/2012).

Honey Bee Breeding Genetics & Physiology Laboratory (Baton Rouge, LA)

- Hosted annual Field Day with a record high attendance of 298 beekeepers (10/15/2011).

Sugarcane Research Unit (Houma, LA)

- Co-hosted with the Louisiana State University the Terrebonne Parish Sugarcane Field Day (6/1/2012).

Cotton Fiber Bioscience Research Unit, Cotton Chemistry and Utilization Research Unit, Cotton Structure and Quality Research Unit, and Food Processing and Sensory Quality Unit (New Orleans, LA)

- Conducted tours for Cotton Incorporated's bi-annual Cotton Breeders Tour. Attended by over 135 individuals from private companies, public institutions, and eight foreign countries (8/30-9/1/2012).

Maine:

Genetic Improvement for Fruits & Vegetables Laboratory (Beltsville, MD)

- Conducted the annual Potato Breeding Program's Cooperators' Harvest in Presque Isle, ME for over 900 different advanced selections with input provided by university scientists and extension personnel from Florida, North Carolina, Maryland, Pennsylvania, New York, Long Island, Maine and two growers (9/9-12/2012).

Maryland:

Beltsville Area Office

- Coordinated and Co-sponsored with the University of Maryland a Symposium on *Trends in Agriculture* talks on symbiogenetic phenomenon, development of perennial grains, linking food production to ecological realities, and sequencing and assembling large genomes with new technology. Included a poster session highlighting research conducted by the University of Maryland and BA scientists. Approximately 140 people attended the event. (10/2011)

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Sustainable Agricultural Systems Laboratory (Beltsville, MD)

- Organized a 3-day workshop in Stevensville, MD for 10 national leaders in organic grain research and outreach to develop a Grains Systems Community of Practice (CoP) for eOrganic, which is a part of eXtension (2/2012).
- Co-hosted the Maryland Organic Grain, Forage and Vegetable Workshop with University of Maryland Extension and Maryland Department of Agriculture in Queenstown, MD (3/6/2012).
- Conducted a tour on research integrating cover crops and animal wastes to improve agricultural sustainability; nutrient dynamics and greenhouse gas emissions in reduced-tillage organic systems; and long-term farming systems research to USDA Know Your Farmer, Know Your Food Committee (8/7/2012).
- Conducted a Sustainable Farming Research Tour for over 130 farmers, agricultural professionals and agency personnel highlighting projects on integrating cover crops and animal wastes to improve agricultural production (8/28/2012).
- Conducted a tour for the policy group AGree on long-term farming systems research; integrating cover crops and animal wastes in reduced-tillage organic systems; and perennial wheat breeding lines (9/19/2012).

Food Composition & Methods Development Laboratory (Beltsville, MD)

- Coordinated a 2-day research symposium and mentors for 26 students from the 1890 Land Grant Universities (2/10-11/2012).

Bee Research Laboratory (Beltsville, MD)

- Participated in the Smithsonian Folklife Festival on the Mall in Washington, DC featured the Bee Laboratory (7/2012).

Genetic Improvement for Fruits & Vegetables Laboratory (Beltsville, MD)

- Participated in the Annual Blueberry Growers' Open House providing research results on the mycorrhizae colonization of blueberry (3/13/12).
- Participated in the American Cranberry Grower's Association providing research results on the colonization of cranberry with ericoid mycorrhizae (8/16/12).

Hydrology and Remote Sensing Laboratory

- Conducted a tour of the OPE3 field site for "Know Your Food" committee, industry, students and interns providing recent major research accomplishments with regard to agrichemical transport and fate, precision agriculture and remote sensing (8/7/ 2012).

Invasive Insect Biocontrol & Behavior Laboratory

- Participated University of Maryland Day presented stink bug, bed bug and tick bug exhibits to 100's of people (3/26/2012).
- Participated in Brown Marmorated Stink Bug Working Group meetings at Virginia Tech in Winchester, VA presenting research accomplishments to industry chemist, formulators, farmers/growers and University researchers (6/12-13/2-012).

National Germplasm Resources Laboratory

- Conducted a two-week workshop on GRIN-Global sponsored by PROCINORTE-NORGEN, a North American agricultural research collaborative project, at the Mexican National Genetic Resources Center in Jalisco, Mexico . Attended by 29 trainees from five different countries (1030-11/10/2012).

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- Organized and hosted an approximately 2 hour virtual meeting/webinar for 32+National Plant Germplasm System Crop Germplasm Committee Chairs providing updates from the Office of National Programs, the Plant Exchange Office, and GRIN-Global (10/26/2012).
- Met with numerous research/policy groups to explain activities related to agricultural plant germplasm and answer questions. The most notable were: White House Office of Science and Technology Policy delegation (11/11/2011) and an Agricultural Delegation from Gansu Province in China (11/23/2011).

Nematology Laboratory

- Hosted a visit of the Research Director for potato commissions of Idaho, Washington and Oregon, together with a grower from Idaho, and a grower and member of the Washington Potato Commission to explain the science behind the identification in Oregon of a new type of cyst nematode discovered in Oregon which can reproduce on potato (3/1/2012).

Sustainable Perennial Crops Laboratory

- Hosted the World Cocoa Foundation meeting addressed current research and new research-needs of the industry. Attended by 40 cacao researchers from USA, Ghana, Costa Rica, Indonesia, and UK and members from the chocolate industry (Kraft, ADM, Mars, Hershey), as well as several NGOs and the WCF (6/15/2012).

Systematic Entomology Laboratory

- Participated in a multi-day exhibit at the 2012 USA Science and Engineering Festival in Washington, DC, presenting research accomplishments to over 150,000 participants.
- Participated in USDA's Ag Discovery program at the National Museum of Natural History in Washington, DC (7/26/2012).

Floral & Nursery Plants Research Unit

- Hosted a booth at Mid-Atlantic Nursery Trade Show presenting research accomplishments. Attended by about 10,000 people (1/11-13/2012).

Michigan:

Sugarbeet and Bean Research Unit

- Co-organized a sugar beet diagnostic day at the Saginaw Valley Research and Education Center. Participated as instructor and in setting up demonstration plots. Attended by over 100 local growers, field consultants, and private industry participants.
- Participated in a USAID-funded project on breeding dry bean varieties that are suitable for African countries, and conducted a Participatory Plant Breeding Workshop for technical staff in Rwanda (2/2012).

Minnesota:

Plant Science Research Unit

- Co-hosted a workshop on fast neutron mutagenesis of soybean for 40 soybean researchers to a workshop on fast neutron mutagenesis of soybean. Workshop included classroom presentations, as well as demonstration field plots (07/17/2012).

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North Central Soil Conservation Research Lab

- Conducted annual field day in conjunction with 150th anniversary of USDA, including the evolution of maize, organic weed strategies and land resource sustainability. Participation included more than 80 farmers, producers, crop consultants and scientists (08/16/2012).

Soil and Water Management Research Unit

- Presentation of Ag-Water Research concepts to MN Departments of Health & Agriculture, MN Pollution Control Agency and MN Department of Natural Resources (1/25/12). Presentation taped and sent to district offices around MN.

Mississippi:

Cotton Ginning Research Unit (Stoneville, MS)

- Along with the Cotton Technology Transfer Coordinator, hosted the Western Ginner School. Attended by 78 gin managers and operators (6/12-14/2012).

Southern Insect Management Research Unit (Stoneville, MS)

- Hosted the Mississippi Agricultural Consultants Association to discuss current and future research needs (3/19/2012).
- Hosted representatives of Cotton Incorporated, National Corn Growers, National Cotton Council, and United Soybean Board to discuss current research and future research needs (4/19/2012).

Thad Cochran Southern Horticultural Laboratory (Poplarville, MS)

- Hosted the annual meeting of the Southern Extension and Research Activity – a collaborative group of university and ARS researchers that conduct woody ornamental plant evaluations (6/6/2012).
- Hosted visitors and tours as part of the 29th Annual Blueberry Jubilee (6/9/2012).

Water Quality & Ecology and Watershed and Physical Processes Research Units (Oxford, MS)

- Hosted a Field Day for Oxford Elementary 3rd grade classes with 350 students, teachers, and chaperones attending. Participation was in conjunction with the National Sedimentation Laboratory's Adopt-A-School Program (3/30/2012).

Genetics and Precision Agriculture Research Unit, Crop genetics Research Unit, Genomics and Bioinformatics Research Unit, Southern Insect Management Research Unit, Catfish Genetics Research Unit, and Cotton Ginning Research Unit (Oxford, MS)

- Hosted stops on Cotton Incorporated's bi-annual Cotton Breeders Tour. Attended by over 135 individuals from private companies, public institutions, and eight foreign countries (8/30-9/1/2012).

Missouri:

Plant Genetics Research Unit

- Hosted Stakeholders meeting in Columbia, MO. Presented an overview of the mission and programs, along with ARS research programs and recent accomplishments to the major stakeholders for the programs, including National and State Corn Growers Associations, National and State Soybean Associations, universities, private industry and the Donald Danforth Plant Science Center (3/21/2012).

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Cropping Systems and Water Quality Research Unit

- Presented “Bionergy Production on Poorly-Drained Soils of the Midwest”, Sustainable Bioenergy Training Program for Extension Educators of the North Central Region, in Columbia, MO, with approximately 45 participants (4/1/2012).

Montana:

Northern Plains Agricultural Research Laboratory (Sidney, MT)

- Hosted a Field Day at the Dryland Research Farm in Froid, MT to discuss cropping systems and pest management research. Attended by farmers, ranchers, Natural Resources Conservation Service, Montana Department of Agriculture, Agribusiness and University Extension personal (6/28/2012).
- Hosted a field day at the Dryland Research Farm in Sidney, MT to discuss cropping systems, pest management, greenhouse gas emission research. Attended by farmers, ranchers, Natural Resources Conservation Service, Montana Department of Agriculture, NRCS Plant Materials Center, Agribusiness and University Extension personal (6/29/2012).
- Co-hosted with Montana State University and North Dakota State University Field Days highlighting irrigation research on shared land in Sidney, MT (7/19/2012) and Nesson Valley, ND (7/25/2012). Attended by farmers, ranchers, researchers, Agribusiness and University Extension personal.
- Participated in the Montana Innovation Catalyst meeting in Bozeman, MT. The meeting was sponsored by TechLink to discussed how industry could find out about ARS technologies and how they can partner with ARS to create technology (8/28/12).

Livestock and Range Research Laboratory (Miles City, MT)

- Made fifteen stakeholder presentations to over 1400 stakeholders at various events around the nation in the past year.
- Co-hosted Fort Keogh on the Road (a traveling Field Day) with the Montana Stockgrowers and Fort Keogh Livestock & Range Research Laboratory with presentations at Choteau, MT (5/23/2012) and Big Timber, MT (1/24/2012). Attended by over 90 producers.

Fort Keogh Livestock & Range Research Laboratory (Miles City, MT)

- Co-hosted Fort Keogh on the Road (a traveling Field Day) with the Montana Stockgrowers and ARS Fort Keogh Livestock & Range Research Laboratory with presentations at Choteau, MT (5/23/2012) and Big Timber, MT (1/24/2012). Attended by over 90 producers.
- Updated Montana Stockgrowers Association stakeholders on new projects they had previously provided planning input and offered feedback on pending research that will be starting later this year. The meeting concluded with a summary research accomplishments from the last year.

Nebraska:

Agroecosystems Management Research Unit (Lincoln, NE)

- Co-hosted with the University of Nebraska a Field Day at the University’s Agricultural Research and Development Center on the impact crop residue removal on soil carbon and emission of greenhouse gases. Attended by farmers and researchers (8/8/2012).
- Co-hosted with the University of Nebraska a Field Day at the University’s South Central Agriculture Laboratory on amelioration practices to offset negative impacts associated with crop residue removal for use as livestock feed. Attended by farmers, agribusiness, and extension (8/22/2012).
- Participated in a Field Day celebrating the 75th anniversary of the University of Nebraska’s Agricultural Research and Development Center and the 150th anniversary of the passage of the Morrill Act. Presented information regarding collaborative research between USDA-ARS and the University on cropping systems

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and residue removal impacts on soil organic matter and greenhouse gas emissions. Attended by the general public (9/23/2012).

Grain, Forage, and Bioenergy Research Unit (Lincoln, NE)

- Co-hosted with the University of Nebraska a Field Days at the University's Agricultural Research and Development Center on switchgrass establishment, weed control, herbicides, seed quality, economics, and drill calibration. The information was broadcast as a webinar to numerous participants (3/20/2012, 8/2/2012, & 8/7/2012).
- Participated in the University of Nebraska Range Short Course at Chadron, NE by providing training on bioenergy, range plant physiology, and integrating forages with rangeland. Attended by 20 graduate students and federal and state resource professionals and (6/18 & 20/2012).
- Conducted Crop Management and Diagnostic Clinic. Attended by 45 farmers, certified crop consultants, professional agronomists, and farm management consultants (8/30/ 2012).
- Participated in University of Nebraska's "Sunday with a Scientist" on biomass fuels and soils. Attended by 92 adults, 86 children and 27 University students (9/16/2012).
- Participated in a Field Day celebrating the 75th anniversary of the University of Nebraska's Agricultural Research and Development Center and the 150th anniversary of the passage of the Morrill Act. Presented information regarding collaborative research with the University on biomass energy crops including switchgrass and other perennial grasses for use in pastures. Attended by the general public (9/25/2012).

U.S. Meat Animal Research Center (Clay Center, NE)

- Hosted an education program on DNA technology transfer attended by beef producers.
- Hosted an educational program on DNA tests for Ovine Progressive Pneumonia for sheep producers.
- Hosted a focus group for sheep. Discussed research being done on selection for easy care lines of sheep and OPP. Discussed issues, trends and research needs of the sheep industry.

Nevada:

Great Basin Rangelands Research Unit, Reno

- Led a field tour for Univ. Nevada, Reno students from a Range and Forest Soils Class. (4/20/12)
- Provided a field tour and workshop to 23 attendees at the Barrick Gold "Dean Ranch" to showcase USDA-ARS Great Basin Rangelands Research Units field site. . (5/22/12)
- Provided a one day field tour of USDA-ARS Great Basin Rangelands Research Units field site in Kings River, Nevada on plant material testing and cheatgrass suppression. (5/29/12)
- Hosted the annual field tour for the Nevada Section of the Society for Range Management to 48 attendees. (6/25/12)
- Participated in the University of Nevada, Reno annual Agricultural Field Days with over 400 attendees (9/8/12)

New Mexico:

Rangeland Research Unit based at the Jornada Experimental Range (Las Cruces, NM)

- Hosted open house to celebrate 100th anniversary. Over 225 people attended this daylong event (7/14/2012).

Southwestern Cotton Ginning Research Laboratory (Mesilla Park, NM)

- Participated in the Fiber Arts Festival, sponsored by the New Mexico Extension Service in Silver City, NM. Over 100 area residents witnessed ginning demonstrations and discussions of the ARS cotton ginning research program (11/11-12/2011).

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- Along with the Cotton Technology Transfer Coordinator, hosted the Western Ginner School. Attendees included gin managers and operators (21) with speakers from ARS gin labs and the cotton industry (5/8-10/2012).
- Participated in the Leyendecker Plant Science Center Centennial Field Day sponsored by New Mexico State University and showcased the agriculture industry and agriculture products of New Mexico as part of the State of New Mexico's statehood centennial celebration and the sesquicentennial of the Morrill Act (8/25/2012).
- Participated in Hispanic, Engineering, Science, and Technology program at University of Texas in Edinburg, TX. The purpose of the event was to share best practices and successful technology with educators and middle and high school students to encourage science as a field of study (9/24-25/2012).

New York:

Grape Genetic Research (Geneva, NY)

- Provided numerous tours of vineyards and orchards to graduate students, students from Vassar College, Finger Lakes Community College Viticulture college classes, visiting foreign scientists etc.
- Provided tours, demonstrations etc of orchards and vineyards, during Cornell Plant Breeding Class and the NE-9: Conservation and Utilization of Plant Genetic Resources meetings.
- Four separate programs were offered at the Ovid Public Library in Ovid, NY with DNA and chromatography demonstrations to after school library club with an emphasis on women in science.
- Participated with several other USDA agencies to take part in an exhibit for the USDA at Empire Farm Days. This is the largest outdoor agricultural show in the northeast that has 600 exhibitors and draws about 70,000 people over the three days (8/2012).
- Hosted an Open House with tours and demonstrations at the McCarthy farms of orchards, and vineyards (9/22/2012).

Plant, Soil and Nutrition Research Unit (Ithaca, NY)

- Developed a traveling exhibition on the evolution of maize (Maize: Mysteries of an Ancient Grain). Visitors can explore the science of how maize has evolved over thousands of years to become one of our most significant crops, and discover why it continues to surprise us today. In addition to the exhibit created a Teacher-Friendly Guide to the Evolution of Maize that is available for free online (<http://maize.teacherfriendlyguide.org>). The guide is designed to provide teachers with background information necessary to teach the concept of evolution. Thus, educators around New York State have been provided resources to help connect a field trip the exhibit to their broader science curricula.

Biological Integrated Pest Management Research & Plant-Microbe Interactions Research Units (Ithaca, NY)

- Co-hosted a booth with ARS Unit at Geneva, NY, at the Empire Farm Days presenting displays & information on research programs for farming community and general public (8/7-9/2012).
- Held multiple meetings with land owners, county and state park and tribal land officials, NY State Ag & Market officials, to discuss work on Emerald Ash Borer and Ambrosia beetle biological control.

North Carolina:

Soybean & Nitrogen Fixation Unit (Raleigh, NC)

- Organized a workshop on Drought Tolerance Breeding Workshop for 19 University and ARS scientists to share techniques and approaches for developing more climate resilient crops (3/2012).
- Hosted a Field Day and tour for educators from the North Carolina Museum of Natural History of research programs in preparation for a larger tour of high school science educators in July 2013 (7/2012).

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Food Science Research Unit (Raleigh, NC)

- Hosted a Pickle Research/Brainstorming Meeting with participants from 7 pickle companies and Pickle Packers International, Inc. (1/17-18/ 2012).
- Presented research findings to the Manufacturing and Technology Committee of Pickle Packers International, Inc. on starter cultures for vegetable fermentations, microbiology and biochemistry of spoilage in cucumber fermentation, and the safe processing of acidified foods.
- Participated in the Sweetpotato Field Day at Faison, NC presenting a processing research (10/13/ 2011) and at the Sweetpotato Regional Meeting in Smithfield, NC presenting research on factors affecting product quality (2/16/2012).
- Co-hosted with NC State University the Acidified Foods GMP School to provide training for 35 participants from industry and regulatory agencies to comply with the U.S. acidified foods regulation (4/30-5/2/2012).

North Dakota:

Northern Great Plains Research Laboratory (Mandan, ND)

- Celebrated its 100 year anniversary at its annual Friends and Neighbors Day. More than 600 farmers, ranchers, community leaders, agency personnel, and local citizens attended the event (7/19/2012).

Red River Valley Agricultural Research Center Research (Fargo, ND)

- Hosted the annual meeting of the Red River Valley Agricultural Research Center Research Partners. Presented research briefs and participated in a commodity specific round table discussion of research needs and funding priorities (12/9/2011).

Grand Forks Human Nutrition Research Center (Grand Forks, ND)

- Co-hosted with the Altru Health System and the Grand Forks Park District the dedication and open-house of a new, 160,000 sq. ft. community health and fitness center, which will also house a worksite of the community nutrition and physical activity program of the Center. Attended by about 3500 people from the Grand Forks Community (9/24/2012).

Ohio:

Application Technology Research Unit

- Presentations at Ohio Florists Association Meeting in Columbus, OH, including using CO₂ in greenhouses and environmental control of flowering, as well as demonstrations of Virtual Grower, a greenhouse decision-making tool available on the ARS website. (7/2012).
- Demonstrated new sprayer performance for nursery and vineyard growers, sprayer manufacturer engineers, chemical company representatives, extension educators and researchers from OH, NY, PA, KY, TN, NC, IN, MI and WI (Summer 2012).

Soil Drainage Research Unit

- Helped to develop, organize and presented a webinar sponsored by USDA/NRCS, "Use of Geophysical Methods in Agriculture," with 113 participants (8/21/2012).

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Oklahoma:

Grazinglands Research Laboratory (El Reno, OK)

- Hosted an Oklahoma Land Stewardship Association Grazing Academy to illustrate how grazing intensity and duration affect plant communities of native prairie pastures. Attended by 20 producers from Kansas, New Mexico, Texas, Oklahoma, and Colorado (11/15-17/ 2011).
- Co-organized with the Oklahoma Chapter of Soil and Water Conservation Society a workshop on Communicating with New Producers to exchange information on changing demographics of Oklahoma producers and use of social media to reach non-traditional agricultural producers. Attended by 75 people from a wide range of state, federal, and private sector organizations.
- Hosted a group of Oklahoma Extension Agents for in-service training. Attended by about 18 extension agents (8/8/2012).

Oregon:

Columbia Plateau Conservation Research Center, Pendleton

- Co-hosted with Oregon State University (Columbia Basin Agricultural Research Center) a Field Day to convey research results to stakeholders (6/12/2012).
- Hosted Tiichim Board of Directors from Confederated Tribes of the Umatilla Indian Reservation to inform the group of ARS' research and capacities at this location.

National Clonal Germplasm Repository, Corvallis

- Hosted a blueberry open house with approximately 60 visitors. Members of the public received samples of blueberries and literature related to blueberries, including those grown at ARS (7/26/12).

Range and Meadow Research Unit, Burns

- Hosted the annual Range Field Day at the northern Great Basin Experimental Range.. Attendees included scientists, employees of state and federal land management agencies, and ranchers. Unit scientists presented information on rangeland management and restoration. (6/26/2012)
- Sponsored and participated in symposium on Ecologically Based Invasive Plant Management at annual Society for Range Management meetings in Spokane WA. Attendees included scientists, land managers, and policy specialists. (2/2/2012)

Pennsylvania:

Pasture Systems & Watershed Management Research Unit (University Park, PA)

- Conducted a Field Day in Crisfield, MD on using flue gas desulfurization gypsum to minimize dissolved phosphorus loss from soils. Attended by 30 people (5/23/2012).
- Hosted a meeting with the National Agricultural Research Institute in Montevideo Uruguay on the 'Energy and Climate Partnership of the Americas' program of USDA-Foreign Agricultural Service. Discussed research results on the life-cycle energy balance for grain sorghum, sweet sorghum, sweet potatoes and woody waste for agroenergy production (5/2012).

Grazing Basics and Animal Behavior Discussed at First Grazing Roundtable (University Park, PA)

- Participated with livestock grazers and aspiring grazers from the Lehigh Valley in the first grazers roundtable.

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South Carolina:

U. S. Vegetable Laboratory (Charleston, SC)

- Co-hosted with the Clemson Coastal Research and Education Center the Winter Open House and Tour highlighting research on watermelon, sweet potatoes, broccoli, peppers, leafy greens, and other vegetables. Attended by about 50 people representing a wide range of customer and stakeholder interests (2/28/2012).

Coastal Plains Soil, Water, and Plant Research Center (Florence, SC)

- Participated in the Southern Southeastern, Inc. annual meeting (cotton growers and ginner) held in Hilton Head, SC, by presenting information on irrigation management to approximately 200 attendees (1/25/2012).
- Presented cotton genetics research to the United Soybean Board Drought Tolerance Working Group Annual Meeting held in Charleston, SC. Approximately 30 scientists participated and learned about cotton drought genetics research (3/10/2012).
- Presented research overview to several civic organizations (7/5/2012 & 7/19/2012).
- Hosted visiting foreign scientist from the Brazilian Agricultural Research Agency EMBRAPA to develop more economical manure treatment systems (8/1/12-1/15/13) and the Brazilian Instituto Mato-Grossense Do Algodao on cotton research (5/28/2012-6/1/2012).
- Participated in Clemson University's Pee Dee Farm Field Day at Florence, SC, by presenting research results on cotton breeding and production to approximately 100 farmers, industry representatives, and extension personnel (8/21/2012).
- Participated in and presented research on variable-rate irrigation at the North Carolina Irrigation Society's annual meeting in Raleigh, NC. Attended by over 50 people (11/7/2012).
- Held its annual Customer and Stakeholder Workshop focusing on technological advances in nutrient recovery and reuse, water resources, emerging cropping systems, and how these could function in farming systems. Attended by more than 60 people from state government, academia, federal agencies, and agribusiness (11/8/2012).
- Participated in the Mid-Atlantic Crop Management School to discuss the effective use of biochar to improve soil quality. Attended by over 275 individuals representing university staff, extension agents, farmers, students, and the general public (11/13/ 2012).
- Hosting a Webinar for U.S. EPA staff on livestock waste management focused on nitrogen and phosphorus treatment technologies developed by ARS. The webinar is for EPA staff, both in Headquarters and regional offices (60 to 70 participants) mostly dealing with water and air issues related to animal agriculture production (12/5/2012).

South Dakota:

North Central Agricultural Research Laboratory (Brookings, SD)

- Hosted a Field Day on the hidden profitability of cover crops. Attended by more than 50 farmers, land managers, crop consultants, conservationists, researchers, and educators.

Texas:

Conservation & Production Research Laboratory (Bushland, TX)

- Co-hosted with Texas A&M AgriLife Research, Texas A&M AgriLife Extension Service, and West Texas A&M University at Bushland, TX a Small Grains Field Day on wheat and water issues. Attended by 135 producers, seed and agrochemical company representatives, water district employees, and research and extension faculty (5/24/2012).

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Southern Plains Agricultural Research Center, Pecan Research Project (College Station, TX)

- Hosted a Field Day in association with the Texas Pecan Short Course. Attended by about 75 growers from the U.S. and Mexico (1/25/2012).
- Hosted a Pecan Field Day for about 25 University undergraduate students studying plant breeding (4/25/2012).

Southern Plains Agricultural Research Center, Aerial Application Technology Project (College Station, TX)

- Hosted a Field Day demonstrating modern aircraft nozzle technology to enhance on-target deposition and minimize off-target drift. Attended by over 50 aerial applicators and aerial application technology scientists from across the U.S. (8/1/2012).

Grassland, Soil, and Water Research Laboratory (Temple, TX)

- Hosted a Fertilizer, Poultry Litter and Grazing Field Day. Attended by about 75 producers, in addition to approximately 25 staff personnel from National Resources Conservation Service, Texas States Soil and Water Conservation Board, and Texas A&M AgriLIFE (10/21/2011).

Knipling-Bushland U.S. Livestock Insects Research Laboratory (Kerrville, TX)

- Hosted in conjunction with the annual meeting of the Texas Animal Health Commission – Cattle Fever Tick Committee a Field Day in Edinburg, Texas with hands-on demonstrations of fever tick rearing, field studies, demonstration of tick sampling in permanent quarantine zone, tick acaricide resistance assays, vaccine testing, evaluation of alternate mammal hosts, molecular/laboratory studies, and carrizo cane biological control in the permanent quarantine zone. Attended by about 60 stakeholders (9/12/2012).

Cotton Production and Processing Research Unit (Lubbock, TX)

- Along with the Cotton Technology Transfer Coordinator, hosted the annual National Cotton Ginners Association's Gin School. Classes focused on safety, pneumatics, machinery settings, maintenance, hydraulics, air quality, and history of cotton ginning. Attended by 142 students. A majority of students were from historically underserved populations (4/26-28/2012).
- Hosted a Chinese delegation for a tour presentation on the research being conducted (11/4/2011).

Plant Stress and Germplasm Development Unit (Lubbock, TX)

- Provided research overview and tour to the First Sorghum Leadership Class (9/5/2012), the United Sorghum Checkoff Board Executive Committee (7/30/2012 & 9/14/2012) [Sorghum Checkoff, USDA-ARS Focus on Sorghum Research Video: <http://sorghumcheckoff.com/newsroom/videos-2/>], representatives from six sorghum seed companies and Kansas State University & University of South Carolina (5-9/2012).
- Provided cotton research overview and tour to representatives from Cotton Incorporated (9/26/2012) and a Brazilian delegation (8/15/2012).
- Provided sorghum research overview for Ag Day Lubbock [Fox News Story and Video: <http://www.myfoxlubbock.com/content/agdaylubbock/story/agriculture-farming-sorghum-research/wWKd3FoY9k-q023-fRT9yw.csp>] (6/8/2012).

Wind Erosion and Water Conservation Unit and Livestock Issues Research Unit (Lubbock, TX)

- Participated in USDA's Hispanic-Serving Institutions National Program by giving a tour and research presentations. Attended by 15 science teachers (8/6/2012).

[Utah:](#)

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Poisonous Plant Research Laboratory (Logan, UT)

- Hosted a “Government Research in the Field of Agriculture” Field Day in Brigham City, UT regarding poisonous plant research as well as federal careers. Attended 65 students (Future Farmers of America) and 15 adults.
- Hosted “Toxic Effects of Selenium Containing Plants on Livestock” Field Day/Workshop in Soda Springs, ID. Attended by 20 mining company officials.
- Presented “Effect of Locoweed on Livestock Production in the Western United States” workshop to the Chinese Locoweed Delegation in San Francisco, CA. Attended by 50 Agriculture officials from Tibet and Mongolia, China.
- Presented at Society for Range Management Ranchers Forum and webinar in Spokane, WA regarding managing lupine on the channel scablands. Attended by approximately 300 stakeholders and producers in four states.
- Hosted “Tremetol-containing Plants in your Area” Field Day/Workshop in Kingman, AZ. Attended by 60 extension agents, veterinarians and ranchers.
- Presented at 8 “Various Poisonous Plants that Cause Problems” Field Days/Workshops throughout Idaho and Utah. Attended by over 500 ranchers, land managers, and federal, state, county extension personnel and weed control specialists.
- Presented “Identification and Control of Poisonous Range Plants” workshop at Northwest Intertribal Agriculture Council Conference at Fort Hall, ID.

Forage and Range Research Laboratory (Logan, UT)

- Hosted a Field Day as part of the sixth International Meeting on Molecular Biology of Forage and Turf in Salt Lake City and Cache Valley, UT, highlighting research on pasture, rangelands, and turf grass. Attended by 115 scientists and extension specialists (6/3-7/2012).

Pollinating Insect – Biology, Management Systems Research Unit (Logan, UT)

- Hosted a booth at Logan Farmers’ Market’s National Pollinator Week highlighting research on bee diversity and the importance of bees for pollination. Attended by over a hundred people (6/16/2012).
- Conducted a bumble bee workshop highlighting how to identify different species of bumble bees, their importance for pollination, issues associated with their conservation, methods for using them for pollination, and hands-on methods for bumble bee rearing. Attend by 87 agricultural producers and the general public (6/20/2012).
- Conducted a workshop at Utah State University on native pollinators and suggestions for integrating these pollinators into land management policies and practices. Attended by 6 state and federal land managers (9/12/2012).
- Participated in teaching a nine-day workshop sponsored by the American Museum of Natural History. The course provides botanist, conservation biologists, and ecologists the knowledge and experience needed to understand bee taxonomy and identification tools, applicable to the global bee fauna. Attended by 23 people (9/10-20/2012).

Washington:

Land Management and Water Conservation Research Unit, Pullman

- Hosted and presented a field day in Bridgeport/Okanogan WA. Presented research on weed management in canola, and varieties of winter canola to forty attendees. (5/2012).
- Co-hosted a REACCH field day in Ralston, WA. Presented research and described the use of a stripper header to increase residue (to eliminate the traditional, tillage fallow of the region) to fifty attendees (6/2012).

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Wheat Genetics, Quality, Physiology, and Disease Research Unit, Pullman

- Presented research progress at the 2012 Wheat and Barley Research Progress Review, Pullman, Washington to about 80 stakeholders (02/16/2012)
- Presented research progress at the Stripe Rust Extension Meeting, Pullman, Washington to 20 stakeholders and researchers. (03/06/2012)
- Presented research progress at the Whitman Growers Board Meeting, Pullman, Washington to 10 stakeholders (06/04/2012)
- Hosted five Canadian cereal breeders and pathologists showing field experiments and presented research progress (06/20, 07/02-07/05, 2012)
- Co-hosted the 2012 WERA97 meeting and participated in the Western Wheat Workers and Western Crop Science meetings, Pullman, Washington, showing field experiments and presented research progress to over 100 researchers (07/11-13/2012)
- Hosted five Pakistani wheat breeders and pathologists, showing research techniques and presenting research progress (07/15 -08/02, 2012)

Wheat Genetics, Quality, Physiology, and Disease Research Unit--Western Wheat Quality Laboratory, Pullman

- Hosted Newspaper & Trade Journal Writers on food topics in conjunction with Shephard's Grain, Reardan, WA; gave basic tour of the facilities with explanation as to our purpose and history (10/4/2011, 20 people attending)
- Hosted Mater Farms owners; gave basic tour of the facilities with explanation about quality testing & procedures (10/27/2011, 3 people attending)
- Hosted Research Review group; gave basic tour of the facilities with explanation about procedures, testing, milling, and baking (2/15/2012, 15 people attending)
- Hosted University of Idaho Food Science Class. Gave basic tour of facilities with explanation about procedures, testing, milling, and baking (3/21/2012, 3/23/12)
- Assisted in hosting Ag Exposition; gave basic tour of facilities with explanation about procedures, testing, milling, and baking (4/2/2012, 29 people attending)
- Hosted Washington State University Food Science and Crop Science Classes. (4/17/2012, 4/19/12, 9/17/12)
- Hosted Washington Grain Alliance/Idaho Wheat Commission Wheat Workshop (Cereal School) for Wheat Growers; Hands-on workshop exploring various facets of Wheat Quality Lab testing and grading (6/13/2012, 20 people attending)
- Hosted Washington Grain Alliance/Idaho Wheat Commission Wheat Workshop (Cereal School) for Wheat Industry Persons (mostly Bakers); Hands-on workshop exploring various facets of Wheat Quality Lab testing and grading (6/14/2012, 20 people attending)
- Hosted Argentinian trade team; basic tour of facilities with explanation as to our purpose and history and explanation of testing, milling, and baking procedures (8/9/2012, 3 people attending)
- Hosted Nisshin group; basic tour of facilities with explanation as to our purpose and history and explanation of testing, milling, and baking procedures (8/14/2012, 5 people attending)

Grain Legume Genetics and Physiology Research Unit, Pullman

- Hosted a "Twilight Tour" of the Cool Season Food Legume Breeding Program at Spillman Farm in Pullman, WA, where visitors could look at field plots. This tour was attended by over 50 growers, producers and industry representatives. (8/31/12)
- Hosted employees of Columbia Grain (2 visitors attending): Review of pea, lentil, and chickpea advanced breeding lines. (1/13/12)
- Hosted employees of Spokane Seed (7 visitors attending): Review of pea, lentil, and chickpea advanced breeding lines. (1/12/12)
- Hosted employees of Pacific Northwest Growers' Cooperative (8 visitors attending): Review of pea, lentil, and chickpea advanced breeding lines. (12/15/12)

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West Virginia:

Innovative Fruit Production, Improvement and Protection Unit (Kearneysville, WV)

- Demonstrated rotating cross-arm trellis technology at field days in Circleville, OH (11/2011), Thurmond, MD (6/2012), and Kearneysville, WV.

Wisconsin:

U.S. Dairy Forage Research Center

- Interacted with thousands of dairy producers through World Dairy Expo in Madison, WI. Organized 7 educational seminars on dairy and forage issues (10/04/2011).
- Hosted the Wisconsin Grazing Teaching and Technology Conference at its research farm near Prairie du Sac. Participation included 40 grazing extension specialists, grazing coordinators and farmers (08/28/2012).

Wyoming:

High Plains Grasslands Research Station Rangeland Resources Research (Cheyenne, WY)

- Developed a Stakeholder Group for the new Adaptive Grazing Management experiment at the Central Plains Experimental Range. The Group provided input into goals/outcomes for the new study, objectives, monitoring data needed, decision triggers for moving livestock between pastures during the grazing season, and developing a grazing management plan for ten pastures at the Central Plains Experimental Range (9/18 – 19/12).

Puerto Rico:

Tropical Agriculture Research Station (Mayaguez, PR)

- Provided hands on training on grafting and other propagation procedures to socially disadvantaged growers of tropical fruits in Puerto Rico.
- Participated in activities targeting minority, historically under-served operators/stakeholders by providing information on alternative high-cash crops and best management practices to Hispanic producers in rural areas through farm visits, hosting growers at experimental sites, and on-farm research at Martex Farms and La Balear Farm in Santa Isabel and Adjuntas, Puerto Rico, respectively.
- Participated with Texas A&M University in the Future Scientists Program funded by the National Science Foundation to introduce Hispanic high school teachers to ARS research and take that information back to the classroom to benefit their students.
- Co-hosted the bi-annual Bean Improvement Cooperative meeting in San Juan, Puerto Rico (11/2011).
- Hosted official web site of PROCINORTE's Taskforce on Tropical and subtropical Fruits to improve links between Mexico, Canada and the United States for research issues related to production, quality, safety and traceability of tropical and subtropical fruits. This website disseminates information on work conducted by Taskforce members pertaining to production and quality of tropical/subtropical fruits.
- Served as a horticulture advisor on a newly formed group of Puerto Rican cacao farmers/growers.

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3.10. ARS Technology Transfer Award Winners

2012 ARS Technology Transfer Awards

Technology Transfer Category

Scientists: Dr. Bob Danka et al., Honey Bee Breeding, Genetics & Physiology Laboratory, Baton Rouge, Louisiana

Title: Honey Bees with Varroa Sensitive Hygiene

Award: ARS Outstanding Award

Scientists: Dr. Jonathan Frantz et al., Application Technology Research Unit, Toledo Ohio

Title: Virtual Grower Software for Greenhouse Crop Production

Award: ARS Outstanding Award

Scientists: Dr. Jorge Delgado, Soil Plant nutrient Research Unit, Fort Collins, Colorado

Title: Advances in Tools to Manage Nitrogen

Award: ARS Superior Award

Scientists: Dr. Fumiomi Takeda et al., Appalachian Fruit Research Station, Kearneysville, West Virginia

Title: Development and Technology Transfer of Commercial Rotating Cross-Arm Trellis and Cane Training System for Blackberry Production

Award: ARS Superior Award

Scientists: Dr. Daniel Pote et al., Dale Bumpers Small Farms Research Center, Booneville, Arizona

Title: A Novel Tractor-Drawn Machine (Poultry Litter Subsurfer) that Applies Dry Poultry Litter below the Surface of Pasture/No-Till Systems

Award: ARS Superior Award

Scientists: Dr. Roger Sheley et al., Eastern Oregon Agricultural Research Center, Burns, Oregon

Title: Ecologically-based Invasive Plant Management (EPIBM) of Invasive Annual Grasses

Award: ARS Superior Award

Sustained Effort Category

Scientists: Dr. Steven Evett et al., Conservation & Production Research Laboratory, Bushland, Texas

Title: Soil Water Sensing and Measurement Technology and Tools for Environmental and Water Management

Award: ARS Outstanding Award

Scientists: Dr. Donald Knowles et al., Animal Disease Research Unit, Pullman, Washington

Title: Control of a Re-Emergent Exotic Disease (Babesiosis) in U.S. Livestock through Provision

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of Modern Diagnostics and Chemotherapeutics

Award: ARS Superior Award

2012 Federal Laboratories Consortium (FLC) Awards

Scientists: Dr. Bob Danka, Dr. Jeff Harris, Tom Glenn, and Suki Glenn, Honey Bee Breeding, Genetics and Physiology Laboratory, Baton Rouge, Louisiana

Title: Honey Bees with Varroa Sensitive Hygiene

Award: National Excellence in Technology Transfer

Scientists: Dr. Jonathan Frantz, Byron Hand, Deanna Bobak, Erik Runkle, and Lee Buckingham, Toledo, Ohio

Title: Virtual Grower Software for Greenhouse Crop Production

Award: National Excellence in Technology Transfer

Scientists: Roger Sheley, Brenda Smith, Stuart Hardegree, Thomas Monaco, and Ryan Steineckert, Eastern Oregon Agricultural Research Center, Burns, Oregon

Title: Ecologically-Based Invasive Plant Management of Invasive Annual Grasses

Award: National Excellence in Technology Transfer

Name: Mr. Victor Chavez, Technology Transfer Coordinator, North Atlantic Area

Award: Harold Metcalf

Lab: USDA Agricultural Research Service, Midwest Area

Title: Development and Deployment of the GRIN-Global System for Global Plant Genetic Resource Management

Award: Midwest Region Excellence in Technology Transfer

Scientist: Dr. Donald Knowles, Animal Disease Research Unit, Pullman, Washington

Title: Control of a re-emergent exotic disease (*Babesiosis*) in U.S. livestock through provision of modern diagnostics and chemotherapeutics

Award: Far West Region Outstanding Commercialization Success

Scientists: Dr. Eric Jang and Dr. Spencer Walse, U.S. Pacific Basin Agricultural Research Center and San Joaquin Valley Agricultural Sciences Center, Hilo, Hawaii and Parlier, California

Title: Systems approach for allowing movement of high-value agricultural foodstuffs from state and federal quarantine areas

Award: Far West Region Outstanding Commercialization Success

Scientist: Dr. Walter Mahaffee, Horticulture Crops Research Unit, Corvallis, Oregon

Title: Inoculum detection to aid disease management of grape powdery mildew

Award: Far West Region Outstanding Commercialization Success

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Scientist: Dr. W. Clint Hoffmann, Area Wide Pest Management Research, College Station, Texas

Title: Aerial Application Air Tractor Water Droplet

Award: Mid-Continent Region Outstanding STEM Mentorship

Scientists: Dr. Bradley K. Fritz and W. Clint Hoffmann, Southern Plains Agricultural Research Center, College Station, Texas

Title: First-ever USDA ARS Smartphone app for pesticide spray control

Award: Mid-Continent Region Excellence in Technology Transfer

Scientists: Dr. Daniel H. Pote and Mr. Stephen M. Haller, Dale Bumpers Small Farms Research Center, Booneville, Arizona

Title: Poultry Litter Subsurfer

Award: Mid-Continent Region Notable Technology Development

Agency: Department of Agriculture

Award: Mid-Atlantic Region Interagency Partnership Award

Scientists: Dr. Xixuan Jin, Mr. Dan Custis and Mr. Robert Elliott, Biological Control of Pests Research Unit, Stoneville, Mississippi

Title: Method for encapsulation of Microparticles

Award: Southeast Region Excellence in Technology Transfer

Scientists: Dr. Juan A. Morales, Dr. David I. Shapiro-Ilan, Dr. M. Guadalupe Rojas and Mr. W. Louis Tedders, Biological Control of Pests Research Unit, Stoneville, Mississippi

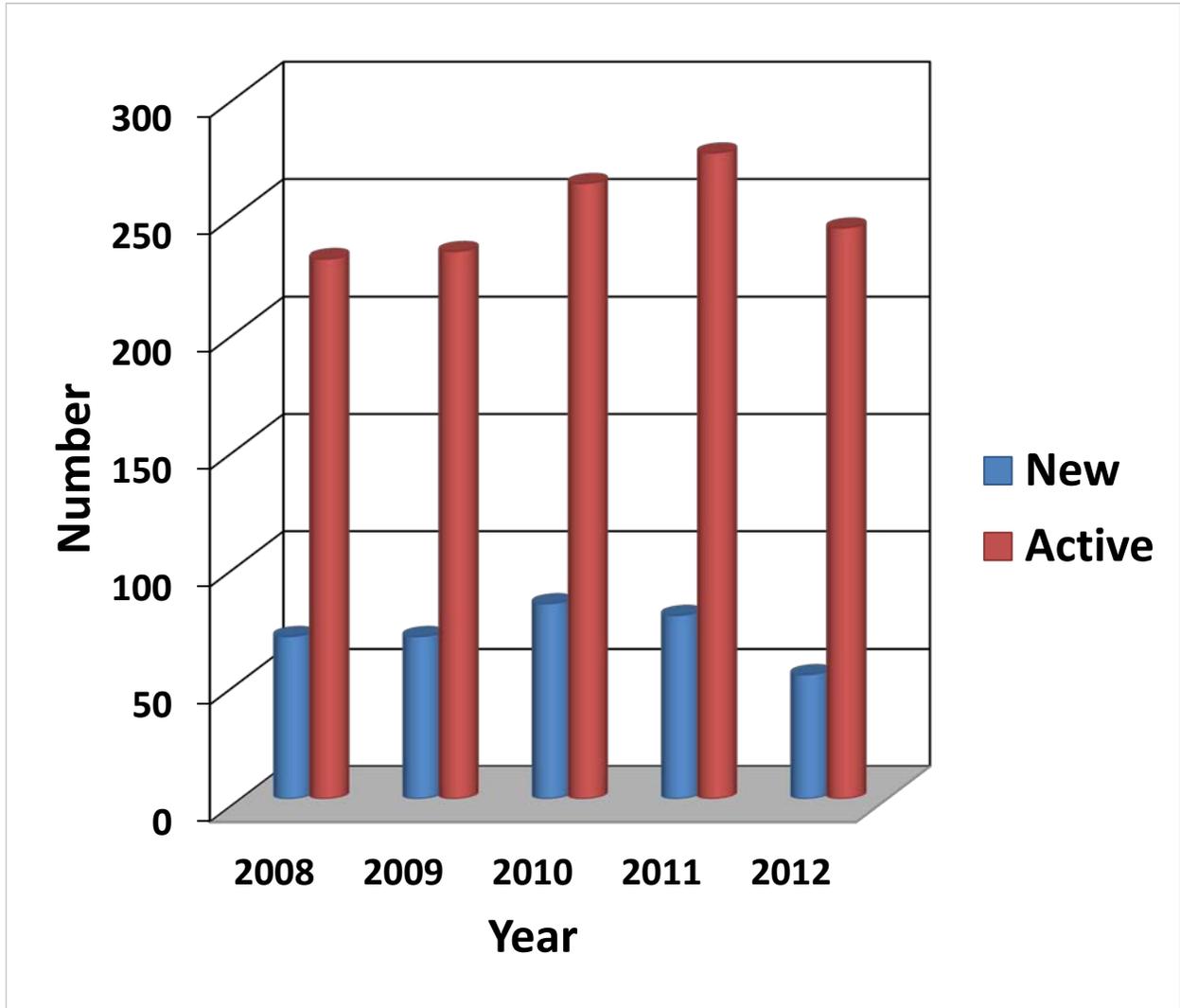
Title: In-Vivo production of Entomopathogenic Nematodes

Award: Southeast Region Excellence in Technology Transfer

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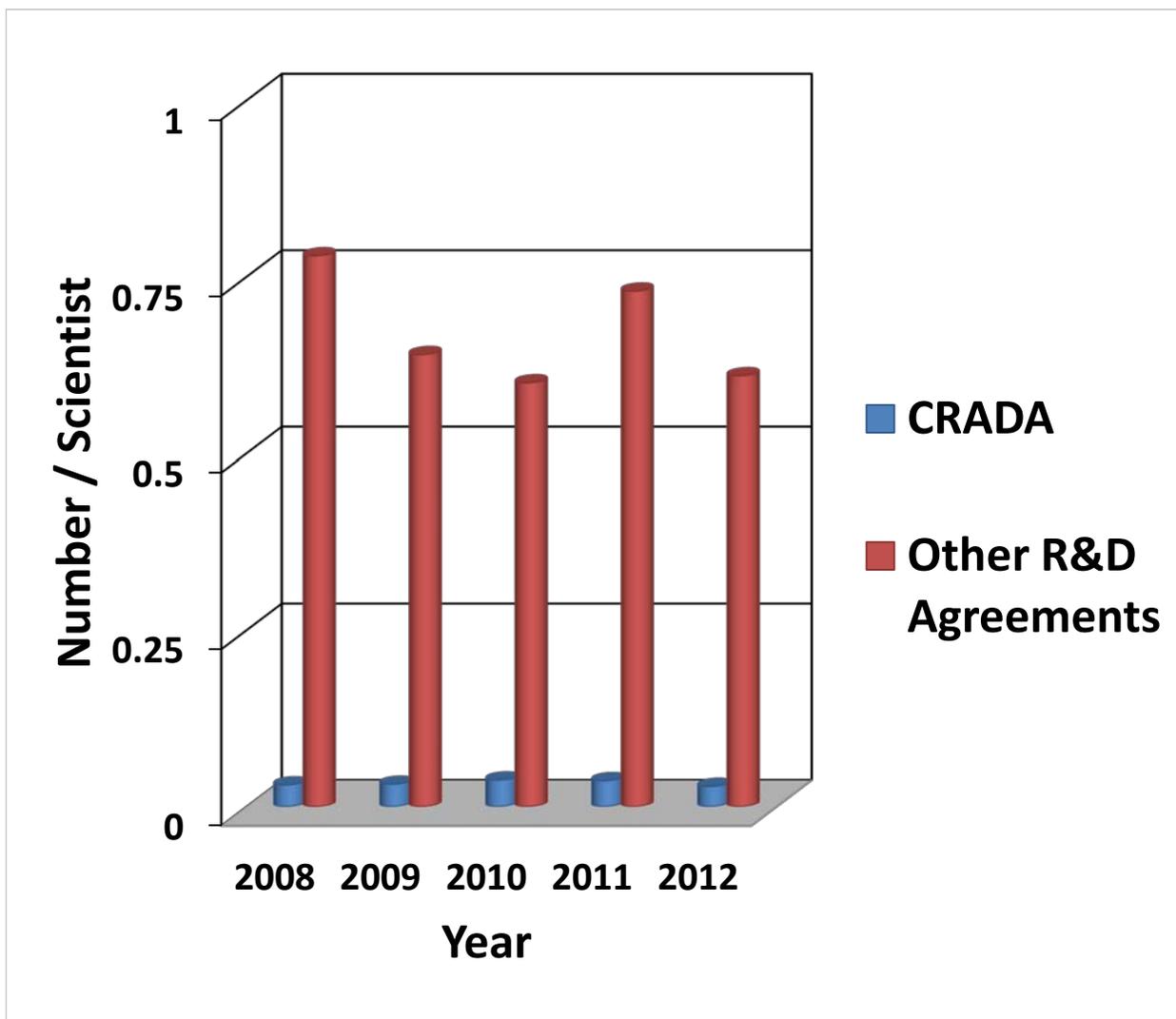
3.11. Selected Metric Charts (data from Tables 1-7)

Figure 1. Number of CRADAs executed for FY2008-FY 2012.



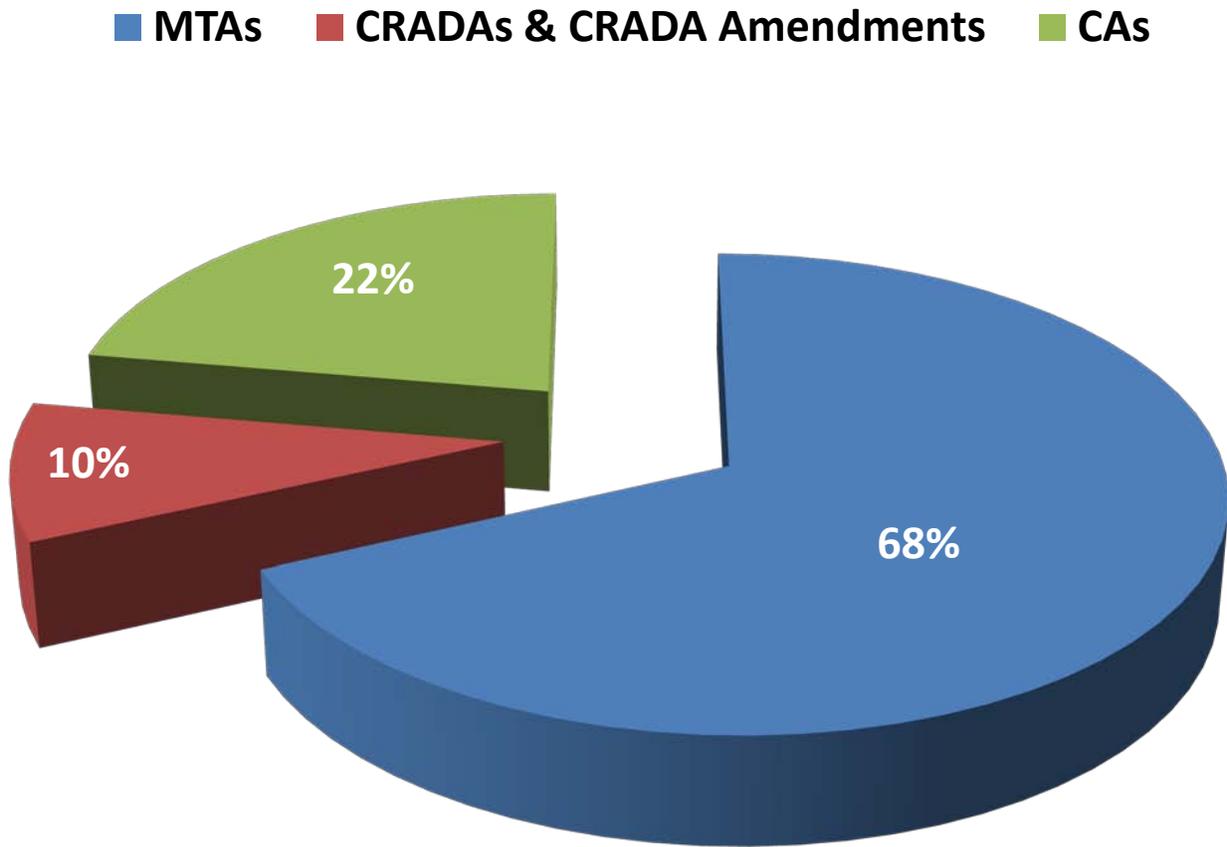
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Figure 2. Number of new CRADA and other R&D agreements per scientist executed for FY2008-FY 2012. In FY 2012, there were 1835 scientists and 1,172 newly executed CRADA and other R&D agreements.



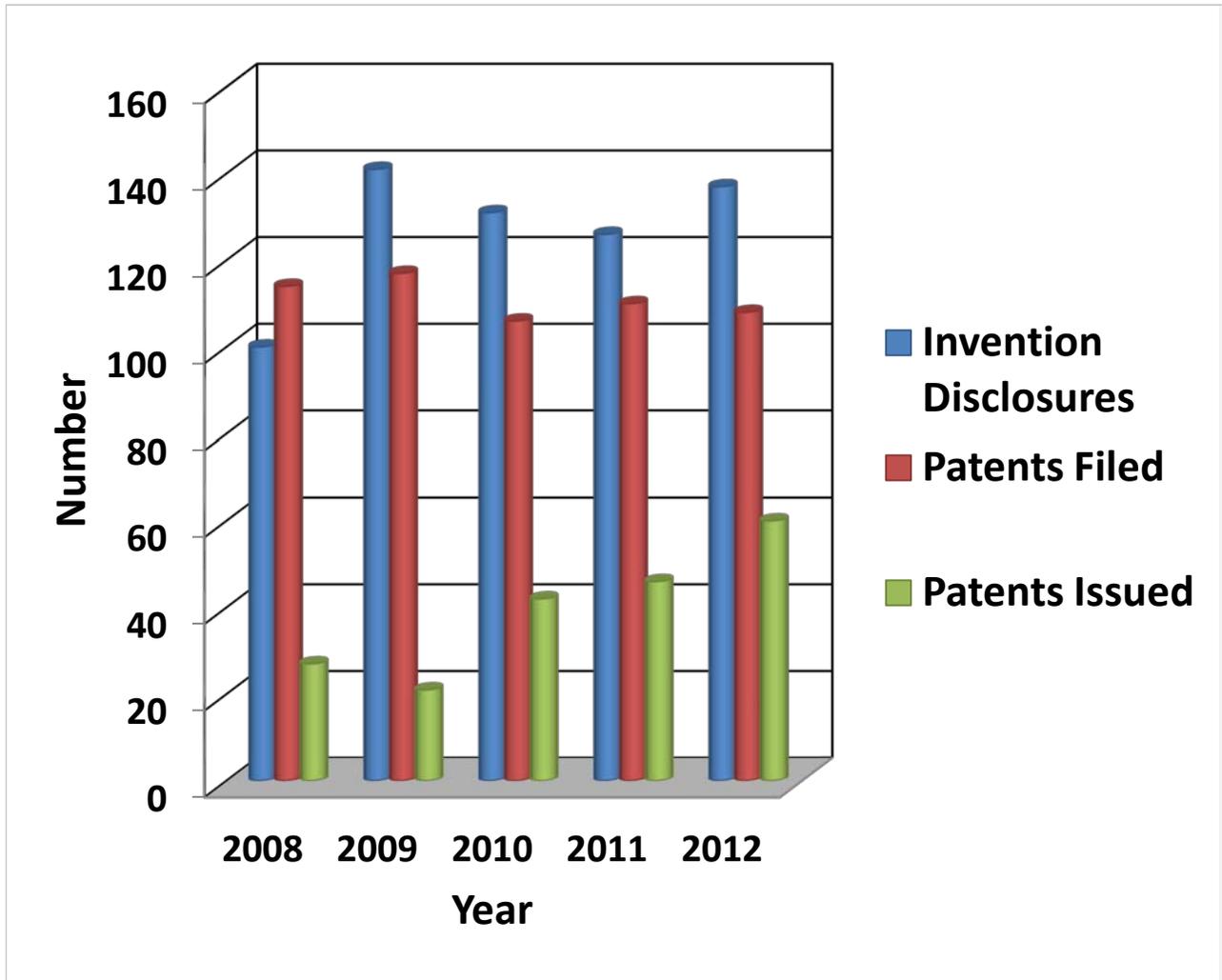
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Figure 3. Percent of total of technology transfer agreements by type in FY 2012.



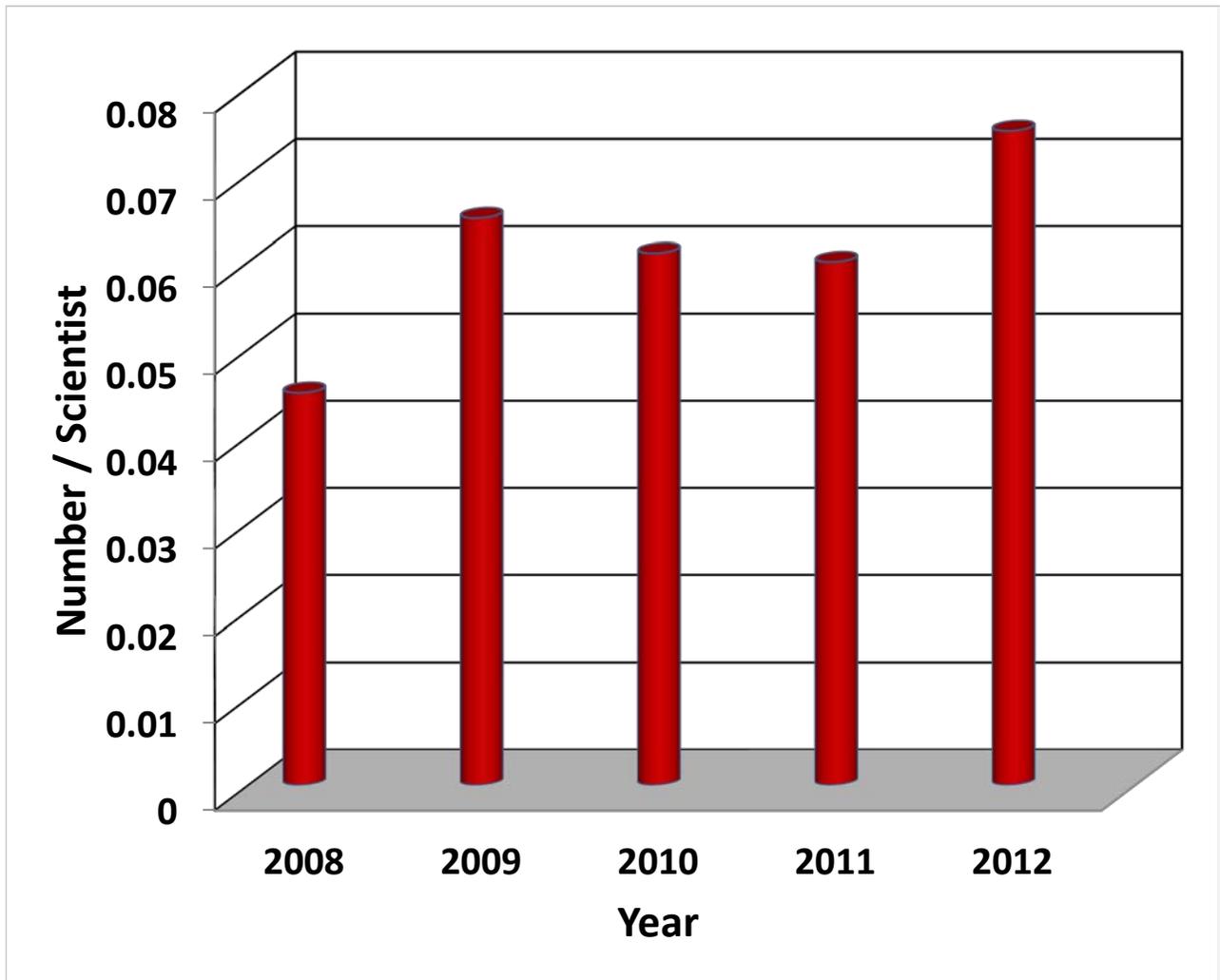
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Figure 4. Number of invention disclosures, patent applications filed and patents issued.



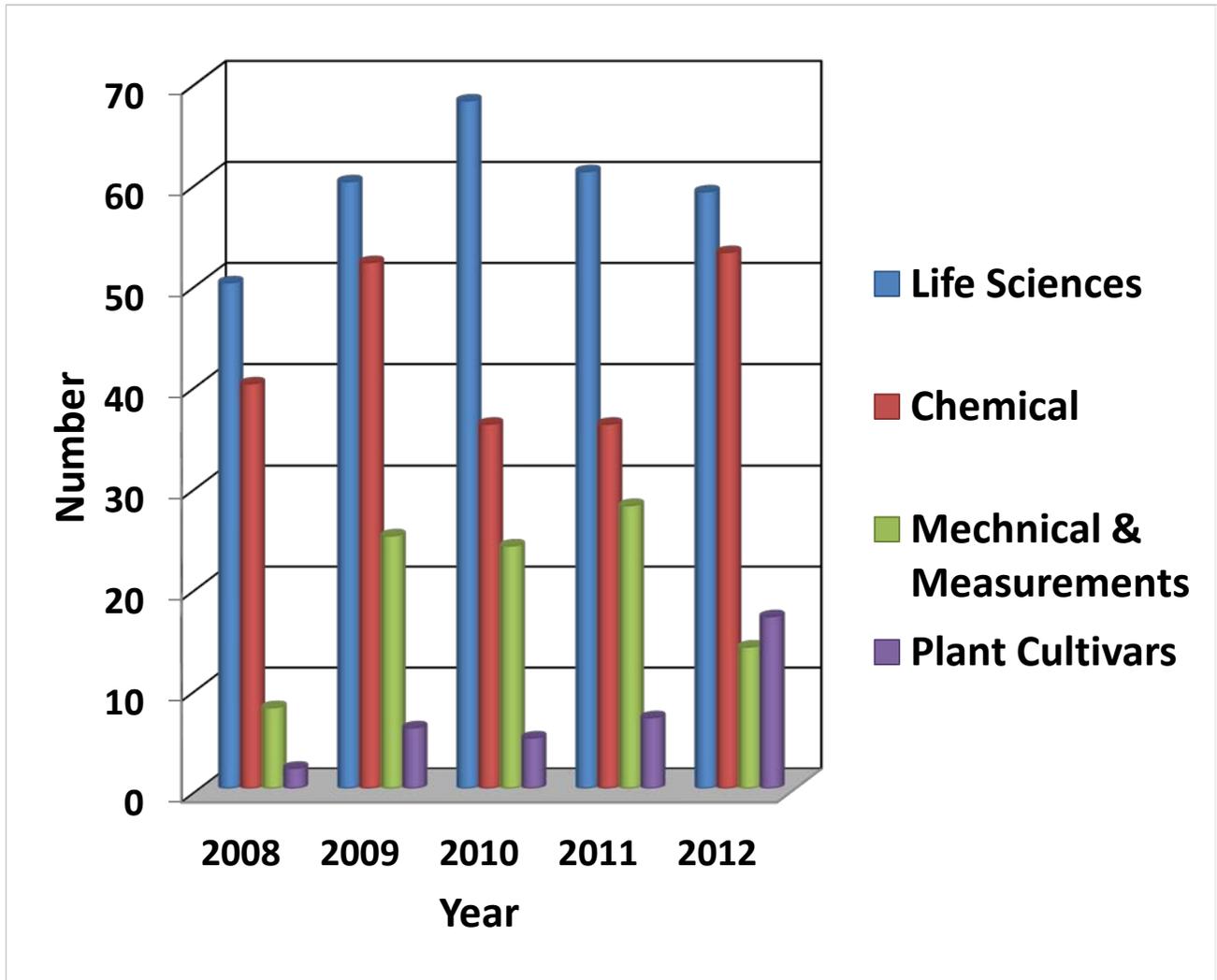
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Figure 5. Number of new invention disclosures per scientists executed for FY2008-FY 2012. In FY 2012, there were 1835 scientists and 76 new invention disclosures.



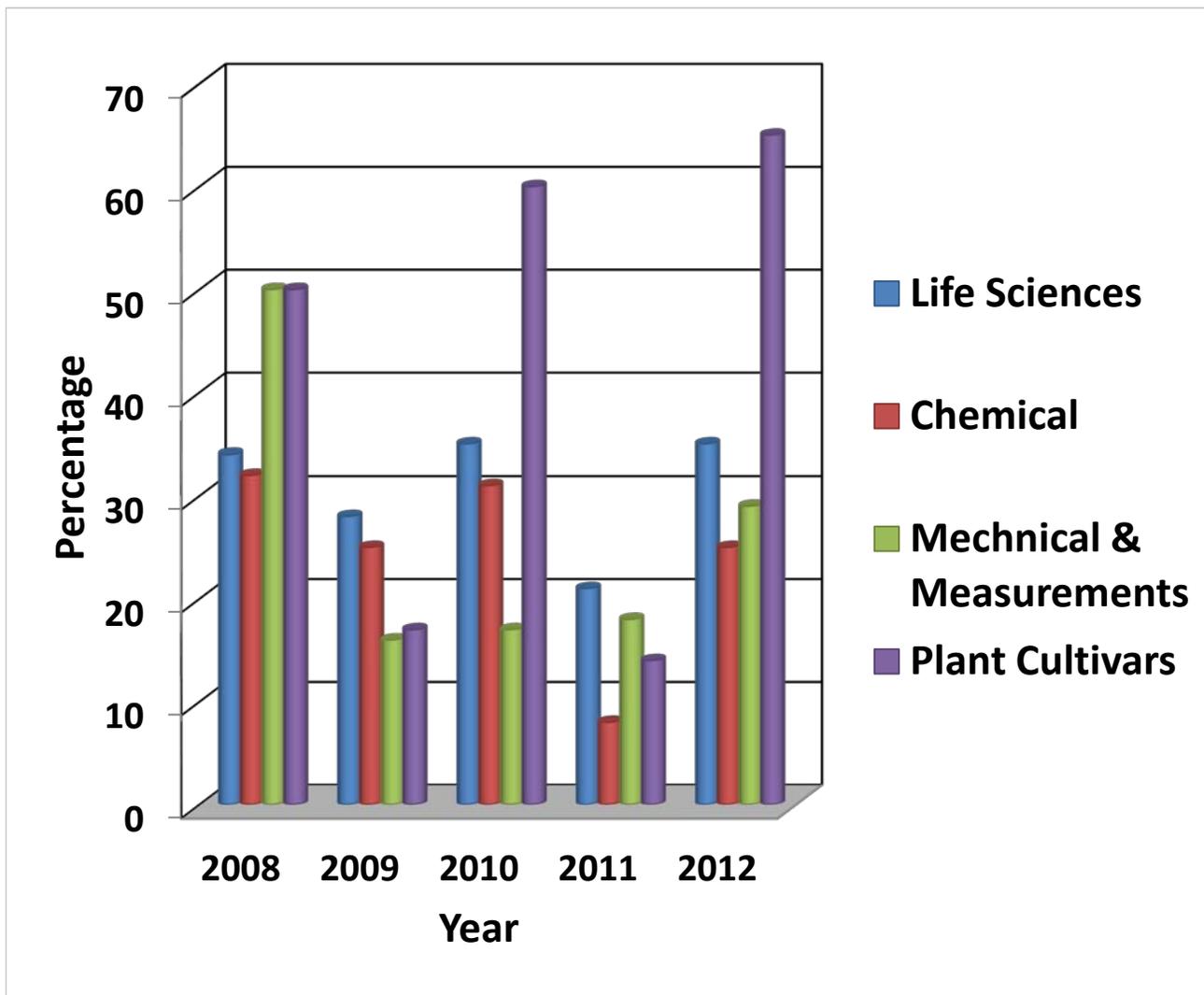
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Figure 6. Number of new invention disclosures received in FY2012 based upon scientific discipline.



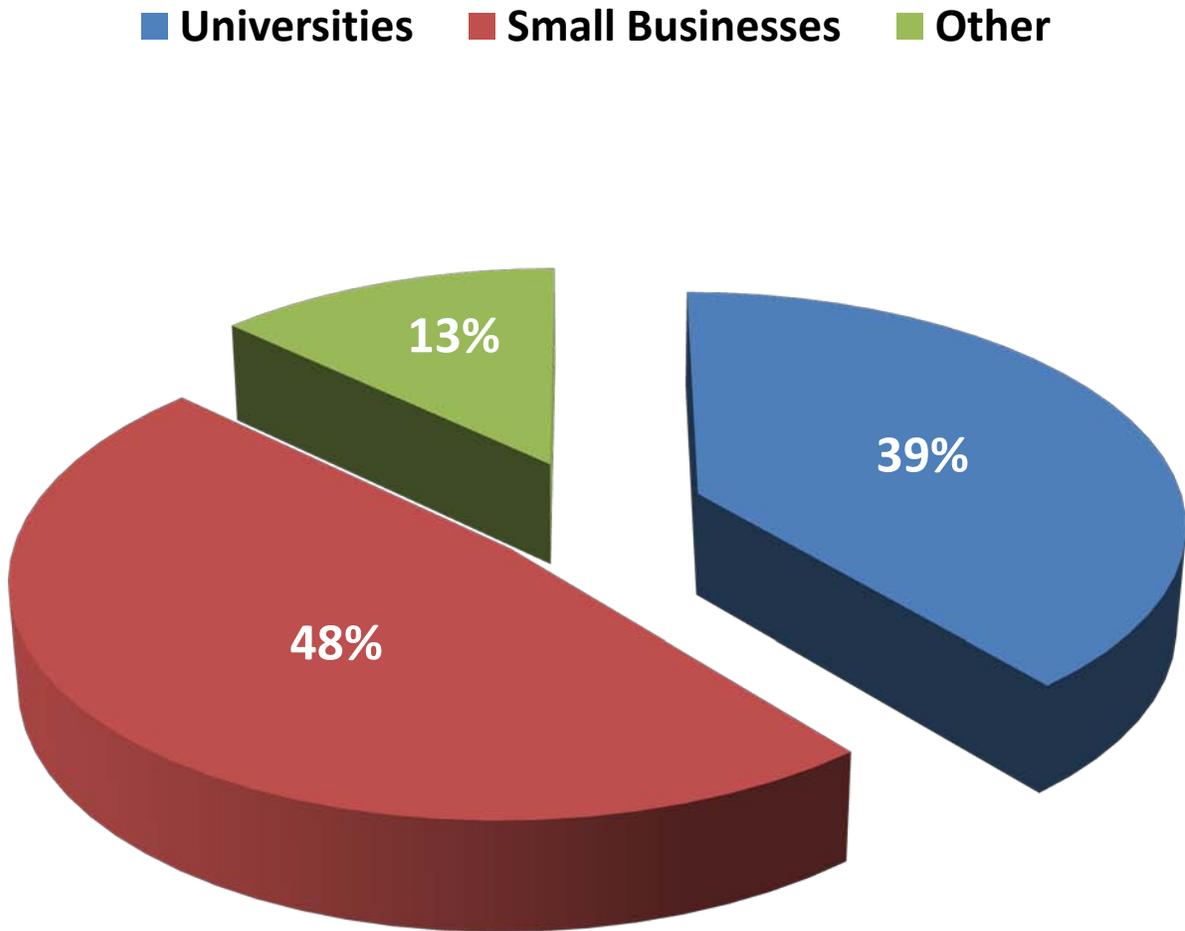
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Figure 7. Percentage of new invention disclosures in each scientific discipline that are University-ARS co-owned in FY2012.



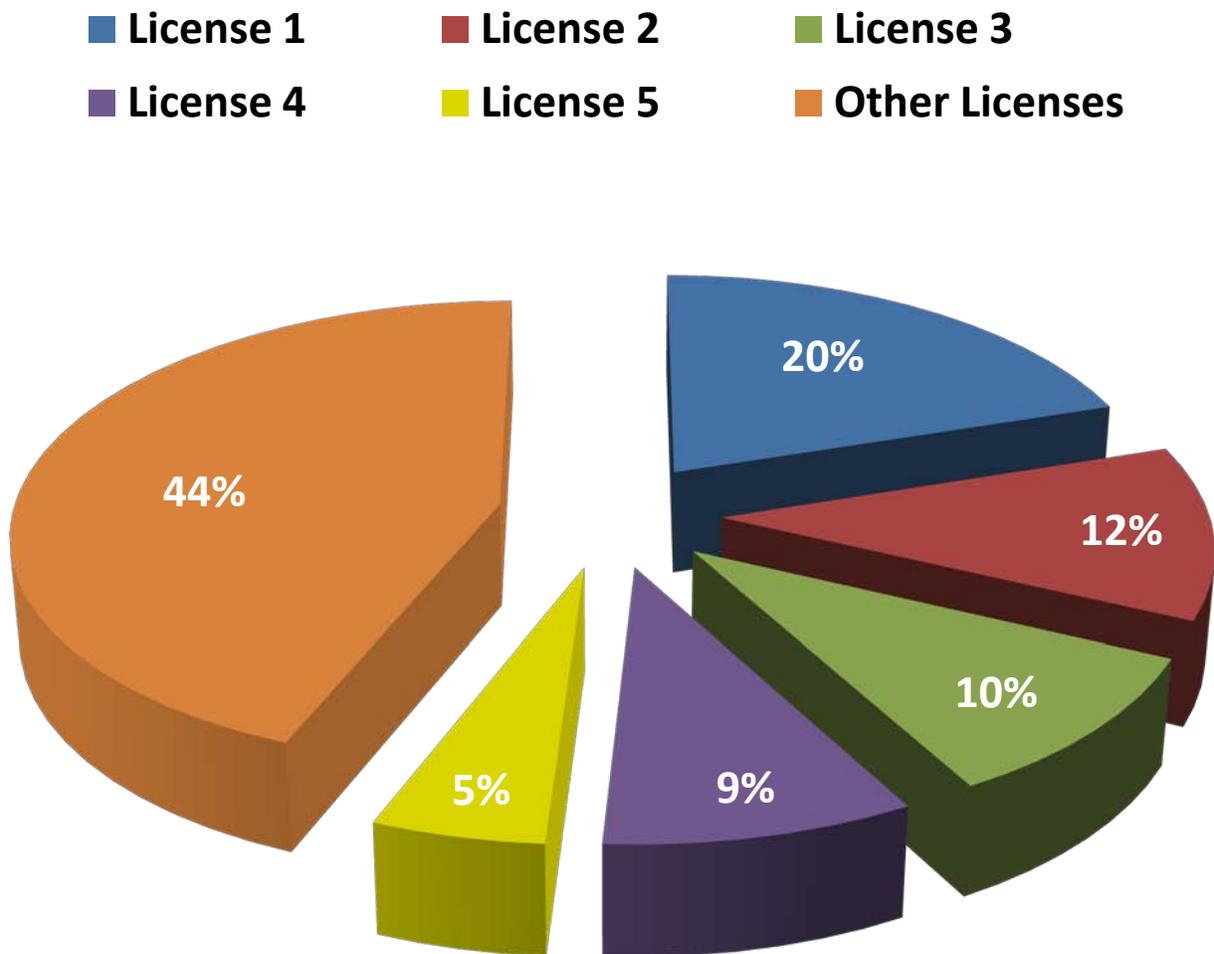
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Figure 8. Percent of total of the new licenses executed in FY 2011 by business type.



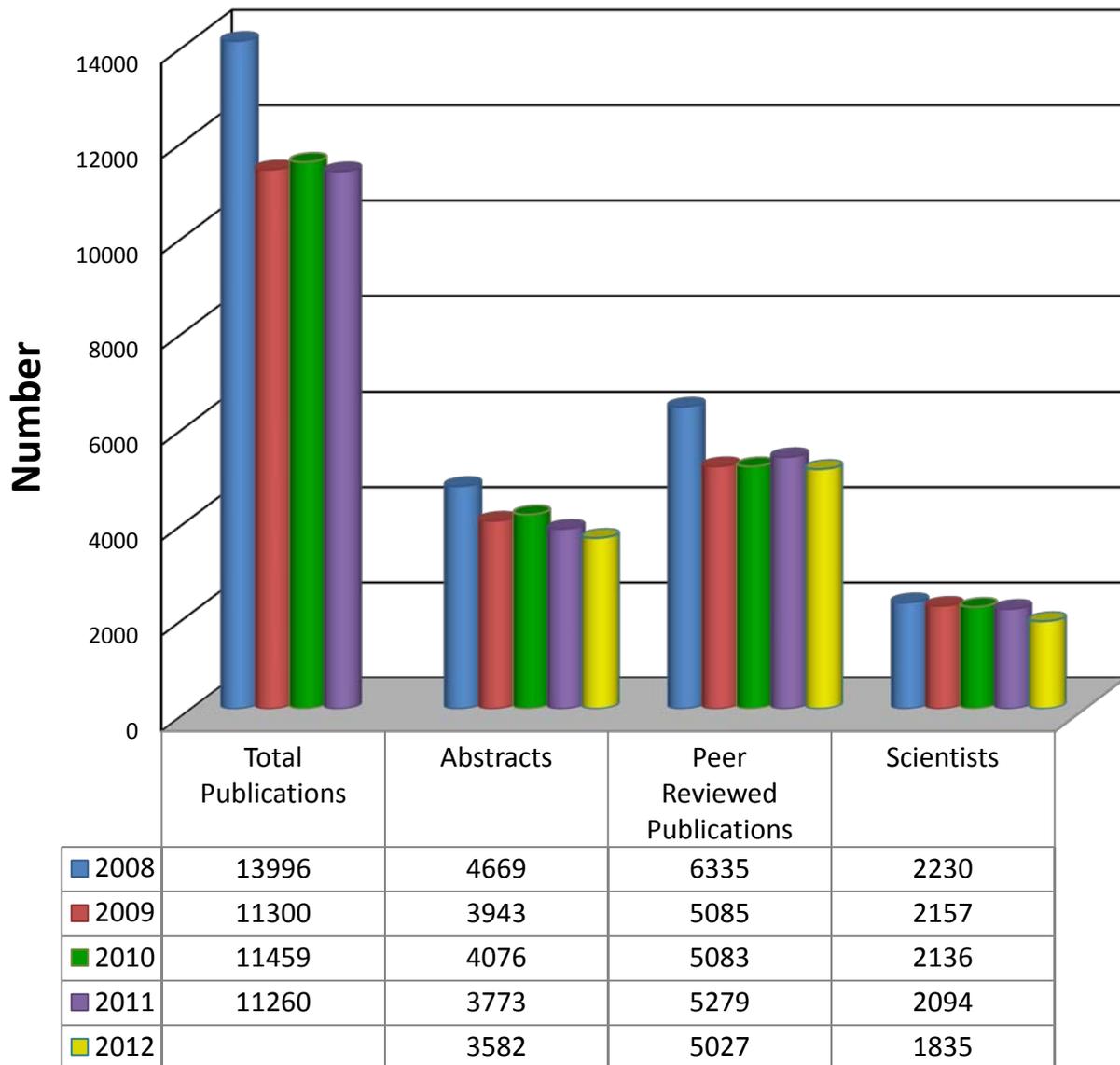
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Figure 9. Percent of total of revenue generated by the top five licenses in FY2012.



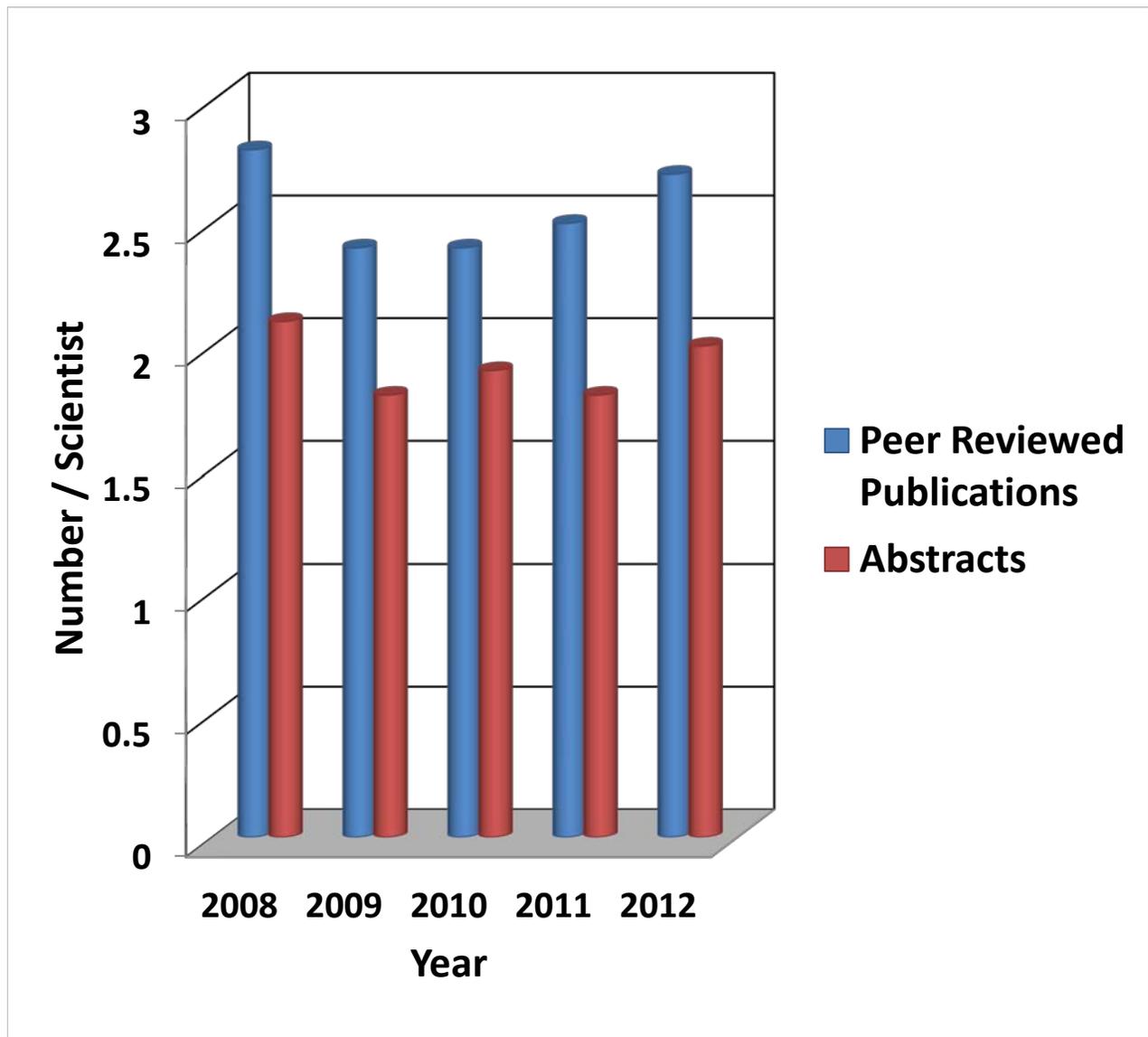
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Figure 10. Number of ARS-approved publications for FY2008-FY2012.



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Figure 11. Number of peer reviewed publications and abstracts per scientist for FY2008-FY 2012.



4. Economic Research Service (ERS)

<http://www.ers.usda.gov/>

4.1. Mission Statement

The ERS mission is to anticipate economic and policy issues related to agriculture, food, the environment, and rural development, and conduct economic research that broadly and specifically informs public program and policy decisions.

4.2. Nature and Structure of Research Program

ERS follows the general USDA definition of technology transfer as the adoption of research outcomes for public benefit. ERS conducts relevant and objective economic research and policy analyses that inform program and policy decisions. ERS designs its research to demonstrate to its customers the consequences of taking alternative policy or programmatic pathways. Our data and market analysis program provides crucial market and trade outlook information to help farmers and agricultural companies run successful businesses and support jobs

ERS is also the primary source of statistical indicators that, among other things, gauge the health of the farm sector (including farm income estimates and projections), assess the current and expected performance of the agricultural sector (including trade), and provide measures of food insecurity here and abroad. ERS is one of the 14 officially designated (by OMB) federal statistical agencies.

ERS disseminates its research findings, market information, and statistical indicators in a variety of outlets including:

- Its website (www.ers.usda.gov/);
- Its online magazine, *Amber Waves*;
- Outlook reports for specific commodity sectors
- ERS research and information reports; and
- Refereed journal articles, which assure the professional credibility of findings.

The ERS is located in Washington, DC, and has about 250 federal researchers working on socioeconomic research. Additionally, ERS seeks out academic and private sector collaborators through contracting and cooperative agreements to leverage external expertise to complement the knowledge of our intramural research staff.

4.3. Current Technology Transfer Goals, Objectives, and Measures of Success (Metrics)

ERS uses a web-centric approach to communication with customers. Our goal is to convey clear, objective, and transparent research, data, and analysis to decision makers, policy officials, industry, non-governmental organizations, and the general public. All ERS research, data, and other information disseminated by the agency are available through the ERS website. ERS measures customer satisfaction with the ERS website using a survey based on American Customer Satisfaction Index (ACSI). The measure tracks satisfaction of Web site users and provides a basis for comparison with similar government and private-sector Web sites. The target for this measure is at or above the average rating for government websites in the Information/News category.

4.4. Strengthening Current Activities

ERS is currently enhancing and updating its website. ERS research, analysis and data will be easier to find, and dynamically displayed in multiple locations. The new website will feature more intuitive

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navigation for customers to enhance information delivery to customers. The website will also feature an enhanced experience for mobile users.

4.5. ERS response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

In the USDA's implementation plan for the Presidential Memorandum, ERS described two initiatives to promote technology transfer and commercialization. The initiatives and their implementation in FY 2012 are described below.

USDA 29: ERS is investigating wider use of social media and new technologies (such as mobile phone applications) to widen and expand the reach of our information services to the general public.

ERS launched a new and improved website that enhanced distribution of data, analysis, and research findings

USDA 30: ERS is exploring new methods for evaluating economic impacts of research collaboration and partnerships between public agricultural research institutions and the private sector.

ERS began a multi-year project to develop metrics to quantify the impact of economic social science research and analysis, including measurements of impact of ERS research as evidenced by media citations, briefings for senior policy officials, citations of ERS research in the scientific literature, and customer use of information published on the ERS website.

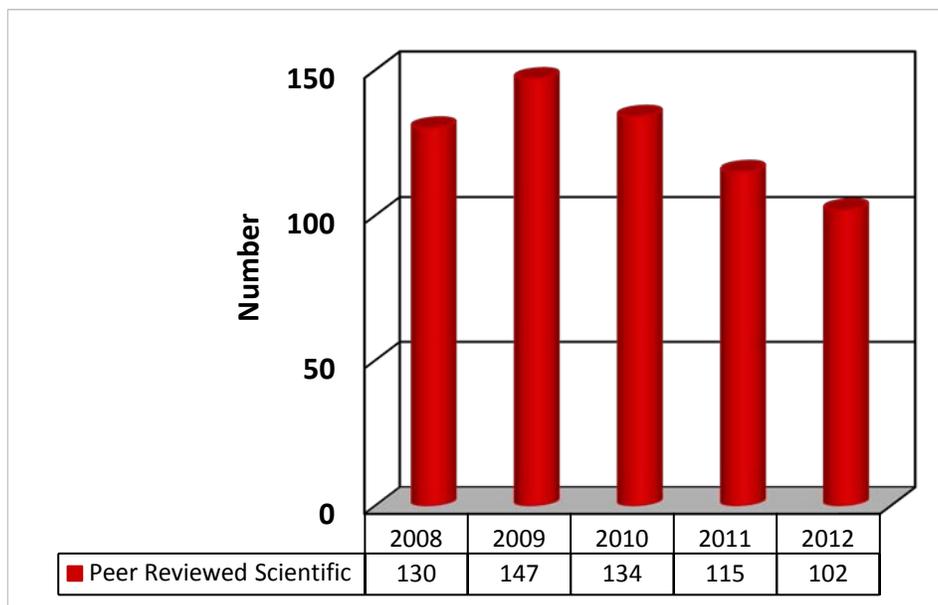
4.6. Downstream Outcomes

- In 2012, ERS completed a comprehensive effort to deliver a new customer-centric, flexible, and responsive website for ERS (<http://www.ers.usda.gov/>) —enabling ready adoption of enhanced design and functionality/services/offerings, including dynamic data and chart libraries that allow for improved exploration, analysis, and dissemination of ERS products. In addition to the look, we refined the information and organization, navigation and functionality, and took the opportunity to upgrade the technical foundation. Since the launch of the new website, visitors are finding their desired items more quickly (search no longer the top click), and are spending slightly more time on the site, which indicates higher engagement.
- ERS's Twitter feed continues to expand our reach: with over 8,000 followers signed up for our tweets in fiscal 2012--up from over 4,900 followers in 2011 and from 950 in 2010.
- ERS research has provided the first ever national assessment of food deserts - low income areas with low access to affordable and nutritious food. This 2009 national assessment, and follow up efforts at ERS to map food access through the food deserts locator (<http://www.ers.usda.gov/data-products/food-desert-locator.aspx>), identified new opportunities for business and employment. Wal-Mart and Supervalu announced plans to open more than 250 new stores in underserved neighborhoods identified by ERS. This shows how ERS is able to create new information of value to the business community.

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- Policy makers and the public are being provided with easily accessible data on rural areas through the ERS Atlas of Rural and Small-town America (<http://www.ers.usda.gov/data-products/atlas-of-rural-and-small-town-america.aspx>). The online mapping tool provides county-level information on over 60 statistical indicators on the people, jobs, agriculture, and county characteristics in nonmetropolitan America. The Atlas helps State and local decision makers pinpoint the needs of particular areas, recognize their diversity, and develop strategies to build on their assets by using location-based data on population, age structure, race and ethnicity, income, employment, agricultural well-being, and other measures. . In FY 2012, county-level economic and demographic data on veterans were added to the Atlas. The veteran’s data come from the Census Bureau’s American Community Survey covering the period 2006-2010. Variables being updated include period served, unemployment, median income, education, gender, and race and ethnicity. Also included in this update were the most recent local area unemployment and employment data for 2011 from the Bureau of Labor Statistics. In FY 2012, county-level economic and demographic data on veterans were added to the Atlas. The veteran’s data come from the Census Bureau’s American Community Survey covering the period 2006-2010. Variables being updated include period served, unemployment, median income, education, gender, and race and ethnicity. Also included in this update were the most recent local area unemployment and employment data for 2011 from the Bureau of Labor Statistics.
- Local officials throughout the country can now easily gauge the characteristics of their food environment and target actions that alleviate problems with the availability of healthy food options for the people in their counties or State using the ERS Food Environment Atlas (<http://www.ers.usda.gov/data-products/food-environment-atlas.aspx>). The Atlas maps 168 different factors that contribute to U.S. counties’ and States’ food environments – from the number of fast food outlets per capita, to average food prices for various products, and the rate of diabetes. Because ERS determined the location and derived the characteristics of the nation’s food deserts – places where grocery stores do not exist or are not easy to get to -- national, State and local governments can target food access investments so that the 23 million people with low access will have better choices and better health in the future.

4.7. Publications



5. Foreign Agricultural Service (FAS)

<http://www.fas.usda.gov/>

5.1. Mission Statement

The Foreign Agricultural Service (FAS) links U.S. agriculture to the world to enhance export opportunities and global food security.

5.2. Nature and Structure of Program

FAS has Washington, D.C. staff and a global network of 95 offices with foreign service officers and locally engaged staff covering 162 countries. FAS supports U.S. foreign policy, identifies problems, provides practical solutions, and works to advance global food security and opportunities for U.S. agriculture. Within USDA, FAS serves as the principle coordinator of international activities, drawing on the broad expertise of USDA and U.S. agricultural organizations.

Trade Policy

FAS expands and maintains access to foreign markets for U.S. agricultural products by providing expertise in international trade policy negotiations and enforcement, and in working to reduce or eliminate technical barriers to trade and sanitary and phytosanitary trade restrictions. FAS closely works with other USDA agencies, federal and state governments, the U.S. agricultural industry, foreign governments, and international organizations to help ensure a level playing field for U.S. agricultural products in the international marketplace.

Market Development and Export Assistance

FAS partners with more than 75 cooperator groups, representing a cross-section of the U.S. food and agricultural industry, and manages a toolkit of market development programs to help U.S. exporters develop and maintain markets for hundreds of U.S. products. FAS also supports U.S. agricultural exporters through export credit guarantee programs and other types of assistance.

Data and Analysis

FAS's network of global contacts and long-standing relationships with international groups contribute to the agency's unique market intelligence capacity for all major agricultural commodities. FAS collects data and its analysts generate objective intelligence on foreign market opportunities, prepare agricultural production forecasts, assess marketing opportunities for U.S. exports, and both identify and monitor changes in policies affecting U.S. agricultural exports and imports. Agricultural markets and key private sector constituents rely on FAS data and analyses to develop and implement domestic and international programs and make business decisions.

Capacity Building and Development

FAS leads USDA's efforts to help developing countries and emerging market economies improve their agriculture and food systems and build their agricultural trade capacity. FAS administers non-emergency food assistance programs to help meet recipients' nutritional needs and support agricultural development and education.

5.3. FAS response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

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USDA 31: Engage in consultation with the Agricultural Technology Innovation Partnership program (ATIP) to assist in establishing U.S. commercial partners with foreign entities.

USDA 32: Provide assistance to ATIP members and their U.S. business clients in finding export opportunities for goods and services arising from USDA innovations.

USDA 31 and 32 will be partnership between FAS and USDA's Agricultural Research Service (ARS) to engage ATIP members and their U.S. business clients. These specific activities were not implemented in FY2012 because ATIP was not ready to engage FAS. However, the ATIP members formed a Foundation in FY2012 to coordinate activities reflected in USDA 31 and 32 among their members. ATIP members accordingly approved an organization structure for the Foundation and will be ready in FY2013 to engage FAS.

5.4. Downstream Outcomes

Norman E. Borlaug International Agricultural Science and Technology Fellows Program.

In 2012 the Norman E. Borlaug International Agricultural Science and Technology Fellowship Program ("BFP") supported 81 Fellows to help transfer new science and agricultural technologies to eligible developing countries. Since the program's inception in 2004, BFP provided training to more than 700 Fellows from 64 countries and facilitated ongoing relationships between Fellows and their U.S. mentors to promote the adoption or commercialization of U.S. technologies in their respective countries. For example, a Fellow from the Philippines conducted research in 2010 at the University of Minnesota on developing a greenhouse gas collection model for confined swine production. In 2012 she applied her model and technology gained during her fellowship towards the Philippines Department of Agriculture's new policy for livestock waste management, particularly to help mitigate greenhouse gas emissions. In Bulgaria, a Fellow applied technology he gained in 2010 at Texas A&M University to expand his current research on diagnostic tests for poultry diseases and, overall, increase the efficiency of Bulgaria's surveillance and detection of important diseases, like highly pathogenic avian influenza and Newcastle disease. An Iraqi Fellow who completed training on soil salinity at Iowa State University and the University of California at Riverside in 2009 applied new instruments and techniques for soil salinity measurement to conduct surveys of cropland in Iraq. The results of these surveys are helping Iraq assess options and determine best practices to sustain crop production on its highly saline soils. Following a



2009 BFP fellowship at ARS in Beltsville, Maryland, an Ecuadoran Fellow helped transfer biological pest management technologies developed by ARS to over 1000 cocoa farmers, extension agents, and university faculty and students and his work is now helping improve cocoa production and quality in Ecuador. As these examples illustrate, by providing targeted training and establishing durable relationships between Fellows and their U.S. mentors, the BFP continues to deliver significant transfers of U.S. technologies that are improving agriculture, economic development, and food security throughout the world.

Photo 1: *Following a BFP Fellowship at Iowa State University, a Fellow from Kosovo is now working to perform the first bovine embryonic transfer in Kosovo and he aims to open a commercial bovine embryonic transfer center, which would be Kosovo's first.*

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Energy and Climate Partnership of the Americas. Under the Energy and Climate Partnership of the Americas (ECPA) framework and with funding provided by the U.S. Department of State, the Foreign Agricultural Service (FAS) continued its implementation of a technical cooperation project to increase the agricultural production and usage of biomass for renewable energy in the Western Hemisphere. This project was a platform for FAS to facilitate transfer of biomass energy technologies from two U.S. land grant universities to partners in Honduras and Ecuador. More specifically, participating scientists from Washington State University (WSU) and Texas A&M University (TAMU) diffused knowledge on the chemical processes, institutional framework, and mechanical engineering for converting renewable feedstock into biogas. In Honduras, the Honduran Institute for Coffee (IHCAFE) received and applied U.S. technology to build a biodigester that could utilize coffee waste to produce biogas to power coffee driers. IHCAFE intends to use their new biodigester as a model for its members to learn more about this technology and how it may be further disseminated and applied among coffee producers nationwide. In Ecuador, the hydroelectric company Hidronacion collaborated with WSU and TAMU to design a biodigester system that converts water hyacinth into biogas. When their design is completed and the



biodigester is brought into production, Hidronacion intends to use the biogas to generate electricity for local communities. In consultation with USDA's Agricultural Research Service, FAS initiated plans for a regional technology and policy fair in early 2013 to showcase these and other biomass energy technologies to governments, multilateral organizations, and private sector stakeholders who are pursuing agricultural production and usage of biomass for renewable energy. The 2013 regional fair will be similar to ATIP workshops with policy dialogue, technical seminars, and technology exhibits.

Photo 2: *This biodigester was constructed in Marcala, Honduras by the Honduran Institute of Coffee in collaboration with USDA/FAS and Washington State University. It is an anaerobic biodigester that utilizes excess coffee mucilage and swine excrement to power a coffee dryer in an effort to increase export value for small coffee cooperatives.*

Technical Assistance for Specialty Crops. In 2012 the Technical Assistance for Specialty Crops Program ("TASC") funded several projects to promote transfer and commercialization of USDA technologies. For example, TASC provided parallel grants to ARS and APHIS to develop innovative phytosanitary irradiation treatments for high impact invasive alien species and an additional grant to Chapman University to minimize any negative impact of post-harvest irradiation treatments on fruit quality and shelf-life. Each of these TASC grants included a requirement of the implementing partners to provide technology transfer, training, and technical expertise to U.S. irradiation firms. Such efforts to develop and commercialize new irradiation treatments, coupled with quality assessments, are critical for U.S. exporters to help meet complex phytosanitary requirements and thereby preserve their foreign markets for U.S. specialty crops. Between 2004 and 2008, the annual value of U.S. exports of specialty crops (e.g., fruits, tree nuts, vegetables, and greenhouse and nursery crops) was \$11 billion. By collaborating with sister USDA agencies, U.S. universities and specialty crops industries to develop and commercialize post-harvest phytosanitary irradiation treatments, TASC is directly helping to promote the transfer and commercialization of these new technologies and, overall, expand the variety, quantity and value of U.S. specialty crops for export markets.

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Food for Progress. The Food for Progress Program (“FFPr”) provides donations of U.S. agricultural commodities to developing countries that are committed to introducing or expanding free enterprise in the agricultural sector. Donated commodities are “monetized” (i.e., sold on the local market) by implementing partners within a participating country and the proceeds are used to support agricultural development activities in that country. In some cases, FFPr activities help accelerate the transfer and commercialization of U.S. technology in partner countries. For example, in 2012, with a grant from FFPr, the National Cooperative Business Association (NCBA) launched a new project in northern Uganda to promote labor-saving, commercially viable conservation technologies for maize, pulse and soybean growers. More specifically, by engaging farmer associations, NCBA is introducing and promoting low-tillage cultivation and the use of crop residue mulches for improved soil and water



conservation among approximately 60,000 small holder growers. This project is also engaging local manufacturers of the conservation farming tools and equipment necessary for growers to adopt improved farming practices. Overall, this 3-year technology transfer project will continue its holistic value-chain approach towards increased crop production and sales by providing training in post-harvest handling and tool manufacturing, developing local and regional markets for locally produced commodities, and increasing farmers’ access to inputs and financial services that are critical for targeted farmers to adopt and accrue the benefits of conservation farming technology.

Photo 3. Staff at the Ngetta Zonal Agricultural Research Development Institute in Lira, Uganda use an improved plow to demonstrate low-till land preparation practices on an NCBA-supported conservation farming demonstration plot.

Global Partnership for Pesticide Standards. With funding provided by the FAS Emerging Markets Program, U.S. Department of State and the U.S. Agency for International Development and with technical cooperation from the IR-4 Project, crop protection industries and the Food and Agriculture Organization of the United Nations, FAS continued to lead a global partnership for transferring and commercializing U.S. crop protection technologies to partner countries in a manner that is concurrently helping to establish Codex standards for innovative pesticide-crop combinations and, ultimately, share costs of generating the data that leads to such standards. Currently, NIFA spends approximately \$17



million each year on IR-4 to conduct pesticide residue field trials for U.S. specialty crops. The IR-4 Project is highly successful to generate data for review and acceptance by the U.S. Environmental Protection Agency. Thus, pace of the registration and commercialization of new pesticides for use by U.S. growers far exceeds the pace of Codex and most U.S. trading partners. As a result, many chemicals approved for use by U.S. growers are not yet approved abroad, often creating situations where affected U.S. products are banned from their intended foreign markets. The FAS-led global partnership is working with stakeholders in partner countries in Africa, Asia, and the Western

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Hemisphere to fill the gap. In short, through policy dialogue, technical training and cooperative research, the global partnership is enabling coordination among the United States and other countries to conduct field trials on pesticides and crops and then jointly submit the data packages to Codex. By transferring these policy concepts and technical skills to foreign partners, the global partnership is complementing the IR-4 Project by supplementing U.S. generated data or completely shifting the trial responsibilities to a partner country. In addition to economizing U.S. resources for development and commercialization of pesticides, this global partnership continues to promote common standards among the United States and our agricultural trading partners and, overall, provide modern pest control tools that may be safely used by growers world-wide.

Photo 4. *Central American research teams received training from IR-4 at a field test site in Costa Rica. The scientists learned how to conduct supervised residue trials to establish Codex pesticide maximum residue levels.*

Cochran Fellowship Program. In 2012 the Cochran Fellowship Program (“CFP”) provided short-term training in the United States for 479 international participants from 65 countries. Since its inception in 1984, over 15,000 Fellows from 123 countries have participated in CFP activities, including meetings with U.S. agribusinesses, agricultural policy and food safety seminars, and technical training related to short- and long-term market development and trade capacity building initiatives. CFP Fellows often focus on transfer and commercialization of U.S. technologies. For example, in 2012 CFP delivered an aquaculture production and processing program for Pakistani Fellows at Mississippi State University, including site visits to fish hatcheries and production farms in Starkville. The Fellows received technical training in state-of-the-art aquaculture production and processing technologies, including HACCP procedures, aquaculture nutrition and feed management, genetic selection of fish stock, and fish harvesting and processing technologies. The program also highlighted aquaculture product marketing and transportation plans. The Fellows concluded their program equipped with knowledge and skills to help transfer and commercialize these U.S. aquaculture technologies in Pakistan, where there is growing interest in aquaculture. In addition, as Pakistani aquaculture develops, a local demands and market for U.S. technologies and inputs are likely to increase in coming years. Overall, this example illustrates how the CFP continues to play a significant role linking technology transfer to commercial enterprises and development of international markets that benefit both the U.S. and participating countries.



Photo 5. *Pakistani CFP Fellows visited Starkville, Mississippi for intensive training in modern aquaculture technologies. In addition, the Fellows examined critical issues, like market development and product transportation, to help promote commercialization of aquaculture in Pakista*

6. Forest Service (FS)

<http://www.fs.fed.us/>

6.1. Mission Statement

The overall mission of the FS is to “sustain the health, diversity, and productivity of the nation’s forests and grasslands to meet the needs of present and future generations.” Established in 1905, FS is an agency of the U.S. Department of Agriculture that directly manages 193 million acres of public land in national forests and grasslands and works with state forestry agencies and other partners to assist in managing 491 million acres of state and private forest lands. Gifford Pinchot, the first Chief of the Forest Service, summed up the mission of the Forest Service —“to provide the greatest amount of good for the greatest amount of people in the long run.” FS is composed of four deputy areas: National Forest System (NFS), Research and Development (R&D), State and Private Forestry (S&PF), and Business Operations.

The R&D mission is to “develop and deliver knowledge and innovative technology to improve the health and use of the Nation’s forests and grasslands – both public and private.” R&D provides this information to landowners, managers, policymakers, and the American people to help inform their decisions and actions.

6.2. Nature and Structure of Research Program

The FS R&D mission area develops and delivers the scientific information and technology needed to manage, protect, use, and sustain the natural resources of forests and rangelands. Research is conducted by more than 550 scientists and several hundred technical and support staff. The FS R&D deputy area includes five research stations (Northern, Pacific Northwest, Pacific Southwest, Rocky Mountain, and Southern), the Forest Products Laboratory, the International Institute of Tropical Forestry in Puerto Rico, and two Technology and Development Centers run by NFS, one in Missoula, Montana and one in San Dimas, California.

Ninety-two research work units are located at 67 sites throughout the United States. The system provides sites for long-term science and management studies of major vegetation types found on the 193 million acres of public land administered by the Forest Service.



The research program is organized among seven Strategic Program Areas: wildland fire and fuels; resource management and use; wildlife and fish; recreation; water, air, and soil; inventory and monitoring; and invasive species.

FS R&D maintains a vital network of 80 Experimental Forests and Ranges, 29 of which were established in the 1930s. Long-term records from some of these forests can provide unprecedented insights into global climate change, watershed function, disturbance recovery and many other areas. Major research themes at the Experimental Forests and Ranges include developing systems for management and restoration of forests, range lands, and watersheds; investigating forest and stream ecosystems; characterizing plant and animal communities; observing and interpreting long-term environmental change and many other themes.



FS R&D is currently placing special emphasis on climate change, biomass to energy, watershed restoration, urban natural resource stewardship, and nanotechnology. FS R&D seeks to achieve excellence in conducting high-quality research on relevant topics in natural resource sciences.

6.3. Current Technology Transfer Goals, Objectives, and Measures of Success (Metrics)

The FS uses many means of technology transfer, including marketing efforts at tradeshow and with universities; patents; webinars; workshops; social media posts; conservation education and citizen science; public outreach; and publications both electronic and paper. Many metrics associated with these efforts are currently being tracked, and FS plans to track new metrics such as social media, web hits and citation indexes within the next five years.

One measure of success currently used by FS R&D is the Customer Satisfaction Survey sent out every three years to the various individuals and groups who use our research information and products. The survey uses econometric models developed collaboratively with FS R&D staff and customized for our products and services. The results are presented as a score based on the American Customer Satisfaction Index methodology, which enables users to compare the scores of other Federal R&D agencies. The three main components measured were relevant activities

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in each area that drive customer satisfaction, satisfaction itself, and desirable customer behaviors and outcomes. The FY 2012 survey scored 79% , exceeding its target and scoring significantly better than the average score of 67% for all other Federal agencies. Results from this survey were incorporated into FS R&D program planning to ensure that the work we do is relevant to customers' needs. The survey will be repeated in FY 2015.

The principal contact for technology transfer via patents and licensing within the FS is the Patent Program reporting to the Washington Office and located at the Forest Products Laboratory in Madison, Wisconsin. The FS Patent Program receives and tracks all invention disclosures, providing guidance to scientists regarding all aspects of intellectual property protection. The Patent Program directs prior art searches and prepares FS invention disclosures for review by the FS Patent Review Committee (PRC), a multidisciplinary committee with members from R&D, NFS, and S&PF. The Patent Program also oversees contract law firms drafting patent applications, and files and prosecutes applications in the U. S. Patent and Trademark Office. Draft patent licenses are prepared by the FS Patent Program and reviewed by ARS OTT Licensing Specialists. CRADAs and other technology transfer agreements for the FS are handled by the FS Grants and Agreements Specialists, with patent marketing responsibilities falling to the FS Patent Program.

The PRC meets bimonthly to evaluate and determine whether to file patent applications on FS invention disclosures. The criteria used by the committee include the invention's relationship to the overall mission of the Forest Service, its potential to further national forest resource goals and objectives, the advancement of the state of the art, and economic concerns such as market potential, costs of production, and licensability. Once the decision to patent an invention has been made, the FS Patent Program handles filing and prosecuting patent applications, and/or working with the joint owner (such as CRADA cooperator or university) to pursue patent protection.

The Forest Service is the only land management agency within USDA and is responsible for 193 million acres. Forest Service R&D provides high-quality scientific information and applications that help land managers restore and maintain healthy forests and grasslands for community protection; multiple environmental and social benefits, such as clean air and clean and abundant water; a great array of recreational opportunities; and a wide range of ecosystem services. The following table illustrates trends in FS R&D performance outcomes, the average of these years will be used as a baseline for the period from 2013-2017.

Performance Measure	FY	FY	FY	FY
	2008	2009	2010	2011
Customer satisfaction index score - (60,000 - 80,000 customers surveyed every three years)	72	75	75	75
Patent Applications filed	9	6	6	13 ¹
New Inventions Disclosed	31	36	18	31
Patents Granted	6	3	2	3

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Patent Licenses Executed	1	0	0	2
CRADAs executed	7	5	6	5
Collection Agreements executed	117	114	107	15
New Interagency Agreements and Contracts	40	57	38	32
Interagency Agreements and Contracts	12	12	12	12
International Cooperative Agreements executed	0	1	3	21
Research Joint Venture Agreements executed	199	300	304	58
Number of invasive species tools developed, delivered, and used is an invasive species PART performance measure calculated as the number of invasive species tools on a 5-year rolling average	142	177	170	163
Articles Published in Journals	1,903	2,294	1,884	3,083
Articles Published in all Other Publications	1,487	921	993	1,178

¹Note: A total of 13 patent applications were filed in FY 2011, 9 provisional and 4 utility applications.

6.4. FS response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

In the USDA's implementation plan for the Presidential Memorandum, FS described six initiatives to promote technology transfer and commercialization. The initiatives and their implementation in FY 2012 are described below.

Strengthening Current Activities

USDA 14: Accountability of Scientists and Engineers in Technology Transfer Accomplishments

Starting in FY 2012, scientist's annual performance standards for evaluation have been revised to include science delivery and technology transfer. Scientists now need to document in their performance reviews additional work beyond publishing to accomplish effective technology transfer and science applications. To be "Fully Successful" under the "Mission Results" element, both careful planning and actual delivery of technology transfer and science application activities must be demonstrated.

USDA 15: New uniform metrics for Forest Service Outcomes

The following metrics are currently being tracked non-uniformly by a number of the FS Research Stations. One of our goals is to standardize metrics tracking at each station in the following areas:

- Agreements (Material Transfer, Confidentiality, Joint Venture, and other agreements, in addition to CRADAs, which are currently counted)
- Videos and podcasts
- Tweets
- Website visitors
- Website downloads
- Workshops and webinars
- Newsletters and station magazines (electronic and print distribution)
- Peer-reviewed publications and publication downloads
- Trade journal publications
- Field days, open houses and tours

Beginning in FY 2013, FS plans to track new metrics, such as oral presentations and posters at meetings; workshops; technical conferences; working committees of scientific professional organizations; articles in applied science outlets, trade journals, interest-group magazines, and e-media whose readership is heavily composed of the targeted audiences; direct communication with potential research users, including both intermediaries (e.g., extension foresters and consultants) and end-users via direct in-person interactions or by electronic means (e.g., Webinars, Web sites); field tours for student groups or visiting professionals; participating at science fairs; and mentoring students interested in science careers.

A new “Science Delivery Award” under the Deputy Chief for R&D awards system was created, with the first recipient awarded in January 2012. The first recipient was selected for playing a critical role in making scientific models available for fire management applications in the form of fire behavior prediction and fire danger rating systems.

The Patent Program website has recently been updated and includes a current listing of patented FS technologies available for licensing. Patent Program staff are currently working with FS Office of Communication to showcase key patents on the National R&D website, with further revisions underway. Also, an RSS feed of available technologies has been posted on the Federal Laboratory Consortium (FLC) website, which is another way for FS patented technologies to gain more national exposure.

New Initiatives

The FS Patent Program plans to continue to devote resources toward similar marketing efforts to increase awareness of FS inventions and promote adoption of technologies outside the FS. Future marketing efforts will focus on recently filed patent applications, with the hope of finding commercialization partners earlier in the process.

USDA 16: New metrics on research outcomes related to intellectual property (patents)

FS R&D developed and implemented the Research Information Tracking System (RITS), which became the official FS reporting vehicle for all science publications in FY 2010. RITS improves the quality and consistency of data, provides transparency to the public, and reduces the need for burdensome data calls. Metrics now available in RITS will be tracked in the USDA Annual Report beginning in FY 2012. In testing now, the next version of RITS will incorporate patent data which will be connected to related publications on specific technology focus areas.

In FY 2012, Forest Service R&D made the Research Data Archive (<http://www.fs.usda.gov/rds/archive>) available on the Internet and added an additional 50 research data sets. To improve long-term management of research data collected on Experimental Forests and Ranges (EFRs), the archive provided metadata training was provided for scientists and EFR data managers. The archive was also the core of an agreement to provide a number of services to the Joint Fire Science Program (<http://www.firescience.gov>) including training webinars for JFSP grant applicants; review of data management plans for grant proposals; metadata catalog services for all JFSP research project; and serving as the recommended data repository for JFSP research projects.

Facilitating Adoption Through Partnerships

As part of the USDA, the Forest Service Patent Program has enjoyed a close working relationship with ARS and the Office of Technology Transfer (OTT) for many years. This partnership has grown and expanded to include FS access to the Agriculture Research Information System (ARIS) database for patent and license tracking, inclusion in OTT teleconferences, and ARS Licensing Associates assisting the FS Patent Program with license negotiations.

USDA 17: Explore additional ways FS and ARS can work together on intellectual property and related matters

CRADA's are widely used within the FS to enable researchers to work with university partners and industry leaders and are drafted by the FS Grants and Agreements Specialists. Recognizing efficiencies that could be gained by having standardized agreement language and procedures, FS hopes to use ARS as a CRADA resource to assist with CRADA questions. For example, FS proposes using the ARS Partnership Liaison to conduct a training session or webinar on CRADAs for all FS Grants & Agreements Specialists.

Currently the FS has an informal relationship resembling a "Partnership Intermediary Authority" (PIA) with the Wisconsin Security Research Consortium (WSRC). ARS is offering to expand their PIA Agreements to enable access for other USDA agencies, subject to their contributions to support OTT operations. The Staff Director for Science Quality Services attended the March 2012 Agricultural Technology Innovation Partnership (ATIP) meeting to help further this relationship. FS would benefit from the opportunity to work more closely with ATIP, with the hope of finding industry partners to collaborate with FS scientists and license their technologies.

USDA 18: Enhance education and extension outreach efforts

FS R&D has a focused effort to educate children about conservation of natural resources and ecology. For example, FS R&D, in cooperation with University of Georgia, created a web-based conservation education program tool called EUGENE (Ecological Understanding as a Guideline for Evaluation of Non-formal Education) based on ecological principles. Educators can use this on-line tool to measure students' gain in knowledge of ecological principles after exposure to the program. Metrics related to this effort that are currently tracked, or will be tracked, include number of downloads of course materials, number of Natural Inquirers downloaded and mailed in printed form, number of teachers using FS-developed educational materials, and cooperative agreements and other efforts with related groups, such as the Cradle of Forestry.

Similar to state Extension services provided by many universities, the Forest Products Laboratory's (FPL's) Technology Marketing Unit (TMU) provides a broad scope of expertise in wood products utilization, marketing, technology transfer, and technical assistance. The TMU is part of the FS S&PF and collaborates with many different partners, particularly the FS R&D staff and state forestry agencies. In

promoting the efficient, sustainable use of wood, the TMU assists private businesses, local governments, and rural communities by transferring wood-based technologies developed by the FPL, other FS research stations, universities, and other Federal research laboratories. The TMU supports the national and international mission of the FS in forest products utilization by ensuring ready adoption of forest-based material technologies to many small, rural forest product businesses. The breadth of TMU’s work includes forest products conservation, processing, manufacturing efficiency, marketing, recycling, and bioenergy. Technical assistance efforts include publications, technical assistance visits, conferences, workshops, meetings, and individual consultations. The TMU manages and awards approximately \$5 million annually each year in grants dedicated to helping improve the utilization of woody biomass removed from forest restoration projects.

USDA 19: Enhance FS interactions with entrepreneurship activities at educational institutions

In FY 2012 the FS Patent Program formed a new partnership with the University of Wisconsin Madison Law & Entrepreneurship Clinic at the UW Law School. Through this connection the Patent Program is working with the “Strategic Management in the Life and Engineering Sciences” graduate class during the 2012 spring semester to evaluate the commercial potential of several FS technologies. The Patent Program hopes to continue to strengthen and further refine this connection in upcoming semesters

Through the FS Patent Program’s work with WSRC, they are now connected to the Center for Innovation and Business Development and the Small Business Development Center at UW-Whitewater. For the past four semesters, the FS Patent Program has worked with undergraduate business students enrolled in the “Consulting for Entrepreneurial Companies” course developing marketing plans for FS technologies. Beginning in FY 2012, increased follow-up with inventors is planned to further market the technologies following recommendations in the students’ reports, including attendance at trade shows and other non-traditional settings.

Working with WSRC, the FS Patent Program is in the process of establishing a connection at one or more of the engineering schools in Wisconsin with the hope of redesigning the FS ADA accessible water pump for use in third-world countries. Beginning in FY 2013, FS plans to expand this partnership to include work on additional FS technologies that could use improved design for manufacturing efficiencies and for mass production.

6.5. Metric Tables

Table 1. Collaborative Relationships for Research and Development (R&D)

Forest Service (FS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
● CRADAs, total active	19	22	22	17	5
- New, executed	7	9	15	5	3
▪ Amendments ¹ , total active					0
- New, executed					0
▪ Traditional CRADAs, total active					5
- New, executed					3
● Publications					
-Peer-Reviewed Scientific Publications ³					2399
-Non-Refereed Publications					650

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¹ Amendments extend existing CRADAs for additional years to a maximum of 5 years, and/or change Statements of Work, and/or change funding levels.

² Includes Trust Fund Agreements, Reimbursable Agreements, and Non-Funded Cooperative Agreements.

³ Peer-Reviewed Scientific Publications for the FS include those that are formally and informally refereed.

Table 2. Invention Disclosures and Patenting

Forest Service (FS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• New invention disclosures in FY	0	1	18	15	23
• Patent applications filed in FY, total	9	6	6	9	13
▪ Non-Provisional	5	4	3	2	11
▪ Provisional	4	2	3	7	2
• Patents issued in FY	3	3	2	3	8
▪ Life Sciences	0	0	1	0	2
▪ Chemical	0	0	0	0	4
▪ Mechanical & Measurement	0	0	0	0	2

Table 3. Licensing: Profile of Active¹ Licenses

Forest Service (FS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• All licenses, total active in the FY	13	13	20	20	20
-New, executed in the FY	1	0	0	2	3
-Newly executed to small business					1
-Newly executed to universities					2
▪ Patent licenses, total active in FY	13	13	20	20	20
-New, executed in the FY	1	0	0	2	3
▪ Material transfer licenses, total active in FY	0	0	0	0	0
- New, executed in the FY	0	0	0	0	0

¹Active means legally in force at any time during the FY, whether or not the license is income bearing. USDA licenses are patent invention and material transfer (invention) licenses. There are no other invention licenses of other IP licenses.

Table 4. Income Bearing Licenses¹

Forest Service (FS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• All income bearing licenses	12	12	18	18	18
- Exclusive	11	11	17	17	17
- Partially exclusive	0	0	0	0	0
- Non-exclusive	1	1	1	1	1
▪ Patent licenses	11	11	18	18	18
- Exclusive	10	10	17	17	17
- Partially exclusive	0	0	0	0	0

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- Non-exclusive	1	1	1	1	1
• All royalty bearing licenses¹	12	12	18	18	18
▪ Patent licenses	12	12	18	18	18

¹Totals include only those licenses that actually received royalty income.

Table 5. License Income

Forest Service (FS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
• Total income, all active licenses	\$25,015	\$6,655	\$5,506	\$15,340	\$12,733
▪ Patent licenses	\$25,015	\$6,655	\$5,506	\$15,340	\$12,733
• Total Earned Royalty Income (ERI)				\$810	\$658
- Median ERI				\$212	\$329
- Minimum ERI				\$187	\$312
- Maximum ERI				\$411	\$346
- ERI from top 1% of licenses				\$411	\$346
- ERI from top 5% of licenses				\$411	\$346
- ERI from top 20% of licenses				\$411	\$346
▪ Patent licenses, total ERI				\$810	\$658
- Median ERI				\$212	\$329
- Minimum ERI				\$187	\$312
- Maximum ERI				\$411	\$346
- ERI from top 1% of licenses				\$411	\$346
- ERI from top 5% of licenses				\$411	\$346
- ERI from top 20% of licenses				\$411	\$346

Table 6. Disposition of License Income

Forest Service (FS)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012 ¹
• Income distributed, total	\$8,500	\$6,000	\$5,506	\$5,810	\$0
- To Inventors	\$8,500	\$6,000	\$5,506	\$5,810	\$0
- To Others	\$0	\$0	\$0	\$0	\$0
▪ Patent licenses, total	\$8,500	\$6,000	\$5,506	\$5,810	\$0
- To inventors	\$8,500	\$6,000	\$5,506	\$5,810	\$0
- Salaries of some technology transfer staff					\$194,496
- Patent filing preparation, fees, & annuity payments					\$46,445
- Other technology transfer expenses					\$0

¹FS licenses income collected in FY12 will be distributed in FY13 due to program changes at ASC.

6.6. Downstream Outcomes from FS Technology Transfer Activities

- 92 Research Work Units
- 67 Locations
- 550 Scientists

Engineered Molded Fiberboard Panels

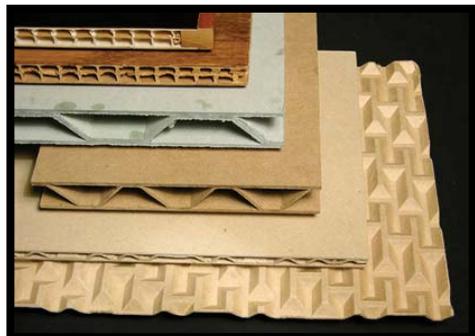


Photo: Examples of fiber-based panels developed at FPL.

This invention uses a broad spectrum of virgin cellulosic fibrous raw materials (such as wood and plant fibers) and recycled cellulosic fibrous materials (such as paper, agriculture waste, corrugated cardboard, and newspaper) to form a sheet using wet-process manufacturing methods. The panels are then cut in specific locations to produce contoured shaped structures which are then bonded together or laminated to produce novel architectural, furniture, or packaging applications. The shapes produced create a three-dimensional, light weight, flexible

material that is strong and durable. This product is environmentally friendly and does not off-gas toxins into the environment ensuring a safe environment for manufacturing personnel and the consumer. Competing products in the specialty panel products area include plastic transparent decorative panels, recycled laminated paper products and honeycomb cores. Competing commodity products include medium-density fiberboard, particle board, and/or oriented strand board which are manufactured using formaldehyde, adhesives, and other additives that often produce toxic off-gases. This patented invention (U.S. Patent 8,297,027, Issued 10/30/12), was jointly engineered by a USDA Forest Products Laboratory (FPL) inventor in collaboration with Noble Environmental Technologies (NET) under a CRADA. NET has exclusively licensed the worldwide rights for this patent and is actively commercializing it. Production engineering has started at FPL under the “pilot plant” authority, which is the first use of this legal authority within the Forest Service. See <http://ecorglobal.com>. *Forest Products Laboratory (FPL), Madison, WI*

Surfactant-Assisted Inorganic Nanoparticle Deposition on Cellulose Nanocrystals

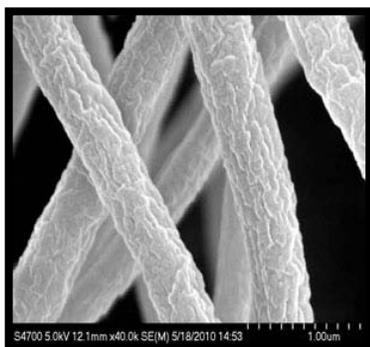


Photo: TEM micrograph of electrospun polymethyl methacrylate fibers containing 17 weight percent cellulose nano-crystals.

This technology consists of methods for synthesizing metallic and semiconductor nanomaterials on cellulose nanocrystals. Unlike proteins, DNA, and other biomolecules, cellulose is abundantly available, relatively inexpensive, and can be easily chemically functionalized. Nano-scale particles of gold, platinum and other rare elements are particularly active as catalysts because of the extremely high surface area of the particles and surface chemistry effects unique to near-atomic-scale

particles. Physically attaching these nano-scale particles to nano-diameter cellulose fibers maintains the high surface area and activity, but the micron-length scale of the cellulose nano-fiber provides dimension that can be used to maintain a fine dispersion of the nanoparticles while also providing the capability to recover the catalyst. Similarly, this above description can also be applied for the nano-scale silver particles, which have antimicrobial functionality. Target markets for technology transfer include the semiconductor industry and filtration companies. A patent application covering this technology is pending and was published as U.S. Publication No. 2011/0262646 on October 27, 2011. Purdue University and the USDA Forest Service (FS), Forest Products Laboratory jointly invented this technology and FS's interest has now been exclusively licensed to Purdue University via the Purdue Research Foundation. Industrial cooperators to further develop the technology and/or licensees are being sought. *Forest Products Laboratory (FPL), Madison, WI*

Renewable Wood Energy Projects



Photo: A truck is filled with wood chips as part of the process of turning wood into energy

Grants of nearly \$4 million were awarded to 20 small businesses and community groups in 2012 to develop wood-to-energy projects that require engineering services. These projects will help expand regional economies and create new jobs. The projects will use woody material such as beetle-killed trees removed from forests to aid in wildfire prevention. The material will be processed in bioenergy facilities to produce green energy for heating and electricity. The awardees will use funds from the Woody Biomass Utilization Grant program to secure the engineering services necessary for final design, permitting and cost analysis. Examples of projects include the engineering design of a woody biomass boiler for steam at a sawmill, a non-pressurized hot water system for a hospital or school and a biomass-power generation facility. The FS S&PF Technology Marketing Unit at *Forest Products Laboratory (FPL) in Madison, WI* administers the grant program.

Nanocellulose Pilot Plant Unveiled at Forest Products Laboratory

Photo: Forest Product Laboratory chemical engineer Rick Reiner (right) shows Under Secretary Sherman the new nanocellulose pilot plant.



The USDA FS Forest Products Laboratory recently opened a \$1.7 million production facility for renewable, forest-based nanomaterials. This facility is the first of its kind in the United States and one that positions the laboratory as the country's leading producer of these materials, also called nanocellulose. Nanocellulose is simply wood fiber broken down to the nanoscale. For perspective, a nanometer is roughly one-millionth the thickness of an American dime. Materials at this minute scale have unique properties; nanocellulose-based materials can be stronger than Kevlar fiber and provide high strength properties with low weight. These attributes have attracted the interest of the Department of Defense for use in lightweight armor and ballistic glass. Companies in the automotive, aerospace, electronics, consumer products, and medical device industries

also see massive potential for these innovative materials. The facility will support an emerging market for wood-derived renewable nanomaterials, helping to spur forest-based job growth and contribute an estimated \$600 billion to the American economy by 2020. The United States and other nations will see numerous benefits from the commercialization of wood-derived cellulosic nanomaterials. Development and commercialization of new lightweight, high-performance wood-derived products can help reduce fossil fuel consumption and greenhouse gas emissions while increasing the potential for rural manufacturing opportunities, including the creation of many new high-paying jobs. The Forest Product Laboratory's new facility will aid in the commercialization of these materials by providing researchers and early adopters of the technology with working quantities of forest-based nanomaterials. *Forest Products Laboratory (FPL), Madison, WI*

Wine Barrels Become Wood Flooring

Forest Products Laboratory engineer John Hunt (left) and Jubilee Flooring owner Joe Triglia inspect flooring milled from discarded wine barrel staves.



Joe Triglia, owner of Jubilee Flooring in Long Island, NY has spent years working out a way to turn discarded wine barrels into wood flooring. Now, with help from the USDA FS Forest Service's Forest Products Laboratory, his vision is turning into a promising business venture. In the United States, most wine barrels are made of white oak and their useful life in the wine industry ranges from one to five years. With large vineyards using as many as 100,000 barrels per year, discarded barrels

represent a significant source of wood. Triglia thought there was an opportunity to reuse the barrels for something more valuable than their common fate: being cut in half and sold as garden planters. However, straightening the curved staves so they could be milled into 3/4-inch tongue-and-groove flooring presented a major hurdle. While combing the internet for solutions for straightening wood, Triglia came across a research paper authored by Forest Products Laboratory engineer John Hunt. The paper described using a microwave drying process to straighten lumber. Triglia came to the Forest Products Laboratory where he and Hunt experimented with the pilot-scale equipment, and the results were promising. Using the lab's equipment helped Triglia figure out what is needed to move on to commercial-scale flooring production. This partnership is a perfect example of what is possible when government and industry work together. Research results were used for a commercial application, and a low-value waste material was turned into a high-value product that helped to advance a small business. Triglia has patented his method for transforming wooden staves into flooring or paneling, and is currently developing a CRADA with Hunt to continue their partnership. *Forest Products Laboratory (FPL), Madison, WI*

Climate Change in Grasslands, Shrublands, and Deserts of the Interior American West: A Review and Needs Assessment

The Rocky Mountain Research Station published a comprehensive report summarizing climate change research and potential effects on grassland, shrub, and desert ecosystems. The report, "Climate Change in Grasslands, Shrublands, and Deserts of the Interior American West: A Review and Needs Assessment," highlights current knowledge and future research essential to mitigate the prospective detrimental effects of climate change. It addresses animal, plant, and invasive species models and responses, vulnerabilities

and genetic adaption, animal species and habitats, and decision support tools for restoration and land management. See <http://www.treesearch.fs.fed.us/pubs/41171>. *Rocky Mountain Research Station, Fort Collins, CO*

Assessment on the Fourmile Canyon Fire Completed and Available Online

The Fourmile Canyon Fire Findings were completed by a team of scientists led by Dr. Russ Graham with the U.S. Forest Service Rocky Mountain Research Station. Its release was announced by Senator Mark Udall. One of the key findings of the Fourmile Canyon Fire assessment is that homeowners' actions are the most important factor in protecting their homes from a wildfire. See www.fs.fed.us/rm/pubs/rmrs_gtr289.html. *Rocky Mountain Research Station, Fort Collins, CO*

Wings Across the Americas National Research and Partnership Award

A 10-year collaborative partnership that coalesced around the relationships between neotropical migratory birds, their habitats, increasing fires, and the spread of exotic woody species in riparian ecosystems of the southwestern United States brought national recognition to Dr. Deborah Finch of the USDA Forest Service Rocky Mountain Research Station and her multi-organizational team. The team's project, "Bird Responses to Invasive Species, Fire and Fuel Removal in Vulnerable Southwestern Ecosystems," was recognized with the National Research and Partnership Award from the Wings Across the Americas program. *Rocky Mountain Research Station, Fort Collins, CO*

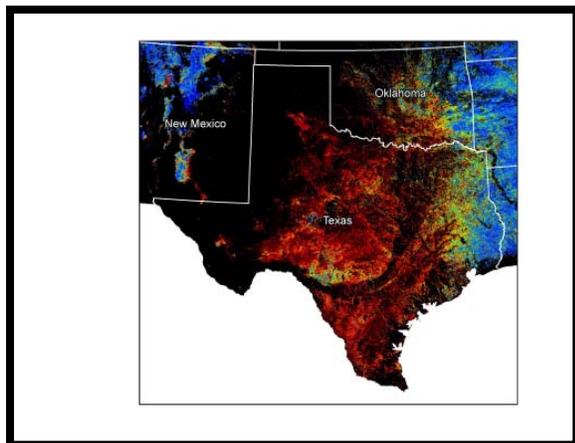
Hayman Fire Symposium

The 2002 Hayman Fire was the largest in Colorado history. Studies by Rocky Mountain Research Station scientists and others were highlighted in The Hayman Fire Symposium, a two-day lecture and field-based workshop held in Denver. This symposium provided an opportunity to share lessons learned from 10 years of scientific research on the Hayman Fire and encourage dialogue about future fire-related research needs. Over 120 participants from land management agencies, state organizations, and nonprofit organizations participated. Videos of the presentations are available on-line. See <http://www.fs.fed.us/rmrs/presentations/hayman-fire-symposium/>. *Rocky Mountain Research Station, Fort Collins, CO*

ForWarn Satellite-Based Monitoring Tool

ForWarn is a satellite-based monitoring and assessment tool that recognizes and tracks potential forest disturbances across the lower 48 United States caused by insects, diseases, wildfires, extreme weather, and other natural or human-made events. Developed through collaborative efforts led by the USDA Forest Service, Eastern Forest Environmental Threat Assessment Center, and the Western Wildland Environmental Assessment Center, ForWarn includes significant and substantive ongoing contributions from the National Aeronautics and Space Administration (NASA), the Department of Energy, Oak Ridge National Laboratory, and the United States Geological Survey. ForWarn began operating in January 2010 and was officially unveiled and rolled out to first-adopters as an operational tool in March 2012. ForWarn

helps natural resource managers rapidly detect, identify, and respond to known and unexpected disturbances in forests across the conterminous United States. ForWarn was developed as a partial response to the Healthy Forests Restoration Act of 2003, which called for the development of a comprehensive national Early Warning System to detect potential catastrophic environmental threats to forests. This tool complements and focuses the efforts of existing forest monitoring programs, providing savings in both time and costs. ForWarn employs satellite imaging to help society address national and regional forest health issues and their impacts. It utilizes a web-based mapping tool, the Forest Change Assessment Viewer, available on-line using any internet browser, that allows users to view current and archived ForWarn satellite-based forest change products that are refreshed every 8 days, as well as other near real-time maps and tools to help interpret new forest disturbances and to create and share custom maps. The forest health management community can freely access both current and historical ForWarn



national forest disturbance maps on-line to assess potential forest disturbances for any particular location across the country, and can check the latest ForWarn products as soon as they are available. This diverse community is responsible for forest health monitoring and protection, and includes employees of multiple federal, state, and local government agencies as well as members of academia, private forest owners, and the general public. See <http://forwarn.forestthreats.org>. Southern Research Station, Asheville, NC

Photo: A ForWarn map uses satellite imaging to track potential forest disturbances in the Texas area.

Partnership with the North Carolina Museum of Natural Science

The Southern Research Station (SRS) is partnering with the North Carolina Museum of Natural Sciences' Nature Research Center. At the new 80,000-square-foot wing in Raleigh, NC, SRS researchers will interact with domestic and international audiences and potentially reach more than a million multicultural school-aged children. The partnership will provide a platform for SRS scientists to share the research behind contemporary issues such as forest threats, water quality and quantity, and fire and emphasize how forests positively impact societal concerns. The collaborative effort will help demystify forest research and inspire a new generation of young scientists. See <http://naturesearch.org>. Southern Research Station, Asheville, NC

WaSSI – Water Supply Stress Index Model

Eastern Forest Environmental Threat Assessment Center scientists based in Raleigh on the Campus of North Carolina State University have developed a web-based planning tool called the Water Supply Stress Index (WaSSI) model. This easy-to-use model allows the user to generate forecast maps of how climate, land use, and human population change may impact water availability for people and ecosystems across the lower 48 United States based on their model input selections. WaSSI can also be used to predict increased forest productivity and carbon sequestration, which can reduce water availability for irrigation, commercial and residential uses out to the year 2100. Simulation results are available as downloadable graphs and data files that users can apply to their unique information and project needs. See <http://www.wassi.sgcp.ncsu.edu>. Southern Research Station, Asheville, NC

US Forest Service's Invasive Plant iPhone App Identifies Nonnative Plants



Photo: The “Invasive Plants in Southern Forests: Identification and Management” iPhone App is currently available for download through iTunes.

U.S. Forest Service research and funding have led to the development of a free software application that will help people identify and control destructive invasive plants in Southern forests and grasslands. Development of the application is part of the Forest Service's multi-faceted strategy to reduce the impact of nonnative species—animals, pathogens and plants. These foreign invaders deplete water supplies, poison wildlife and livestock, and damage property in urban and rural areas at a cost of about \$138 billion annually. Cogongrass, nonnative privets, Autumn Olive and Tallow Tree are among the most common plants plaguing the South. The “Invasive Plants in Southern Forests: Identification and Management” application is currently only compatible with Apple products—iPad, iPhone and iPod Touch—and is available through iTunes. The software provides photos and information that allow users to identify the 56 nonnative plants and plant groups currently invading the forests of the 13 Southern states. Versions for other operating systems are being explored. A grant from the Southern Research Station funded the application, which was developed by the University of Georgia Center for Invasive Species and Ecosystem Health. The software is based on Southern Research Station field and management invasive plant guides. Like the guides, the app divides invasive plants into trees, shrubs, vines, grasses, ferns and forbs and provides identification keys, photos and management recommendations. App users also get simple, on-the-spot options for treating invasive plants. The app is expected to inform many more people about the impact of invasive plants and get them involved in eradication efforts. *Southern Research Station, Asheville, NC*

Changing Roles Professional Development Materials

As populations and urbanization expand in the southern United States, human influences on forests and other natural areas are increasing. As a result, natural resource professionals are faced with complex challenges, such as managing smaller forest parcels for multiple benefits, but often do not possess the skills or tools to meet these new challenges. The U.S. Forest Service Changing Roles Professional Development Program provides state and federal natural resource agencies, as well as other organizations in the southern United States and nationwide, a set of resources to address these new challenges. The program originally consisted of four modules: (1) wildland urban interface issues and connections, (2) managing interface forests, (3) land-use planning and policy, and (4) communicating with interface residents and leaders. InterfaceSouth is developing a new module on emerging issues that consists of fact sheets, exercises, and case studies. Sixteen fact sheets address topics such as climate change, ecosystem services, firewood movement, interface entrepreneurs, succession planning, social media, and environmental justice. Five case studies address topics such as community-based forest management and interface entrepreneurs. Six species briefs were developed to supplement the firewood movement fact sheets, providing information on invasive pests transported in firewood. Additional fact sheets, exercises, and case studies are being developed on topics such as social media, partnerships, and outdoor benefits for kids. The materials are available on-line at <http://www.interfacesouth.org>. *Southern Research Station, Asheville, NC*

Southern Pine Beetle Book

The Southern Pine Beetle is the most destructive forest pest in the southern United States, causing more than \$60 million in damage and lost timber income annually. The most recent outbreak of the insect (1999 - 2003) caused over \$1.5 billion in damages across eight states. Changes in forests from tree death caused by the beetles can impact water supplies from forested watersheds as well as wildlife habitat. Edited by Southern Research Station (SRS) Assistant Director for Research Kier Klepzig and Texas A&M University Professor Robert Coulson, *Southern Pine Beetle II* updates the first synthesis published in 1980 by SRS researcher Robert Thatcher and others and proceedings from an integrated pest management research symposium published in 1985. *Southern Pine Beetle II* consists of five basic sections covering ecology, impact, silviculture and management, treatment tactics and strategies, and integrated pest management. The book is intended for managers, researchers, educators, students, and the interested public. Visit <http://www.srs.fs.usda.gov/pubs/39017> to view or download the book online. *Southern Research Station, Asheville, NC*

Research Leads to Conservation Capitalism Restoration Project

Building on an innovative forest restoration approach developed to an operational scale by the U.S. Forest Service Southern Research Station's Center for Bottomland Hardwoods Research (CBHR), GreenTrees—the conservation arm of C2I, a project development and management company that uses energy assets for ecological purposes—works with private landowners to restore forests in the Mississippi Alluvial Valley (MAV) and deliver carbon credits to corporations.

Conventional bottomland hardwood forest restoration practices are inherently slow developing, with economic returns from traditional forest products such as timber and nontraditional benefits such as carbon sequestration and forested wildlife habitat being realized several decades following the restoration investment. The CBHR, in collaboration with several cooperators including the U.S. Fish and Wildlife Service, the USDA Natural Resources Conservation Service, Mississippi State University, the National Council for Air and Stream Improvement, and Crown Vantage Corporation, developed a forest restoration system that involves interplanting rapidly growing eastern cottonwood with other slower growing hardwoods such as Nuttall oak. This cottonwood-interplanting system provides the private landowner with a forest restoration practice designed to quickly develop a forest environment with considerable enhancement of carbon sequestration, forested wildlife habitat, and initiation of natural ecosystem recovery processes over the conventional forest restoration method. Furthermore, the cottonwood-interplanting system enables the private landowner to receive returns on the restoration investment decades before financial returns would be possible under the conventional restoration method.

GreenTrees' goals and expectations were met through the implementation of the 302-302 cottonwood-hardwood interplanting practice for private landowners that had its genesis in Forest Service research. GreenTrees is currently two-thirds of the way to realizing its goal of planting 6 million trees over 10 thousand acres in the MAV. The realization of this goal is being made possible through the financial backing of Norfolk Southern, a Class 1 railroad shipping and transportation company, and Duke Energy, one of the largest utility companies in the South, partnering with GreenTrees in a reforestation program designed to offset carbon dioxide. This project demonstrates that conservation capitalism works through the combined contributions of federal researchers, environmental entrepreneurs, and private corporations. *Southern Research Station, Asheville, NC*

FS-NRCS-Extension Partnership Produces Award-Winning Webinars

The U.S. Forest Service Southern Research Station (SRS) and Southern Region partnered with the USDA Natural Resources Conservation Service, Southern Regional Extension Forestry, North Carolina State University (NCSU), Texas AgriLife Extension, and North Carolina A&T State University to produce webinars through the Forestry and Natural Resources Webinar Portal.

In 2012, 184 people participated in the SRS webinar about special forest products. Participants who planned to adopt the knowledge said the impact could affect 60,086 acres. Eighty-seven people participated in the Template for Assessing Climate Change Impacts and Management Options webinar, presented by SRS and NCSU. The potential area impacted totaled 4,325,412 acres. SRS and The American Chestnut Foundation presented a webinar on the restoration of the American chestnut that drew 217 participants. Participants indicated the knowledge gained could potentially impact 29,645 acres.

These webinars draw participants from across the country and around the world. The Society of American Foresters and the International Society of Arboriculture award continuing education credit for live and archived webinars. Additionally, attendance at these distance learning courses prevents the production of carbon dioxide since attendees do not have to drive to a similar program offered at a university. Participation results in travel and salary cost savings, and targeted outreach efforts enable the SRS to reach diverse audiences. The webinar team received the 2011 Chiefs' Award for Group Partnerships. SRS also completed a Webinar Resource Guide to help others produce successful webinars. *Southern Research Station, Asheville, NC*

Guidebook Provides Foundation for Adapting to Climate Change in National Forests



Photo: The guidebook Responding to Climate Change in National Forests: A Guidebook for Developing Adaptation Options is available through the Pacific Northwest Research Station.

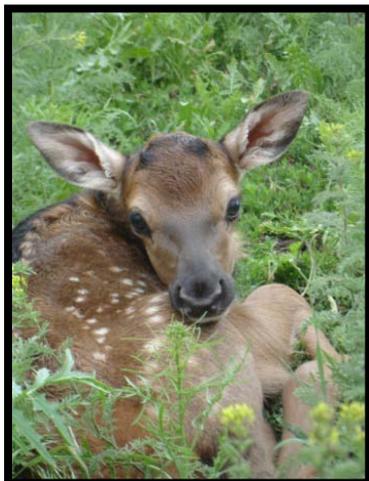
This new guidebook is being used throughout the National Forest System and by other federal agencies and institutions to develop options for adapting to climate change. It is the basis for adaptation principles and applications cited in the forest sector technical report for the 2013 U.S. Global Change Research Program National Climate Assessment.

It was developed through partnership with scientists and local resource managers and provides a scientific foundation and framework for preparing for climate change in U.S. national forests. Adaptation to climate change will be successful only if it can be fully implemented in established planning processes and other operational aspects of national forest management. Tools and processes such as vulnerability assessments and adaptation planning that have been tested in national forests are described in detail, along with examples and scientific documentation. *Pacific Northwest Research Station, Portland OR*

West Elk Nutrition and Habitat Models

Photo: The nutrition and habitat models developed by the Forest Service assist wildlife management services in caring for the region's elk population.

Forest Service scientists recently developed new nutrition and habitat selection models for elk in Western Oregon and Washington. Since the release of the models, a variety of users have applied the models within the Pacific Northwest region:



- The Willamette National Forest is using the models to estimate improvements in elk nutrition under various thinning scenarios.
- The Siuslaw National Forest is using the models to evaluate changes in habitat use by elk for a proposed restoration project on the Central Coast Ranger District.
- Washington Department of Fish and Wildlife is using the models to evaluate habitat conditions for elk across game management units in western Washington.
- The Lower Elwha-Klallam Tribe is using the models to assess impacts of various management activities on elk habitat use and nutrition.

The modeling team continues to offer training in model use, including for tribal biologists from the Makah Nation and Lower-Elwha Klallam, Washington Department of Fish and Wildlife, and the FS Pacific Northwest Region. To further assist in technical transfer of the model, the Pacific Northwest Research Station has designated a staff biologist to work with model users as needed to implement the models. *Pacific Northwest Research Station, Portland OR*

DNA Sequencing Technique for Plants May Improve Pre-Natal Care for Humans

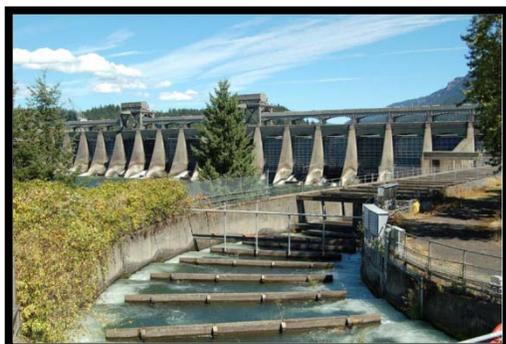
In 2008, Pacific Northwest Research Station geneticists developed “multiplexed massively parallel sequencing”, a DNA sequencing technique that adds unique molecular tags to samples and enables cost-effective, high-throughput genome sequencing. Originally developed for forest and range plants, the method has been widely adopted for evaluating genetic variation in mammals of conservation concern, such as western fisher and sperm whales. The method has also been adapted to human clinical genomics, providing a noninvasive alternative to amniocentesis for fetal trisomy screening.

Pacific Northwest Research Station, Portland OR

New Tool Used to Prioritize 20,000 Annual Requests for Repairs to Infrastructure

New decision-support technology developed by Forest Service scientists and collaborators is helping the U.S. Army Corps of Engineers (USACE) streamline and optimize budget-allocation decisions. The USACE has seven major business lines that manage about \$800 billion in infrastructure across the United States including dams, reservoirs, levees, coastal-protection structures, canals and locks, and recreation areas. USACE headquarters annually receives about 20,000 funding requests from its field units to

maintain, repair, or construct infrastructure. In recent years, the annual budget expenditure for infrastructure maintenance has been about \$5 billion. Prior to having this new decision-support technology, USACE business line managers manually sifted through thousands of lines of spreadsheet reports to develop the USACE's annual budget allocation to projects. This budget-allocation process lacked a rational, transparent, and repeatable process for managing this \$5 billion annual investment. The new decision-support tool expedites the process of assembling and analyzing alternative budget



portfolios, and explicitly considers value to the nation of infrastructure condition and Presidential direction to the USACE on national goals such as energy independence, economic competitiveness, and jobs. *Pacific Northwest Research Station, Portland OR*

Photo: The Bonneville Dam on the Columbia River between Washington and Oregon is managed by the U.S. Army Corps of Engineers. It provides safe passage to migratory fish via its fish ladders while generating hydroelectric power for the Northwest.

Smoke Modeling Helps Protect Public Health



Photo: Emergency workers convene at the High Park Fire, west of Fort Collins, CO.

Forest Service scientists provided customized smoke projections and analyses that guided public health outreach during major wildfires. The smoke from these fires creates a significant public health challenge because of unhealthy air quality conditions and reduced visibility in transportation corridors. These data and expert analyses were used by incident management teams and by the Environmental

Protection Agency for use in Exceptional Events assessments, and were disseminated to state and local air quality agencies in the areas affected by the fires. The scientists provided custom modeling for the High Park Fire west of Fort Collins, Colorado. As new fires started, they adopted a regional focus and provided smoke dispersion projections for fires burning in Colorado, Wyoming, and Utah. They provided similar support for the Halstead Fire in Idaho, wildfires in eastern Washington, and all the wildfires burning in northern California in 2012. *Pacific Northwest Research Station, Portland OR*

New Techniques Improve National Emissions Inventory for Wildland Fire

Created every three years, the Environmental Protection Agency's National Emissions Inventory forms the basis of regulatory modeling and numerous other studies, including global climate change greenhouse gas reports, regulatory policy decisions, and state and federal implementation plans. Forest Service scientists worked with numerous stakeholders including federal agencies, regional planning organizations, state agencies, air quality regulators, and the EPA, to significantly improve the national emissions inventory for wildland fire. The inventory now significantly improves overall estimates of fire size, fuel loading, fuel consumption, and emissions by utilizing additional data sets and a new methodology for

combining and reconciling disparate datasets into a unified data stream. The EPA is using these new techniques to create the next national emissions inventory for wildland fire. The Forest Service Fire and Aviation Management unit has expanded this effort to create a 10-year climatology of wildland fire (both prescribed fire and wildfire). Development of additional techniques is being funded by a research grant from the Joint Fire Sciences Program. *Pacific Northwest Research Station, Portland OR*

New Report Assesses Impact of Climate Change on Forest Diseases

Climate change is projected to have far-reaching environmental impacts both domestically and abroad. A recently published report by the USDA Forest Service's Pacific Southwest Research Station (PSW) examines the impact of climate change on forest diseases and how these pathogens will ultimately affect forest ecosystems in the Western United States and Canada. Drawing on a large body of published research, the report details the effects of eight forest diseases under two climate-change scenarios—warmer and drier conditions, and warmer and wetter conditions. Forest diseases discussed in the report include foliar diseases, Phytophthora diseases (such as sudden oak death), stem rusts, canker diseases, dwarf mistletoes, root diseases, and yellow-cedar decline. The likelihood and consequences of increased damage mortality to forests from each disease as a result of climate change were analyzed and assigned a risk value of high, moderate, or low. The risk value is based on available biological information and subjective judgment. Key findings include the following:

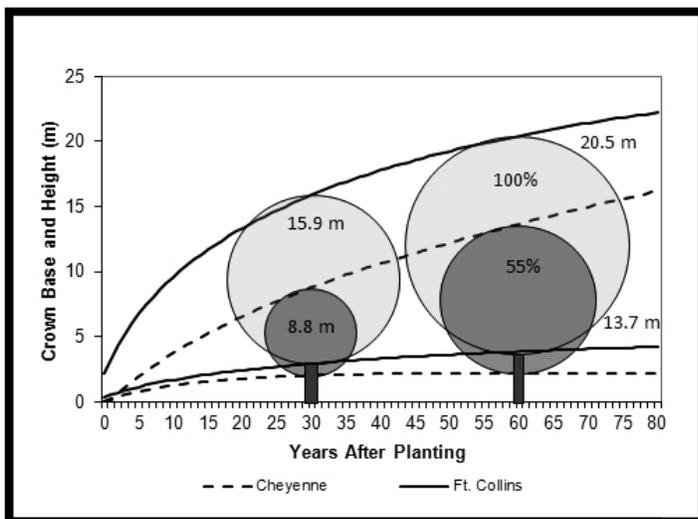
- Armillaria root disease is projected to result in the greatest risk under drought (warmer and drier) conditions. Armillaria is common on conifers and some hardwoods; it lives on tree roots and grows exponentially when a tree becomes stressed. Yellow-cedar decline, Cytospora canker on Aspen and dwarf mistletoes also pose high risk under drought conditions.
- Sudden oak death and other Phytophthora tree diseases are likely to be most damaging under wetter and warmer conditions. These deadly pathogens reproduce and spread quickly under favorable moist and warm conditions.

Although the report suggests that climate change will affect forest health, uncertainty arises exists regarding the degree of climate change that will occur; pathogen biology under changing climate; the effects of changing climate directly on the host; and the interactions between the pathogen, host, and climate. "Tree diseases shape our forests," says Susan Frankel, the report's project leader and a PSW plant pathologist. "This assessment explains fundamental relationships between trees diseases and climate that will help people determine how local conditions may influence tree survival." To read the full report, "A Risk Assessment of Climate Change and the Impact of Forest Diseases on Forest Ecosystems in the Western United States and Canada," go to: http://www.fs.fed.us/psw/publications/documents/psw_gtr236/ This technology was transferred through a public release. *USDA-Forest Service, Pacific Southwest Research Station*

Prevention of Large Wildfires Using the Fire Types Concept

Historically, forest fires have played a significant role in shaping European (most particularly, Mediterranean) forest ecosystems. During the past few decades socio-demographic changes in Mediterranean basin countries have caused changes significantly altering land use patterns. These have resulted in abandonment of large areas, reduction in agricultural crops and reconversion to forest lands. A concomitant resulting change has been an increase in the number, intensity, and size of large fires at the European level. An evidence of this is the number of conflagrations experience in several European

countries recently: Portugal in 2003 and 2006, France 2003, Spain 2006 and 2009, and Greece 2007 and 2009. In response to these events the European Union Commission chartered a fire science research project titled “Fire Paradox” to address the causes and consequences of large fires in Europe and offer potential solutions. The management guidelines highlighted in the booklet *Prevention of Large Wildfires Using the Fire Types Concept* (original in Spanish as *La Prevención de los Grandes Incendios Forestales adaptada el Incendio Tipo*) was developed to provide policy makers and fire managers the necessary tools to better respond to the fire management problem in their regions. This is a detailed guide explaining not



only the reasons for large fires, but also how to combat them and even use them as a tool in the arsenal of fire management tools. This work relates to USDA Goal 2.4, *Reduce Risk from Catastrophic Wildfire...* and the FS Wildland Fire and Fuel SPA by providing managers with information to better allocate firefighting resources over the terrain potentially reducing fire suppression costs. Dr. Armando González-Caban, was member of the international Scientific Steering Committee providing guidance and technical review to the Fire Paradox Project. Work funded by Spain’s National Forest Fire Service, Ministry of Environment, *Forest Service, Pacific Southwest Research Station*

Geocaching the High Tech Adventure Hide and Seek

Research demonstrates the power of a relatively new technology enticing publics to get outdoors and enjoy nature. Although challenge and testing of GPS skills were a major draw, enjoying nature and scenery were key to respondents. Geocaching continues to increase in popularity around the globe, involving more than 197 countries worldwide. FS research along with the University of Minnesota examined the emergence of geocaching as a relatively new technology influencing the form and pace of engagement in outdoor recreation. Initiated in 2000, geocaching now involves caches in over 197 countries. Aiding its popularity are the use of portable technology (GPS units), online communities, and opportunities that can be found locally in outdoor settings. Although challenge and skill testing are part of the adventure offered in geocaching, the draw to diverse age ranges as well as solitary or group participants is to enjoy outdoor scenery and nature. Online support tools and guides aid managers in addressing potential impacts to the natural setting, fulfilling an important need to ensure this enticing form to get Americans outdoors remains available long into the future. The research day-lighted the interest and motivators for geocaching providing important information to managers and the recreation research community. The public benefits from this work through continued outdoor opportunities and the increased opportunities that result when activities and motivations are better understood. For more information please see the following published papers <http://treesearch.fs.fed.us/pubs/40523>; http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs150.pdf
USDA-Forest Service, Pacific Southwest

Urban Tree Growth Modeling - Why Tree Size Matters

Large trees provide more ecosystem services than small trees. However, the science of predicting tree size is hindered by few long-term studies tracking tree growth and a poor understanding of the effects of multiple stressors on health. This research has developed growth equations for urban species throughout the United States and is catalyzing new collaborations between researchers and professionals in the planning and management of high-performing landscapes. Research on urban tree growth is improving the accuracy of models that quantify urban forest function and value. It is helping managers select, locate and manage trees to more effectively cool urban heat islands, conserve energy, filter air pollutants, reduce runoff, sequester carbon and promote human well-being. Greater awareness of tree benefits, increased investment in tree management and more productive urban forests are resulting from this science.

Reference city research has developed more than 1,800 growth equations from measurements on more than 17,000 trees in 16 US cities. In 1998, researchers began measuring 20 of the predominant tree species in Modesto, CA. Field surveys spanned cities in 16 climate zones and took 14 years. For each reference city, researchers produced a “Municipal Forest Resource Assessment” that quantified annual benefits and costs. A “Community Tree Guide” and “Trees Pay Us Back” brochure were produced for each of the 16 regions. Their information on the 40-year benefits and costs of typical large, medium and small trees has been widely used to show the value of healthy trees. For example, tree groups use these data for “price tags” attached to legacy trees that display the dollar value of ecosystem services produced. This tree growth research is central to many computer models used in urban forestry, such as i-Tree Streets and Design, National Tree Benefit Calculator and Open Source Map. Other scientists are using these tree growth data and the benefit-cost calculations it underpins in their analyses of the cost-effectiveness of emerald ash borer treatments, green infrastructure practices and climate adaptation measures. The tree growth database will be completed in 2013 and serve as a valuable source of information that reflects regional differences in species composition, climate, soils, site conditions, and management practices.

In 2011 the FS principal investigator was instrumental in establishing the International Society of Arboriculture’s first working group on Urban Tree Growth & Longevity. As Chair, he convened The Urban Tree Growth and Longevity Conference held on September 12-13, 2011 at The Morton Arboretum in Lisle, IL, and a year later, the Urban Tree Monitoring Symposium held in Portland, OR. These international conferences brought together researchers and practitioners to discuss the current state of knowledge concerning urban tree growth and monitoring. Two special issues of the *Journal of Arboriculture & Urban Forestry* contain papers presented at the conference.

Partners/Collaborators: WO S&PF, U&CF, UC Davis Dept. of Land, Air, and Water Resources, Local Government Commission, State and municipal foresters throughout the US, International Society of Arboriculture, Arboricultural Research and Education Academy. *USDA-Forest Service, Pacific Southwest Research Station*

Innovative pest prevention: Apply food processing hygiene techniques to nurseries

Forest pathogens, like the fungus that causes sudden oak death, can spread from nursery plants into the wild. Quarantines that rely on inspection are not completely effective at preventing pathogen transport, so innovative approaches are needed to prevent pathogens from hitch-hiking on nursery stock.

To prevent pest movement via commercial nursery stock, researchers tested a systems approach for horticultural nurseries modeled after Hazard Analysis of Critical Control Points (HACCP), widely used in the food processing industry. This systems approach for analyzing and correcting unsafe practices offers an alternative strategy for preventing plant contamination that could be broadly applied to many pests and pathogens in a wide range of nurseries and growing conditions.

Horticultural nurseries are complicated growing systems, which present formidable challenges to management of diseases and pests. Moreover, nursery plants shipped interstate and internationally can serve as important vectors for pathogens and pests that threaten both agriculture and forestry. Current regulatory strategies to prevent the movement of pathogens and pests with nursery plants are based on visual inspections of plants just before shipping, a process that is costly and inadequate.

Researchers in Oregon propose a systems approach for horticultural nurseries modeled after HACCP. They evaluated each step in propagation to analyze contamination hazards by a common forest and nursery pathogen (*Phytophthora* species) and then implemented management practices to eliminate the pathogen at each growth stage. The systems approach for analyzing and correcting unsafe practices offers an alternative strategy to prevent plant contamination that could be applied to many pests and pathogens in diverse growing environments to thereby prevent pathogens from spreading to new areas.

Research partners: Oregon State University, USDA Agricultural Research Service, The Nature Conservancy; Publication Link: <http://www.treesearch.fs.fed.us/pubs/41236>; *USDA-Forest Service, Pacific Southwest Research Station*

Estimating Habitat Value Using Forest Inventory and Analysis (FIA) data

A standard forest inventory tool helps public and private land managers understand the effect of forest management on the resting habitat of an imperiled carnivore, the fisher (*Martes pennanti*), using a standard forest inventory tool.

Wildlife species use habitat at various scales. Often the most difficult to assess and monitor over large areas is microhabitat use associated with resting locations. Because these are critical to the conservation of the fisher, a rare forest carnivore, forest managers require quantitative tools to monitor resting conditions over time. Forest Service researchers developed a predictive model that, linked to Forest Inventory and Analysis (FIA) plot data, characterizes the value of resting habitat across large regions in northwestern California such that the effect of forest management, and other forms of disturbance, can be quantitatively evaluated.

Researchers developed a regionally specific model describing habitat selection that can be linked to an institutional forest inventory program to assess and monitor habitat for a key wildlife species in northwestern California, the fisher (*Martes pennanti*). They developed the model by comparing vegetation data at 99 randomly selected fisher resting structures on public and tribal lands with 883 FIA plots within the same ecoregion. A total of 58 alternative vegetation models were specified, and a high-performing, five-variable model (canopy closure, tree age, total basal area, volume of “large” wood and basal area of hardwoods) was chosen because it included the fewest variables and only those that could be affected by management. The model indicates that small trees appear to be less important (compared to southern Sierra Nevada) and therefore the probability of producing high-value resting habitat without

higher fire risk is greater. Together, the Sierra Nevada and northwestern California models provide managers in California a quantitative method to assess and monitor resting habitat suitability using current and future data that are part of an institutionally supported program to inventory forest vegetation. *USDA-Forest Service, Pacific Southwest Research Station*

Do Insects Visit and Pollinate Tanoak Flowers? A Potential Undocumented Casualty of Sudden Oak Death

Tanoak flowers are visited by a range of insects which is key knowledge for informed conservation of the species. Premise: Tanoaks (*Notholithocarpus densiflorus*) are highly susceptible to Sudden Oak Death (SOD). However, little is known about the basic ecology of the species. Are tanoak flowers insect- or wind- pollinated? Floral observations were conducted by citizen scientist volunteers at three different sites in the Midpeninsula Regional Open Space District lands in the Coast Range of California in 2009. The citizen scientists observed 148 insect visitors to tanoak flowers over 11.5 hours of observation (in 65 observation periods).

The data here show that tanoak flowers are visited by insects. This information, along with a parallel pollinator exclusion study conducted by Richard Dodd at UC Berkeley, suggests that tanoak flowers are predominately insect pollinated but that some level of wind pollination is likely.

Significance: Tanoaks are being decimated by SOD. Here we show that there is a diverse community of insects visiting tanoak flowers. These insects may be dependent on tanoak as a food source and are therefore also at risk due to the loss of trees from SOD. Secondly, tanoak conservation is dependent on understanding the basic ecological genetics of the species. Pollination biology influences the size of local genetic neighborhoods and hence defines conservation priorities.

The results were presented at the Sudden Oak Death Science Symposium in June 2012 during a special session on Tanoaks. The proceedings for that session will be in a peer-reviewed special edition of *Madrono*. J. Wright is the first author of that paper, which includes data from the flower observations along with Richard Dodd's pollinator exclusion study. J. Wright was awarded the national "Excellence in Pollinator Management" award in 2012 by the USDA-FS for this project. *USDA-Forest Service, Pacific Southwest Research Station*

Mitigating Impacts of Wind Energy Development on Populations of Migratory Bats



Bird and bat fatalities at wind energy facilities are a common occurrence. Although changes in facility siting and turbine design have reduced bird deaths, bat activity and migration is still poorly understood and casualties remain high. Bat activity depends on time of year and a number of environmental conditions, such as wind direction and speed, air temperature, and moon phase. PSW scientists developed a new interactive tool that allows users to visualize how changes in date and weather conditions affect the probability of bats being present near

wind energy facilities. They used data from multiple echolocation detectors at a site near Palm Springs to model weather conditions when bats were present at the site. Use of such models, if integrated into existing computer software in turbines, could help to optimize turbine mitigations such that fewer bats might be killed with minimal disruption of energy production.

Fatalities of migratory bats, many of which use low-frequency (<35 kHz; LowF) echolocation calls, have become a primary environmental concern associated with wind energy development. Accordingly, strategies to improve compatibility between wind energy development and conservation of bat populations are needed. Researchers combined results of continuous echolocation and meteorological monitoring to model conditions that explained presence of LowF bats at a wind energy facility in southern California. They used a site occupancy approach to model nightly LowF bat presence while accounting for variation in detection probability among echolocation detector heights. Detectors at 22 and 52 m had greater detection probabilities for LowF bats than detectors at 2 m above ground. Occupancy of LowF bats was associated with lower nightly wind speeds and higher temperatures. Nevertheless, researchers found that building separate models for each season and with multiple covariates resulted in better fitting models. They suggest that use of multiple environmental variables to predict bat presence could improve efficiency of turbine operational mitigations (e.g., changes to cut-in speeds) over those based solely on wind speed. If mitigation efficiencies are increased, it could increase their use at wind energy facilities, with benefits to bat populations. Collaborators: California Energy Commission, Public Interest Energy Research Program, Iberdrola Renewables, Bat Conservation International; Publication: <http://tresearch.fs.fed.us/pubs/3960>. *USDA-Forest Service, Pacific Southwest Research Station*

Landbird Monitoring Network of the Americas (LaMNA)

With an increasing focus on global-scale environmental issues, there is an urgent need to address large-scale issues for landbird populations, such as life histories, migration patterns, and population trends, among others, that cannot be accomplished on the scale of individual projects. A wealth of data from projects are lost on a yearly basis that can inform these analyses, especially long-term trends in bird populations. These data need to be retrieved and archived for future generations. PSW-Arcata (PSW-A) has joined with other governmental agencies, organizations, and individuals in the Western Hemisphere to create the Landbird Monitoring Network of the Americas (<http://www.klamathbird.org/lamna/>). LaMNA is actively working to archive banding and census data, bringing together scientists and database experts from the Avian Knowledge Network, Cornell Laboratory of Ornithology, PBRO Conservation Sciences, Klamath Bird Observatory, and PSW-A. LaMNA currently has archived almost 4 million records of capture and census data from 60 cooperators in North and South America. About 40% of those data are available online for researchers to access and query over web-based applications. LaMNA works to increase communication between researchers through regular newsletters and web page, as well as facilitating large-scale studies between multiple researchers. Collaborators: Klamath Bird Observatory, UCLA's Center for Tropical Research, Institute for Bird Populations, Avian Knowledge Network, Cornell Laboratory of Ornithology, PBRO Conservation Sciences. *USDA-Forest Service, Pacific Southwest Research Station*

Biocontrol of Strawberry Guava

Hawaii Department of Agriculture and USDA Forest Service conducted the first field release of a biocontrol agent for strawberry guava in Hawaii beginning in December 2011. Releases to build populations of the biocontrol agent have continued at two Hawaii island demonstration sites monitored by PSW research entomologist Tracy Johnson. The highly host-specific leaf-galling scale insect *Tectococcus ovatus* was imported from its Brazilian native range and studied over the past decade to determine its suitability for introduction to manage strawberry guava, a widespread and devastating invader of native rainforests. Initial establishment of galls in the field has been slowed by unusually cool temperatures, but gall development has increased rapidly with the onset of summer. Potentially reproductive galls appeared in July 2012, providing the first indication of a self-sustaining population. These first sites of establishment will serve to demonstrate the specificity and impact of the agent and will be used to initiate further releases in native forests, where biocontrol is intended to slow the spread of strawberry guava and complement other approaches for long-term management. Collaborators: Hawaii Department of Agriculture, University of Hawaii, Hawaii Department of Land and Natural Resources. *USDA-Forest Service, Pacific Southwest Research Station*

Managing Sierra Nevada Forests for Fishers and Martens

There has been widespread interest in applying new forest practices based on U.S. Forest Service General Technical Report 220 “An ecosystem management strategy for Sierran mixed-conifer forests,” especially as it relates to sensitive wildlife species. The distributions of American martens and fishers in the Sierra Nevada and Southern Cascade region have decreased, and both species are expected to suffer additional habitat loss under changing climatic conditions. Resting and denning structures are likely the most limiting habitat elements for fishers and martens, and understanding resting habitat characteristics may be particularly important for conserving both species. High canopy cover and large trees and snags are important components in both fisher and marten resting habitat. Results suggest a minimum canopy cover target of approximately 60% for fishers and 30% for martens. Both species select sites characterized by complex vertical and horizontal structure. Recent findings support recommendations for focusing habitat management for fishers and martens in areas where fire would have burned less frequently historically, such as north-facing slopes, canyon bottoms, and riparian areas. Two new analysis tools may be helpful for predicting management impacts on fisher populations. One tool allows the quantitative evaluation of proposed treatments on fisher resting habitat using Forest Inventory and Analysis data. A second analysis tool uses growth and disturbance models, combined with landscape trajectory analysis, to provide a visual, intuitive representation of the predicted risk of potential management actions on fisher habitat at the home range scale. *USDA-Forest Service, Pacific Southwest Research Station*

Developing Resources for Understanding Wood Development in Forest Trees

Methods and tactics were established for more cost-effective and scientifically rigorous means for understanding the biological processes underlying how trees create woody tissues and how these processes can be modified for diverse applications. Understanding how wood development is regulated at the genetic level is central to our basic understanding of tree biology and is also the focus of research

aimed at tailoring wood development to address problems related to forest health and productivity, biofuel feedstock development, and industrial forestry. To date this research has primarily been undertaken through studies of individual species. A more effective approach is now enabled by new genomic and DNA sequencing technologies, in which genetic regulation of wood development can be undertaken simultaneously in numerous species of interest, using comparative genomics technologies. The PSW co-organized an NSF-sponsored meeting at Duke University and NESCent, which brought together an international group of researchers to establish foundational methods for comparative genomics of trees and wood development. One need identified was access to plant material from diverse species, which was highlighted by a subsequent publication in *Frontiers in Plant Science*. Another need identified was the development of a controlled vocabulary enabling searches and analyses across genomics databases. The establishment of this vocabulary was established at a meeting of researchers at the New York Botanical Garden, sponsored by NSF, in which the terms to be used and their definitions were established and included in the Plant Ontology database. Collaborators: Connecticut College, Harvard University, Leiden University (Netherlands), New York Botanical Garden, Oregon State University, University of California Davis. *USDA-Forest Service, Pacific Southwest Research Station*

California Golden Trout and Stream Temperatures

Climate warming and increased water temperatures will exacerbate the plight of aquatic organisms already inhabiting stressed habitats, such as the California golden trout (CGT) and their cattle-degraded streams. In 2012 significant progress was made on the National Fish and Wildlife Foundation funded research project (FS Strategic Goal Wildlife and Fish) characterizing the water temperature, dissolved oxygen, and solar shading of the CGT's native habitat in the high-elevation meadows of the Golden Trout Wilderness; this research project (FS Strategic Goal Wildlife and Fish), funded by the National Fish and Wildlife Foundation, will also assess whether golden trout habitat is resilient to future climate warming. The information is crucial in determining if water temperatures and shading are already stressful for golden trout and whether it can withstand future climate warming. The results will also be useful for the Inyo National Forest grazing management plans currently being written and for the Conservation Strategy for the imperiled trout. Preliminary results indicate that many stream areas are experiencing high water temperatures (>25°C), low dissolved oxygen (<6.0 mg/l), and low streamside shading (5%), indications that golden trout habitat will not be resilient to further warming from climate change. Restoring vulnerable streamside areas and managing cattle grazing could increase stream shading and reduce water temperatures. Important partners include Inyo National Forest, California Department of Fish & Game, Western Watershed Alliance, Sierra Pacific Fly Fishers, and Mountains Restoration Trust. *USDA-Forest Service, Pacific Southwest Research Station*

Effects of Passage Barriers on Demographics and Stability of Trout Populations

Loss of habitat connectivity in stream networks can create problems for the persistence of valuable populations of aquatic animals. This research used a spatially explicit, individual-based model of a stream network to examine habitat fragmentation effects on the persistence of trout population. The results provide a framework for, and illustrate the value of, prioritizing efforts to restore the connectivity of stream networks. Resource managers need tools to identify and prioritize actions. Although substantial resources are being spent on restoring connectivity of stream networks, it is clear that better priority setting would increase the efficiency of the effort. Using a spatially explicit model of a northwestern

California watershed, this research (published in 2012) established a framework to better understand the effects of barriers on fish populations and identify those of greatest significance to population size and persistence. The novel modeling approach arose from a collaborative effort including PSW researchers. The approach has been used to address a variety of key management issues, including cumulative effects analysis, the effects of streamflow diversions on fish populations, prediction of habitat restoration outcomes, and the effects of water quality on fish populations. Collaborators: S.F. Railsback, Humboldt State University Department of Mathematics. *USDA-Forest Service, Pacific Southwest Research Station*



Pacific Fire Exchange - The Hottest Partnership in the Pacific

Despite an urgent need for detailed, relevant and accessible information, the Pacific region is generally underrepresented in regionally specific fire science information and technology. The Pacific Fire Exchange was recently formed and funded to address this need for a collaborative and regionally specific approach toward effective fire prevention, mitigation, and management, and to stimulate and utilize “best available” research to reduce wildfire management costs and enhance our ability to effectively protect natural, cultural, and community resources from wildfire devastation.

Although initial efforts have made significant progress in understanding fire dynamics, ecological impacts, and fuels mitigation in the Pacific region, the need for additional region-specific fire research is growing. To maximize the value of this next generation of fire science, effective communication and bidirectional information transfer must be expanded and formalized so that future research is guided by manager needs, and knowledge and tools gained from the science are efficiently transferred back to end-users. The Pacific Fire Exchange (PFE) is working to develop a means of transferring knowledge among scientists, resource managers, decision-makers, fire suppression agencies, and communities in Hawaii and the U.S. affiliated Pacific through the following initial deliverables: PFE website, calendar of Pacific-based wildfire-related trainings, searchable bibliography of journal articles relevant to the region, wildfire-focused decision support tools, support of a wildfire-management-focused outreach liaison, and the creation and hiring of a fire-science-focused University of Hawaii Extension Specialist position. The PFE is part of the national network of Joint Fire Science Program Knowledge Exchange Consortia. *USDA-Forest Service, Pacific Southwest Research Station*

The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawaii

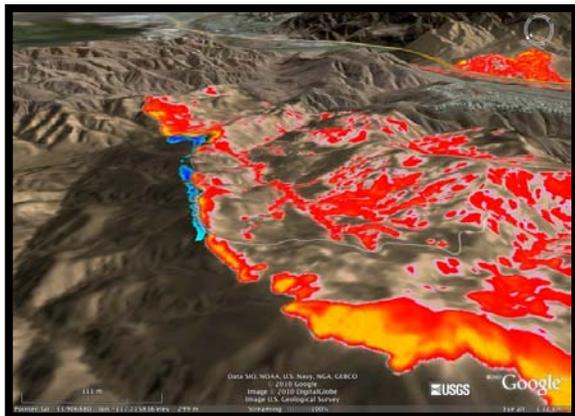
Tropical dry forest landscapes on military lands in the Pacific are declining at alarming rates, largely a result of fire that originates with invasion of native ecosystems by fire-prone invasive grasses and shrubs. These novel fire regimes have serious impacts to cultural and natural resources and the health and safety of the region’s citizens. Scientifically based tools developed to strategically inform natural resource management may be the most cost-effective approach to protect and restore native biodiversity and

reduce fuel loads, fire danger, and fire impacts while also controlling invasive species establishment and spread. Researchers have combined newly developed remotely sensed information with field-based studies on the Island of Hawaii to (1) define the current condition and historical changes to tropical dry forests, (2) develop technology for restoration planning and ecosystem monitoring, (3) quantify restoration potential and develop restoration prescriptions for remnant dryland ecosystems, and (4) develop effective fire risk reduction measures that protect forest fragments and initiate succession of degraded grasslands into native woody communities. Remotely sensed data have provided insights on historical dryland communities; aerial photography analysis indicate forest change over time; high-resolution ecosystem mapping has informed natural resource management planning efforts; and near-real-time web-based satellite monitoring provides land managers an effective tool to evaluate fire danger. Field-based methods address the potential for restoration of native species to alter ecosystem structure to reduce fuel loads and fire danger, the major barriers to restoration across remnant native community types, and to test the effectiveness of a firebreak design that incorporates traditional fuel-breaks grading into “greenstrips” planted with fire-resistant native species. Results from this project benefit the military mission in the Pacific by increasing capacity and knowledge to restore native forests, thereby reducing wildfire and enhancing habitat for threatened and endangered species. *USDA-Forest Service, Pacific Southwest Research Station*

Effects of Hydromulch after Fire on Erosion and Vegetation Recovery

Wildfires make chaparral watersheds susceptible to accelerated erosion, which poses a threat to downslope homes, highways, and other human and natural resource values. Hydromulch (a mixture of fiber and tackifier mixed with water that dries to a crust and can be used where high winds blow straw mulch away) is a fairly high-cost treatment that effectively reduces erosion from most storms during the first and often second years after a fire. Public concerns about negative effects on natural vegetation recovery proved unfounded. Wildfires in the southern California wildland - urban interface threaten lives and property while they burn and then put homes, highways and residents at risk again from accelerated erosion and runoff that occur after fire. Forest Service Burned Area Emergency Response (BAER) teams prescribe treatments, if warranted, to mitigate the risks. Covering bare soil with some kind of mulch is the most effective way to reduce erosion, but high winds typical of fall and winter in southern California blow traditional mulches, such as straw, far away. Hydromulch, a slurry of paper or wood fiber mixed with a tackifier to stick it together and to the ground, has long provided effective protection of roadsides and construction sites, but it is very expensive to apply from aircraft to large expanses of natural land. Researchers from PSW and Rocky Mountain Research Stations assessed the effectiveness and ecological impacts of hydromulch on four burned areas in southern California from 2003 to 2009. Treated hillslopes generally produced less sediment than untreated during the first year after fire, when erosion is greatest; protection continued into the second year at several sites. There was no difference in chaparral vegetation recovery, contrary to public fears about “paving over” the wildlands. Aerial hydromulch can be an effective postfire land treatment where values at risk justify its cost. BAER teams and land managers make use of this information. *USDA-Forest Service, Pacific Southwest Research Station*

Response of Wildland Fires to Aerially Delivered Fire Retardant



Aerial assault on wildland fires with air tankers and fire retardant is a critical and expensive element of modern fire suppression. Yet the practical effects of retardant application on fire behavior have not been critically assessed across the range of conditions encountered in active, large wildfires. The Pacific Southwest Research Station has begun applying its FireMapper remote-sensing system as part of a national study of Aerial Firefighting Use and Effectiveness. Incorporating the FireMapper thermal-imaging radiometer, the airborne system provides the means to not only track the aerial delivery of retardant along fire lines but also to ultimately determine the effects of that retardant on fire

intensity and spread and to improve the effectiveness of retardant applications. In 2012 the FireMapper was flown over active wildfires in Montana, Idaho, and California and recorded retardant applications from Single Engine Air Tankers; P2 and S2 aircraft; Military Aerial Fire-Fighting System (MAFFS) C130 aircraft; and Tanker 910, a DC-10 Very Large Air Tanker (VLAT). The FireMapper radiometer measures upwelling radiation at thermal-infrared wavelengths to map surface temperatures across landscapes and provide quantitative measurements of the temperatures and high rates of energy release associated with wildland fires. Recently applied fire retardant, which is up to 10° C cooler than unburned surroundings, can be differentiated by its shape and appearance in time sequences of images collected by successive flights above the fire and smoke column. This PSW research has potential to improve the effectiveness of fire retardant applications and tactical fire suppression nationally and to minimize negative environmental impacts and expense of retardant by optimizing application tactics and reducing its use in situations of limited or no effectiveness. The research shows the value of remote sensing at thermal-infrared wavelengths for characterizing fire behavior at the full scale of a wildland fire and the ability to detect and monitor fire retardant applications. Outside Collaborator: National Center for Atmospheric Research. *USDA-Forest Service, Pacific Southwest Research Station*

Incorporation of American Indian traditional ecological knowledge and values into understanding Fire Effects on Cultural Resources and Heritage Value



Photo: “What Happened?-Undesired consequences of fire line construction.” Lake serving as a READ working with Karuk Tribe Heritage Consultant Bill Tripp on the 2008 Ukonom Complex-Northwestern California. Excessive falling of culturally important oak trees resulting in damage to tribal food-spiritual values and site archaeological resources. Photo credit: LeRoy Cyr

This research directly benefits American Indians, tribal communities, land/fire managers, and the public who are concerned with protecting cultural and heritage resources from undesired effects of wildland fires and associated management practices. Compiling and incorporating information of archaeological, historical and tribal/public values regarding fire effects increases the Forest Service’s capacity to strategically lessen, mitigate or avoid impacts to cultural resources, preserve or maintain use of

sacred/valued areas or sites, and prevent violations of federal policies pertaining to these resources. The research integrated wildland fire resource advisor experiences working with American Indian tribes and rural communities on fire management planning and suppression operations. The outcome is to understand, categorize, and describe the “values at risks” and more effective methods for addressing cultural and heritage resource concerns with wildland fire management. The concept of Third Order Fire Effects was incorporated and used in the recently released “Wildland Fire In Ecosystems: Effects of Fire on Cultural Resources and Archaeology, RMRS-GTR-42, Vol. 3” regarding the incorporation of tribal traditional ecological knowledge and values in wildland fire management. Additionally, a case study example of “Working with American Indian Tribes on Wildland Fires: Protecting Cultural Heritage Sites in Northwestern California” was published that can serve as a model for other regions nationally, or internationally when working with Indigenous people on wildland fires. This research has been a work in progress for over the past five years. Additional research applications and testing of the effectiveness of this regional case study model to other areas nationally or internationally with regard to the United States’ Wildland Fire Decision Support System are planned. *USDA-Forest Service, Pacific Southwest Research Station*

Science Synthesis for Forest Plan Revision

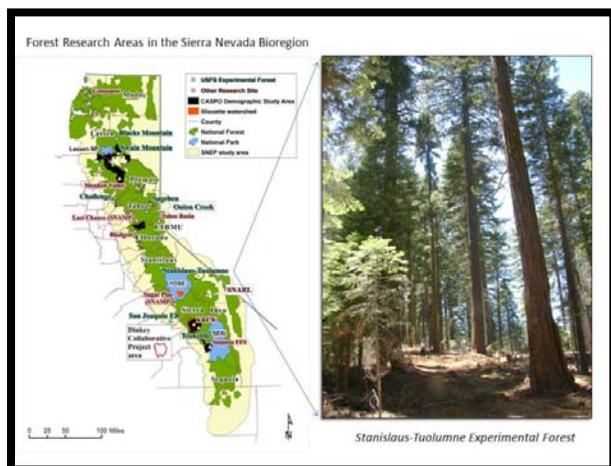


Photo: A variety of research projects have contributed information about management strategies to promote forest resilience, including ongoing research at the Stanislaus-Tuolumne Experimental Forest. Such projects demonstrate a small-scale application of the strategies being addressed through the larger Science Synthesis. Photo by Jonathan Long.

The Pacific Southwest Research Station has led an innovative one-year effort to synthesize and distill recent scientific research to guide revision of land and resource management plans on the National Forests of the Sierra Nevada. This approach

focused on recent advances in scientific understanding to inform landscape-scale management strategies to sustain socio-ecological resilience in the Sierra Nevada bioregion. Highlights of this approach include analysis and design of treatments that (1) reduce the extent of undesirably severe wildfire while avoiding impacts to sensitive species, (2) consider opportunities to promote resilience of local communities, and (3) apply principles of adaptive management to evaluate outcomes. The science team produced an integrated report on strategies to promote long-term socio-ecological resilience in the Sierra Nevada Bioregion in the face of climate change, increases in wildfire severity and extent, demographic changes, and other expected stressors. This research will benefit the National Forests of the Sierra Nevada bioregion, as well as other key stakeholders, including non-governmental organizations from the environmental community and forest products industry who initially requested this synthesis. The synthesis was developed at the behest of the Region 5 planning staff and with involvement by scientists in the Region’s Ecology Program. The report expands upon recent successful PSW station reports by considering more social and economic values as well as a broader range of forest and aquatic ecosystems in the Sierra Nevada. The effort also enlisted scientists from the Pacific Northwest Research Station to address socio-economic issues including ecosystem services and community well-being. With a requirement that the report be completed entirely in 2012, this effort required a series of collaborations to address key scientific challenges in managing landscapes for long-time resilience. Following extensive

internal and external reviews, the final report will be delivered in December 2012 and will be published as a General Technical Report. This research was conducted in collaboration with the University of California Cooperative Extension. *USDA-Forest Service, Pacific Southwest Research Station*

Seasonal Prediction for Fire Danger

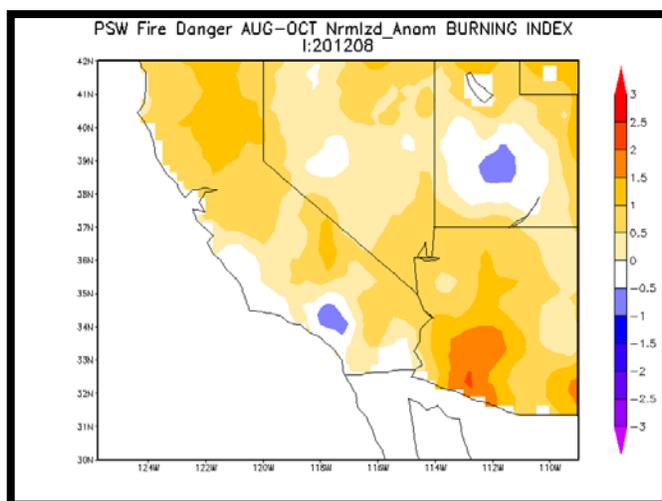


Photo: Seasonal forecast of burning index for August-October, 2012. Northern California and southwestern Arizona show high fire danger with standard deviation one and two times, respectively, above the normal values.

To develop a fire danger predictive capability for wildland fire and fuel treatment managers and communities, in-depth knowledge of the spatial and temporal variability, and hence predictability, of fire weather variables from weather/climate models is essential. In response to the need, FS Research has just signed a Memorandum of Understanding (MOU) with National Oceanic and Atmosphere

Administration (NOAA) in August 2012 addressing collaborative research in weather and climate-related physical fire science. PSW Riverside scientists are taking lead roles in the Mid-Range and Seasonal Fire Weather/Climate Forecasting Group. Their collaborative research will enhance understanding of the predictive skill of fire risk using upstream climate forecasts and thus provide a tool to improve the formulation of forest and wildland management strategies. Researchers will develop a management system that can predict the timing, location and severity of wildfires with sufficient lead time. Such a management tool would require an integrated system with quantified predictions of fire weather variables and a statistical model to empirically associate these variables to fire severity predictions. The experimental downscaled Climate Forecast System (CFS) at National Centers for Environmental Prediction (NCEP/NOAA) predicts weather 7 months into the future over the contiguous United States at 60-km resolution at the beginning of each month. A series of downscaled historical forecasts from January 1980 to the present were also completed to establish model climatology and for statistical fire severity model training. Predicted surface variables of CFS are archived at PSW Riverside for fire danger indices (FDIs) computation every month. Researchers previously found that these FDIs can be skillfully predicted at weekly to seasonal time scales, especially over the U.S. West. They are now developing a monthly to seasonal fire severity forecast, which will be empirically derived from the dynamically predicted FDIs. These experimental products (as Figure) over southern California are published monthly on a website to be used by collaborators. Evaluation of the fire severity forecast skill is underway. The Forest Service collaborated with the National Weather Service/National Center for Environmental Prediction on this technology. *USDA-Forest Service, Pacific Southwest Research Station*

Beetle pheromones save endangered whitebark and limber pines from bark beetles

Researchers dispersed pheromone-releasing flakes into stands of endangered whitebark and limber pines to prevent bark beetles from aggregating on and killing these at-risk pines. The flakes release a behavioral



chemical that convinces the beetles that these are not good host trees in which to reproduce. The flakes can be dispersed into remote, high-elevation stands even when there is snow on the ground, when beetle attack commonly occurs. This research benefits specialists working to protect at-risk tree species in fragile, high-elevation forest ecosystems where whitebark and limber pines grow. Protection of disease-resistant trees is crucial for genetic conservation programs to maintain these trees in the face of white pine blister rust and bark beetle attacks. It benefits public land managers attempting to protect/preserve fragile, high-elevation pine

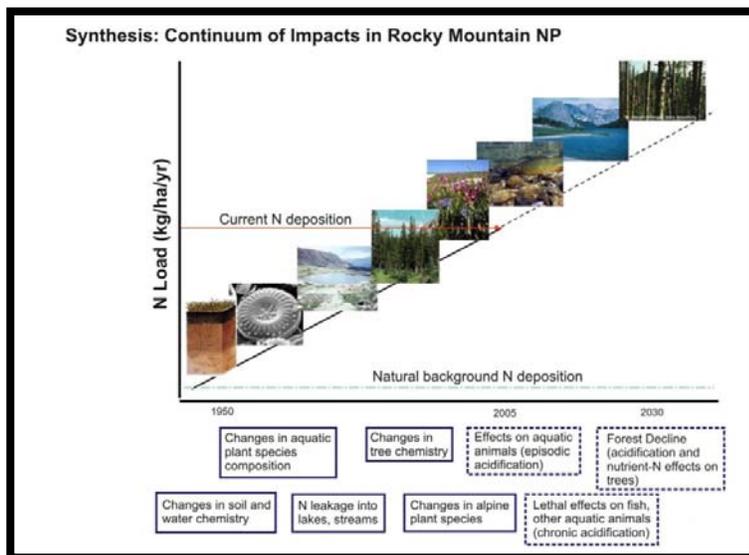
ecosystems that are habitat for Grizzly Bears and Clark's Nutcracker. A pheromone-based approach to prevent bark beetle attacks was developed, thus protecting whitebark and limber pines. The findings provide a nontoxic alternative to insecticides to protect high-elevation pines from bark beetles. The most likely uses are in locations such as campgrounds, administrative sites, ski areas, and rust-resistant stands used for genetic conservation. The research was conducted in Colorado, Montana, Wyoming, and Washington. It will benefit land managers throughout the west where these pines grow. The research involved cooperators from RMRS and PSWRS, FHP entomologists from Regions 1, 4, and 6, and faculty from UC Berkeley and University of Alberta. The research spanned 2005 - 2011, and has been published in peer-reviewed journals, FS GTRs, and popular science articles (Discovery Magazine, SAF's Forestry Notes). The scientists accomplished the research by applying pheromone-releasing flakes in two different approaches: (1) aerial application over large stands and (2) "sticker" applications to individual tree trunks. They compared bark beetle attack in treated stands to that in untreated stands. Protection ranged from 50% to 80%, even for trees baited with the beetle's aggregation pheromone. *USDA-Forest Service, Pacific Southwest Research Station*

Managing Sierra Nevada Forests

All National Forests in the Sierra Nevada now design forest treatments following concepts presented in PSW-GTR-220 "An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests." This publication, a collection of 15 chapters, provides useful examples of implementation, clarifies concepts and summarizes recent relevant science. Forest managers now have the guidance and flexibility to design treatments consistent with GTR 220, a conceptual model of integrated management that has been widely supported across a diverse array of stakeholders. The research directly benefits forest managers and stakeholders in the Sierra Nevada by providing concrete examples of how to implement new management strategies. Resistance to new practices is often centered on notions that the changes are too difficult to implement, costly, and time consuming. The examples and discussions in this collection of papers not only show these concerns to be overstated, but also indicate that collaboration, stakeholder involvement and the pace and scale of treatments have increased using these new methods. Examples are from ongoing, successful projects throughout the Sierra Nevada. Summaries of recent science in the fields of climate change, bark beetles, fire and fuels, and sensitive species habitat are also presented and provide strong scientific support for these new management practices. The 26 authors that contributed information come from three Forest Service Research Stations, the Forest Service Region 5 Office and four National Forests, three Universities, the USGS, and a private stakeholder. New tools were developed to help implement new forest practices, including modifications to analysis in the Forest Vegetation

Simulator (FVS) and landscape analysis tools for ArcGIS. *USDA-Forest Service, Pacific Southwest Research Station*

Air Pollution Thresholds to Protect U.S. Ecosystems



In recent years, recognition of the need to define the critical loads of atmospheric pollution inputs that put natural resources and ecosystem services at risk has grown in the United States. Advances in defining thresholds for acceptable air pollution exposure have greatly increased our capacity to protect and restore at-risk ecosystems. The use of these thresholds applies to toxic, acidic and eutrophication impacts on aquatic and terrestrial ecosystems that are affected by pollutants such as mercury, sulfur and excess nitrogen. This research benefits air quality specialists, land managers, scientists, policymakers and

the U.S. Congress. The critical loads developed in this work are being applied for natural resource protection by the Forest Service, National Park Service and others. Another aspect of this work was a synthesis of empirical critical loads for atmospheric nitrogen deposition effects for major ecoregions of the United States. Included are U.S. maps showing regions where ecosystems are at risk from the harmful effects of nitrogen deposition. A related high-profile report geared for a broad audience was also published on the use of air pollution thresholds in policy and to protect and restore U.S. ecosystems. Scientists and air quality specialists from many U.S. institutions and agencies were involved in these efforts as well as international colleagues. The research took place primarily over the past decade in all major regions of the United States. Air pollution studies in California form an important part of these efforts. A Federally-mandated peer-reviewed report was also submitted to Congress providing an update on the status of pollutant emissions, atmospheric deposition, ecosystem effects, and projections of emissions necessary to prevent future adverse ecosystem effects in the U.S. *USDA-Forest Service, Pacific Southwest Research Station*

7. Food Safety Inspection Service (FSIS)

<http://www.fsis.usda.gov/>

7.1. Mission Statement

The Food Safety and Inspection Service (FSIS) is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged.

7.2. Nature and Structure of Research Program through Partnerships

Although FSIS does not conduct research, through its Research Priorities Review Panel, FSIS routinely identifies research that will facilitate the accomplishment of the Agency's mission in the constantly shifting food safety landscape and prioritizes that research. Current FSIS Research Priorities include developing analytical methods that increase the efficiency of analysis, identifying and understanding emerging hazards (including drug resistant pathogens), identifying and evaluating hazard mitigation techniques (e.g. pathogen interventions), and evaluating the effectiveness of Agency regulations.

As FSIS is not a research funding agency, FSIS addresses its research priorities through partnerships with the USDA Agricultural Research Service, USDA National Institute of Food and Agriculture, the USDA Economic Research Service, FDA Center for Veterinary Medicine, FDA Center for Food Safety and Applied Nutrition, and the Department of Health and Human Services' Centers for Disease Control and Prevention (CDC). Communication of FSIS Research Priorities is facilitated by the annual ARS-FSIS Food Safety meeting (which includes FDA, CDC, EPA, and AMS participation). Additionally, FSIS communicates its research priorities to ARS through quarterly meetings with ARS Food Safety National Program Leaders and by FSIS participation in the ARS Scientific Quality Review Program, the Research Position Evaluation System, and Research Scientist application evaluation. FSIS encourages alignment of FSIS Research Priorities with NIFA-funded research opportunities via meetings with NIFA Food Safety National Program Leaders, FSIS scientist participation in the review of NIFA grant proposals, and FSIS scientist participation on scientific advisory committees for NIFA-funded research. FSIS Scientific Liaisons are charged with communicating FSIS' research priorities to ARS, NIFA, ERS and CDC. FSIS Scientific Liaisons and FSIS management frequently meet with FDA leaders to identify commonalities in the public health issues of concern to each agency.

In addition, the list of FSIS Research Priorities is communicated to other agencies, as well as to our stakeholders, through a posting on the FSIS website. During FY 2012, the FSIS Research Priorities website was accessed on 1,731 occasions. Furthermore, 46 % of the time that individuals accessed the website, they navigated to associated pages for additional information on the FSIS Research Priorities.

7.3. Facilitating Commercialization

By addressing FSIS Research Priorities, researchers can develop analytical methods and products that can lead to commercial products. For example, methods developed by ARS researchers to address FSIS Research Priorities are transferred to and validated by FSIS regulatory laboratories. The resulting official methods provide performance criteria for commercial development of laboratory and field adaptable analytical instrumentation and rapid-analysis kits for use by industry and by FSIS inspection personnel. Official methods also facilitate the commercial development of reagents and supplies.

Applications for proposed innovations to enhance food safety which may or may not require a waiver to a regulation (e.g. new commercial pathogen interventions, process innovations, new ingredient usages) are evaluated by FSIS. If there are no objections, the Agency issues a “no objection” letter, which facilitate the production of FSIS regulated products with enhanced safety. In FY 2012, FSIS issued 128 no objection letters in response to requests by industry.

7.4. Measures of Success (Metrics)

FSIS collaborations with ARS led to the development of methods and technologies that are now broadly used by industry as well as the Agency. One measure of FSIS’ success is its ability to deploy laboratory technologies that allow FSIS to monitor the meat and poultry supply and minimize human exposure to hazards. This permits FSIS to better ensure that US produced meat is safe which helps to maintain consumer demand and access to domestic/international markets for US produced meat. For example, in FY12, FSIS validated and adopted eight new analytical chemistry methods for this purpose. These methods permit FSIS to expand the number of potentially hazardous compounds monitored by the agency and increase the efficiency of monitoring the food supply. One example is the validation and adoption of an ARS developed laboratory method to screen for over fifty compounds in a single sample. This method effectively consolidates at least five separate screening methods while enhancing the quality of the sample data using modern technology.

Similarly, ARS food pathogen research products have been adapted by FSIS, and then industry has stepped in to further develop these applications. For example, during FY12, FSIS validated and adopted a regulatory method which FSIS uses to determine the prevalence of the top 6 Shiga toxin-producing *E. coli* (STEC) in beef. Multiple private entities followed with the introduction of commercial instrumentation and reagents to similarly determine the prevalence of STECs in beef. The USDA ARS is independently comparing the performance of the official FSIS method and those developed by industry.

FSIS also offers technology training in official laboratory methods to countries deemed to have equivalent food safety systems. Finally, FSIS is prominently involved in the development of international standards by its interaction with the Codex Alimentarius Commission, where an FSIS leader is the Chair of the Codex Committee for Food Hygiene.

7.5. Publications and Presentations

As a means of conveying information to its stakeholders, FSIS publishes articles in scientific and trade journals, contributes to book chapters, writes scientific summary documents (white papers), and delivers oral and poster presentations at scientific and trade meetings. A summary of FSIS publications and presentations follows:

abstracts	31
articles	31
chapters	2
letters	4
posters	12
presentations	35
white papers	1

8. Grain Inspection, Packers and Stockyards Administration (GIPSA)

<http://www.gipsa.usda.gov/>

8.1. Mission Statement

To facilitate the marketing of livestock, poultry, meat, cereals, oilseeds, and related agricultural products, and promote fair and competitive trading practices for the overall benefit of consumers and American agriculture.

8.2. Strategic Plan

GIPSA's Strategic Plan serves to ensure fair and transparent markets free from deceptive and fraudulent practices, combined with recognized and reliable descriptors of crop quality and value, to promote economic health and prosperity in American agriculture. U.S. farmers produce a wide variety of agricultural products, and the vast American infrastructure permits these products to be processed and distributed throughout the United States and international markets effectively and efficiently. The markets serviced by GIPSA represent a total economic value of approximately \$170 billion annually with exports contributing over \$28.7 billion to the U.S. economy.

8.3. Nature and Structure of Research Programs

GIPSA maintains a strong presence, domestically and internationally, in the development, evaluation, and implementation of practical grain quality assessment and inspection methods. Our laboratories work with the latest technologies, and through these technologies and our ongoing efforts, we're helping improve the quality of U.S. grain available to the global market. But to enhance the marketing and facilitation of grain into the future, we're also conducting internal research and participating in development and collaborative efforts with other governmental entities, laboratories, and private business. The research and analysis we conduct is in response to clear and widespread market needs. In general, GIPSA research is highly "applied" in that GIPSA's successful projects result in direct and immediate use in the US grain industry. GIPSA also develops written information for customers and stakeholders, including scientific publications, publications in trade journals, and reports to stakeholders.

As agricultural crops evolve and varieties with enhanced traits are developed, reliable tests must be developed to detect and quantify the quality traits important to the market. GIPSA conducts a research program to assess the performance of rapid test kits that are designed for detecting and/or quantifying the presence of mycotoxins in grain or for detecting the presence of specific biotechnology-derived traits in grain to allow test kit manufacturers to make verified claims regarding their products. GIPSA research results in new applications of existing technologies (such as near-infrared spectroscopy and nuclear magnetic resonance) and improvements in those technologies to meet identified market needs for grain quality assessments. The accurate prediction of end-use quality of wheat has become a major objective in recent years. Millers, bakers, and grain processors are looking to rapid industry-applicable testing methods to replace or supplement current chemical and rheological tests. With the development of such new testing procedures, reference methods are needed to validate and improve their accuracy.

8.4. Current Technology Transfer Goals, Objectives, and Measures of Success (Metrics)

8.4.1. Current Technology Transfer Initiatives

Moisture measurement remains one of the most important official and commercial grain inspection

activities because of moisture content's impact on end-use value (dry matter content) and storability. GIPSA research (in collaboration with ARS) has resulted in the Very High Frequency (VHF) Unified Grain Moisture Algorithm (UGMA)—an approach to grain moisture measurement that should improve grain moisture measurement by (1) yielding improved accuracy, (2) permitting multiple manufacturers to design moisture meters that can use common calibrations and give equivalent results, and (3) reducing the cost of on-going calibration maintenance. GIPSA has worked closely with manufacturers for approximately 10 years to develop instruments that could use GIPSA's UGMA technology successfully. GIPSA made the UGMA freely available as a public algorithm to facilitate adoption by multiple manufacturers.

Two manufacturers have developed and commercialized UGMA-compatible instruments and other manufacturers have expressed interest in developing such instruments. GIPSA's Grain Inspection Advisory Committee (consisting of U.S. producers, exporters, USDA Cooperator organizations, academicians, and other U.S. stakeholders) encouraged the agency to proceed to implement the new moisture measurement technology beginning in September 2012 to better serve the Agency's stakeholders. The UGMA technology was implemented for corn, soybeans, sunflower, and sorghum on September 10, 2012, and implementation for most other grains is scheduled for May 2013. The impact of this research project is very high, with the potential to improve the accuracy of grain moisture measurements for the entire U.S. grain industry and, eventually, for the global grain industry.

GIPSA is currently engaged in a cooperative research program with ARS, two land-grant universities, and a private company to develop a relevant and practical method for assessing the gluten strength of wheat. Guidance provided to GIPSA by our major stakeholders has indicated that gluten strength is probably the best definition of wheat end-use quality. GIPSA contributed to the project by acquiring and preparing representative samples, testing prototype instruments, contributing to algorithm refinement, and providing overall project coordination. If this project results in a market-acceptable method for assessing wheat gluten strength, GIPSA intends to implement official testing services for gluten strength. This research could significantly benefit U.S. wheat growers, handlers, and processors by directing wheat with certain properties to markets where it has highest value and by sending clear signals to producers regarding what varieties to grow to enhance the U.S. reputation as a supplier of high quality wheat.

GIPSA collaborated with ARS and a university to conduct research on standardizing sorghum odor assessments. Sorghum inherently has a range of odors. Sorghum end-users find different types and levels of odor unacceptable based on their preferences and the grain's intended end-uses. This variance poses many challenges for the sorghum industry. GIPSA's goal for this project was to ensure that the official system properly recognizes and characterizes these odors, particularly sorghum "storage musty" odor. Our research identified chemical compounds that could be used to "spike" clean sorghum to create "storage musty" reference samples. GIPSA surveyed key sorghum inspection personnel, obtained industry and end-user feedback on the sorghum odor reference, and presented findings to the Grain Inspection Advisory Committee. Based on the results of the survey and feedback received, GIPSA selected a chemical "recipe" to use as the reference for "storage musty" sorghum. In 2012, GIPSA prepared and distributed odor reference samples to all official inspection laboratories that inspect sorghum. For the first time, inspectors had an objective odor reference available to ensure consistency throughout the official inspection system.

8.4.2. CRADA Activities

When it would contribute to a project's success, GIPSA works through ARS to establish Cooperative Research and Development Agreements (CRADAs) with land-grant universities or private industry; however, most of GIPSA's research projects do not involve CRADAs. GIPSA does not have any active

CRADAs at the present time.

8.4.3. Measures of Success

One measure of our success is through feedback expressed by our Grain Inspection Advisory Committee members. Another metric is the number of quality and weight complaints we receive from our customers each fiscal year. A critical measure of success of GIPSA's research is the commercialization and adoption of the methods that GIPSA has developed. The successful implementation of the UGMA moisture meters for official inspection was a major accomplishment.

8.4.4. Strengthening Current Activities

GIPSA participates in the Pesticide Data Program, a cooperative effort of USDA, the U.S. Environmental Protection Agency, and 10 participating States to monitor pesticide residue levels in fruits, vegetables, grain, dairy products, and other foods. GIPSA tests grain and grain-related products that are included in the program and develops new methods of analysis when necessary. In 2010, GIPSA developed two new analytical methods for oats and analyzed 300 oat samples. In 2011, GIPSA analyzed 300 soybean samples and in 2012, 300 wheat samples.

8.5. Downstream Outcomes

- **Harmonizing Biotech Reference Methods.** There is a need for highly specific and accurate tests for the various genetically-engineered (GE) crops grown in the United States. GIPSA has developed intra-laboratory validated real-time polymerase chain reaction methods and has evaluated the accuracy, reliability, and proficiency of publicly available methods used to detect and identify GE grains and oilseeds. GIPSA participated on a scientific panel of experts engaging U.S. stakeholders and influencing outcomes on issues related to testing of GE traits in grains with the goal of developing global scientific consensus regarding the analysis of transgenic events. GIPSA continues to collaborate with international organizations such as Codex Alimentarius, International Organization for Standardization, Association of Analytical Communities, American Association of Cereal Chemists, American Oil Chemists' Society, Institute for Reference Materials and Measurements, the Canadian Grain Commission, and the National Institute for Standards and Technology to harmonize testing technologies for GE grains and oilseeds. Some of these collaborations result in publications in peer-reviewed scientific journals.
- **Asia Collateral Duty Officer.** Since 2002, GIPSA has stationed an employee in Asia for a 1- to 3-month detail to work with Asian customers and their governments. We have been able to address immediate and long-term issues in the region, promote a better understanding and adoption of U.S. sampling and inspection methods to minimize differences in results, and develop face-to-face relationships with customers, USDA Cooperators, and government officials. In July 2012, we placed one representative in Asia on a 2-week assignment. The representative traveled to Vietnam, Malaysia, and Indonesia to give a presentation on the role of GIPSA, and conducted corn grading seminars for importers and end-users at the request of U.S. Grains Council.
- **Korea Corn Quality Assessment Project.** Feed buyers in Korea complained about inferior corn quality over the past few years. In July 2012, U.S. Grains Council and the Korean Feed Association, in conjunction with GIPSA, monitored the levels of broken corn and foreign material, test weight, and moisture in three shipments of U.S. Yellow corn to Korean ports. A GIPSA representative performed additional sampling of shipholds at loading and traveled to Korea to sample them when they arrived. This project served to demonstrate to Korean corn

importers that we are responsive to their concerns, and when the project report is completed, it will allow us to compare U.S. and Korean sampling and inspection procedures and identify if further collaboration is warranted.

- **China Soybean Vessel Surveying Project.** The U.S./China Memorandum of Understanding (MOU), which addressed China's concerns over soybean quality, plant health, and food safety on soybeans, was signed in December 2010. Stemming from the MOU, officials from China's Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) requested that in CY 2012, the U.S. and China conduct a joint survey of four U.S. soybean vessels to address their concerns regarding treated soybean seeds and other quality factors. Representatives from GIPSA, Animal and Plant Health Inspection Service (APHIS), Foreign Agricultural Service (FAS), American Seed Trade Association, North American Export Grain Association, and U.S. Soybean Export Council drafted a project protocol for the soybean vessel surveying project with China. Officials from China plan to travel to the United States to observe GIPSA sampling and inspection procedures and obtain loading samples. Then, representatives of GIPSA, FAS, APHIS, and NAEGA will travel to China to observe their sampling and inspection procedures and obtain destination samples. This project will serve to demonstrate to Chinese quarantine officials that we are responsive to their concerns, and will allow us to compare U.S. and Chinese sampling and inspection procedures and identify why we have obtained discrepant results in the past.
- **Export Wheat and Corn Quality Surveys.** GIPSA coordinates with representatives of U.S. Wheat Associates and U.S. Grains Council to conduct export wheat and corn surveys. GIPSA assisted with the wheat survey by collecting samples, providing inspection results, and performing additional tests for pesticide residues and heavy metals. We helped with the corn survey by collecting samples and providing inspection results. We have assisted with the wheat survey for about 30 years, and 2012 was the first year of the corn survey. The two market development organizations use the data to advise importers worldwide on what is available for sale, the cost, and the advantages that U.S. wheat and corn have over the competition.

8.6. Outreach Activities

8.6.1. Domestic Outreach

- GIPSA conducted a grain grading seminar to improve the business acumen of headquarters employees stationed in Kansas City, Missouri and Washington, D.C. The class was designed for GIPSA employees who have limited experience performing original grain inspection, which is a vital part of the GIPSA mission. The class promoted a greater understanding of the processes and procedures of the work performed on a daily basis throughout GIPSA.
- GIPSA participated in the (APHIS AgDiscovery Program at Delaware State University in Dover, Delaware. AgDiscovery is an outreach program designed to enrich teenage students with information about careers in plant and animal science and wildlife management. GIPSA staff presented information to students on the role we play as part of USDA and the Federal Government as well as provided information on random sampling, inspection techniques, statistics, and check-testing of equipment.
- We also participated in the 2012 Commodity Classic in Nashville, Tennessee. The Commodity Classic is America's largest farmer-led, farm-focused convention and trade show. GIPSA sponsored a booth at the seminar, which was attended by growers (and their families) and

industry representatives. Speakers addressed market trends and agribusiness issues, and a GIPSA staff member was available to answer any questions about the services we provide.

- A GIPSA scientist presented information on GIPSA's new Unified Grain Moisture Algorithm and its FY2012 implementation for official inspection at grain industry meetings in New Orleans, Louisiana; Portland, Oregon; Kansas City, Missouri; and through a webinar.

8.6.2. International Outreach

- A GIPSA scientist served as an instructor for a course entitled, "Methods of Determination of Mycotoxins in Food" given by the International Food Safety Training Laboratory, which is a part of the Joint Institute for Food Safety and Applied Nutrition (JIFSAN). JIFSAN is a joint collaboration between the U.S. Food and Drug Administration and the University of Maryland and helps provide the scientific basis for ensuring a safe, wholesome food supply as well as provide the infrastructure for contributions to food safety programs and international food standards. The purpose of the course was to educate international scientists involved in food safety on mycotoxin testing methods in food.
- A GIPSA scientist traveled to Tokyo, Japan, to participate in the 46th Annual Meeting of the U.S.–Japan Cooperative Program on Development and Utilization of Natural Resources, Panel on Toxic Microorganisms and the 11th International Symposium entitled "Risk Control and Food Safety." He presented and discussed the GIPSA mycotoxin testing programs. GIPSA's participation led to an improved understanding between U.S. and Japanese food safety officials and contributed to facilitating the marketing of grain by removing concerns about U.S. products.
- GIPSA staff served as members (alternate delegate and technical expert on sampling) of the U.S. delegation to the Codex Committee on Methods of Analysis and Sampling meeting held in Budapest, Hungary. The U.S. delegation actively participates in continuing discussions on uncertainty of sampling, conformity assessment, and processes for resolution of disputes.
- A GIPSA scientist presented "Sampling Bulk Commodities for NIR Analysis" at the International Diffuse Reflectance Conference in Chambersburg, Pennsylvania. The audience consisted of an international group of chemists, physicists, and engineers representing academia, government, and industry sharing a common interest in diffuse reflectance spectroscopy.
- GIPSA's statistician gave a presentation entitled "Statistical Considerations When Sampling Bulk Commodities" at the Second International Forum on Sampling for Commodity Grains in Beijing, China. The forum was held as a workshop under the authority of an ISO International Workshop Agreement and held in conjunction with the 14th ICC Cereal and Bread Congress and Forum on Fats and Oils. The international audience discussed sampling issues relevant to ISO sampling standards for bulk commodities.
- Technical Assistance. In FY 2012, GIPSA responded to customers' needs for technical assistance in foreign markets. Exporters, importers, and end-users of U.S. grains and oilseeds, as well as other USDA agencies, USDA cooperator organizations, and other governments, occasionally ask for our personnel to provide expertise. These activities include representing the Agency at grain marketing and grain grading seminars, meeting with foreign governments and grain industry representatives to resolve grain quality and weight discrepancies, helping other countries develop domestic grain and commodity standards and marketing infrastructures, assisting importers with quality specifications, and training local inspectors in U.S. inspection methods and procedures. Such activities typically have been funded through various programs administered by FAS, Farm Service Agency, or directly by GIPSA. These types of outreach activities serve to strengthen the

U.S. reputation for being a reliable supplier of high-quality grain, to reinforce the integrity of GIPSA as an independent quality inspection authority, and to minimize discrepancies in inspection results between GIPSA and the importer.

- GIPSA personnel frequently meet with delegations visiting from other countries to brief them on the U.S. grain marketing system, our national inspection and weighing system, U.S. grain standards, and our mission. Many of these delegations are sponsored by USDA Cooperator organizations like U.S. Wheat Associates and U.S. Grains Council, which arrange visits to grain production areas, GIPSA field offices, onsite laboratories at export grain elevators, and our National Grain Center in Kansas City, Missouri. At the National Grain Center, delegations sometimes receive technical training on analytical testing procedures and grain inspection methods and procedures.
- Briefings are tailored to address each group's interests and concerns. Presentations include explanations of the various services available from GIPSA, our use of the latest technology to provide grain traders with accurate and reliable inspection and weighing information and, for importers or potential importers new to the U.S. grain market, information on contracting for the quality they desire. These briefings foster a better understanding of the entire U.S. grain marketing system and serve to enhance purchasers' confidence in U.S. grain. Ultimately, these efforts help move our nation's harvest to end-users around the globe. During 2012, GIPSA personnel met with 36 teams from 24 countries.
- In FY2012, GIPSA received 5 grain quality complaints that involved about 0.2 percent by weight of the total amount of grain exported during the year. GIPSA administers a formal process for investigating grain quality and weight discrepancies. When an importer of U.S. grain reports a discrepancy regarding quality or weight, we analyze samples retained on file from the original inspection and samples submitted from the complainant (if they choose to submit them), and evaluate the accuracy of the initial inspection. This process allows us to verify whether the original inspection and weighing service provided at the time of loading was correct, based on all available information. We then issue a report of findings. Occasionally, a particular buyer or importing country reports repeated discrepancies which cannot be resolved by a shipment-by-shipment review under this process. In such cases, GIPSA may conduct collaborative sample studies or joint monitoring activities to address the discrepancy in a more comprehensive manner.

8.6.3. Inspection Training Seminars.

The Board of Appeals and Review (BAR) in GIPSA's Technology and Science Division is a group of the best grain inspectors in the U.S. who are charged with maintaining sensory inspection standards and training official inspectors to achieve high levels of accuracy and consistency in grain inspection. The BAR conducted numerous training seminars during FY2012 to improve the skills of grain inspectors and grain buyers.

- A wheat and soybean seminar for six participants from Patterson Grain, Winnipeg, Manitoba, Canada. The Canadians were here to learn how to grade wheat and soybeans under the U.S. standards and to prepare themselves if they start shipping grain to the United States.
- A wheat and edible bean training seminar for GIPSA and official agency inspectors. Breakout groups received specialized training for the grains and beans typical to their market.
- Six 3-day Quality Assurance Specialist seminars. The major topics addressed were damage and odors in corn, soybeans, wheat, and sorghum. Training was also conducted on wheat of other classes, edible beans, rice, and the sorghum odor reference sample. The purpose of the seminars

was to enhance the skills of the quality specialists who oversee and train the official grain inspectors at export and domestic inspection laboratories.

- The Chair of the BAR attended the GIPSA/North American Export Grain Association Industry Workshop in New Orleans, Louisiana, and conducted an interactive demonstration of the “storage musty” sorghum odor reference sample for U.S. grain exporters.
- A corn and soybean seminar for in-house grain company inspectors in Norfolk, Nebraska, sponsored by Louis Dreyfus Commodities and Schmit Industries, which manages the Association of Nebraska Ethanol Producers.
- Three-day corn and sorghum grading seminar for the Egyptian Central Laboratory for Food and Feed. Their visit was sponsored by U.S. Grains Council.
- A tour and wheat grading overview and demonstration for a group of Hard Red Winter wheat buyers from Guatemala, El Salvador, and Colombia. The group was hosted by Engrain LLC of Manhattan, Kansas.
- A tour and wheat grading overview for a group of wheat flour millers from the Mexican Flour Milling Association. The International Grains Program, Manhattan, Kansas, hosted the group.
- A tour and wheat grading overview for the Colombian Wheat Trade Mission Team, representing the major wheat importing groups in Colombia, accounting for over 50 percent of the country’s wheat imports. The group was sponsored by U.S. Wheat Associates and FAS.
- Three corn and soybean grading seminars at the request of the Illinois Grain and Feed Association. Participants were primarily industry graders from first point of delivery and terminal elevators.
- Five training seminars on wheat odors and wheat damage within the League City, Texas, Field Office circuit. Participants included GIPSA Agricultural Commodity Graders and local industry quality assurance personnel.
- Five training seminars and site visits in the New Orleans, Louisiana, circuit. Seventy-nine participants, including members of GIPSA and industry quality assurance teams and GIPSA Agricultural Commodity Graders, attended.
- Two Inspection Equipment Training Seminars attended by equipment specialists from GIPSA field offices and private agencies licensed to provide official grain inspection.
- Tour and wheat grading overview and demonstration for wheat buyers, millers, and government officials from Egypt and Libya, sponsored by U.S. Wheat Associates and FAS.
- A presentation to at the U.S. Pea and Lentil Trade Association annual meeting. BAR staff made a proposal to the association’s Grades Committee for development of two visual reference images for damage specific to Garbanzo beans. We also sought input pertaining to the grading of off-color Smooth Yellow peas and marketing implications.

8.7. Publications

8.7.1. Book Chapter

- Mulvaney, S. J, Chen, J., Zhao, D., Allvin, B., Chinnaswamy, R., Rayas-Duarte, P., McCluskey, P., Delwiche, S., and Seabourn, B. 2011. Large deformation elasticity of gluten. Pages 327-338. In *Wheat Science Dynamics: Challenges and Opportunities*. R. N. Chibbar and J. E. Dexter, editors. Agrobios International, Jodhpur.

8.7.2. Peer-reviewed publications

- Jenkins G.R., Helber J.T., Freese L.D . [Concordance Study: Methods of Quantifying Corn and Soybean Genomic DNA Intended for Real-Time Polymerase Chain Reaction Applications](#). J. Agric. Food Chem., 2012, 60 (34), 8323–8332
- Chapman, S. J., Mulvaney, S. J., Chinnaswamy, R., Rayas-Duarte, P., and Allvin, B. 2012. Large deformation stress relaxation and compression-recovery of gluten representing different wheat classes. *Journal of Cereal Science* 55: 366–372.

9. National Agriculture Statistics Service (NASS)

<http://www.nass.usda.gov/>

9.1. Mission Statement

“The National Agricultural Statistics Service provides timely, accurate, and useful statistics in service to U.S. agriculture.”

The statistics NASS compiles are used by agricultural producers and businesses to ensure an orderly flow of goods and services among agriculture’s production, processing, and marketing sectors. Reliable, timely, and detailed crop and livestock statistics help to maintain a stable economic climate and minimize the uncertainties and risks associated with the production, marketing, and distribution of commodities.

NASS data are also vital to policy makers, researchers, and scientists in the agriculture community who depend on reliable and unbiased facts. The Census of Agriculture, conducted every five years, provides comprehensive, county-level data about agricultural communities across the United States. NASS statistical data are essential to both the public and the private sector for making effective policy, and for production and marketing decisions.

9.2. Nature and Structure of Research Program

NASS conducts primarily applied research to improve and enhance the agency’s census and survey programs. Research strives to increase the efficiency, accuracy, and quality of official estimates by improving statistical and survey methodology.

NASS’ Research and Development Division is located in Fairfax, Virginia, and has about forty permanent federal researchers working on various statistical, methodological, and geospatial research projects. Additionally, NASS augments its research capacity by seeking input from academics by contracting with them or entering into cooperative agreements.

NASS does special tabulations of its data in response to requests, and also makes unpublished data available in Data Labs to other government agencies and university researchers. Advanced security technology allows such access to data, which is tightly controlled and monitored to ensure all output retains the confidentiality of the farmer’s individual information.

Advanced geospatial technology has made it possible to deliver the NASS Cropland Data Layer (CDL) to users for their own research and analysis. CropScape, a state-of-the-art portal, features a web-based interactive map visualization, dissemination, and querying system. The portal is available on the NASS website.

9.3. Current Technology Transfer Goals, Objectives, and Measures of Success

NASS, working in partnership with George Mason University’s Center for Spatial Information Services and Systems (CISS), continues to develop its new tool VegScape. VegScape is a crop condition website that will improve the objectivity, robustness, and defensibility of nationwide crop condition monitoring operations. Using GIS technology, the new system will provide data retrieval and processing automation, ad-hoc data retrieval and processing for emergency assessments/reporting, objective quantification, and historical data comparison for crop condition assessment using various vegetation condition metrics. It will provide web-based interactive mapping, various online capabilities such as zooming, panning, and

downloading, and will be complementary to existing crop condition survey products. VegScape is a natural extension of the CropScape website released January 2011. This program is scheduled for release to the public spring 2013.

9.4. Downstream Outcomes

- **Data Collection Enhancements.** During 2010, NASS developed a prototype for collecting survey data on a tablet (Apple *iPad*) and transmitting those data over a secure Internet connection to the agency data warehouse, effectively eliminating the costs of printing, handling, reviewing, and keying paper questionnaires. During 2011, NASS piloted using the tablet for data collection and training enumerators in the technology. In 2012, NASS state offices implemented the technology with a field force of over 3,000 NASDA (National Association of State Departments of Agriculture) enumerators. The computer-assisted personal interviewing (CAPI) solution uses thin-client technology, leveraging wireless broadband and a web-based data collection system. To complete a survey questionnaire for the respondent, the field enumerator accesses NASS' data collection website via the Internet using the Apple *iPad* and conducts the interview through a browser window, with no data ever residing on the *iPad*.
- **Estimation Enhancements.** NASS is examining model-based estimation techniques to improve the statistical reliability of published forecasts/estimates and error measures. This effort includes research on 1) time series techniques to model hogs and pigs estimates as well as labor estimates, and 2) small area estimation techniques to model county-level estimates of cash rental rates for pastureland, irrigated cropland, and non-irrigated cropland; harvested corn and soybean acreage; and corn and soybean yield. In 2011, NASS began research on how to improve nonresponse and coverage adjustments for the census of agriculture, including potentially using a unified capture-recapture estimation framework to adjust census-based estimates for non-response and undercoverage.
- **Modernization of the NASS Area Frame.** In late 2011, NASS initiated a three-year research effort to modernize the agency's area sampling frame. Advances in software and statistical methods and the completion of the 48-state Cropland Data Layer (CDL) provide new opportunities to improve survey quality and efficiency. The research includes developing new statistical methods to combine three sources of data – the CDL, the June Area Survey, and data from the Farm Service Agency – to estimate crop acreages for non-major crops when the June Area Survey data alone are inadequate. The research also includes adding GIS (rather than cumbersome aerial photographs) to the *iPad* survey collection instrument, which replaces the paper survey data collection instrument for the area based sample.

9.5. Outreach Activities

- **Data User Input.** NASS holds an annual data users meeting to gather input to ensure the agency statistical program is meeting the needs of our user community. The 2012 Data Users Meeting was held in Chicago, Illinois, on October 22, 2012. It featured representatives from NASS as well as other USDA research agencies and provided an open forum for data users to ask questions about the entire USDA statistics program. From a customer service perspective, the meeting provided an excellent opportunity for NASS to learn about data users' concerns and desires for improvements or changes to the statistics and economics programs.

- **Centralized Telephoning, Frames Maintenance, and Training.** NASS opened a National Operations Center (NOC) that provides infrastructure for increased telephone data collection capacity; centralized maintenance of the NASS list sampling frame; development of electronic survey questionnaires; receipt, scanning, and keying of mail questionnaires; standardized training materials for telephone and field interviewers; and laboratory for processing objective measurement for crops such as corn, soybeans, wheat, and cotton. The NOC opened on schedule in fall 2011, and in late 2012, is staffing up to meet the census production schedule. A review team to conduct clerical reviews of census questionnaires will be housed at the center. NASS plans to add printing and mailing capabilities to the NOC, as well as to make it the agency site for continuity of operations.

10. National Institute of Food and Agriculture (NIFA)

<http://www.csrees.usda.gov/>

10.1. Mission Statement

NIFA's mission is "Leading food and agricultural sciences to create a better future for the nation and the world." NIFA advances knowledge for agriculture, the environment, human health and well-being, and communities by providing leadership and grant funding to help support research, education, and extension programs in the Land-Grant University System and other partner organizations.

10.2. Nature and Structure of Research Program

NIFA's two key mechanisms for accomplishing its mission are:

- National program leadership. NIFA helps states identify and meet research, extension, and education priorities in areas of public concern that affect agricultural producers, small business owners, youth and families, and others.
- Federal assistance. NIFA provides annual formula grants to land-grant universities and competitively granted funds to researchers in land-grant universities, other universities, and other partner organizations.

NIFA collaborates or has formal working partnerships with many institutions and individuals. Our key partners are the institutions of higher learning making up the Land-Grant University System. However, we also partner with other federal agencies, within and beyond USDA; non-profit associations; professional societies; commodity groups and grower associations; multistate research committees; private industry; citizen groups; foundations; regional centers; the military; task forces; and other groups.

NIFA and its partners focus on critical issues affecting people's daily lives and the nation's future. The advanced research and educational technologies NIFA supports empower people and communities to solve problems and improve their lives on the local level.

Among the many programs NIFA leads, many are currently focusing efforts on the following societal challenges:

- Advance our ability to provide global food security and fight hunger
- Create a resilient and environmentally sustainable agricultural system responsive to climate change
- Enable U.S. energy independence through the development of sustainable bioenergy feedstocks and value-added bio-based industrial products
- Combat childhood obesity by ensuring the availability of affordable, nutritious food and providing individuals and families science-based nutritional guidance
- Reduce the incidence of food-borne illness and provide a safer food supply

NIFA does this not only through their research and higher education programs, but also through an extensive network of state, regional, and county extension offices in every U.S. state and territory. These offices have educators and other staff who respond to public inquiries and conduct informal, noncredit workshops and other educational events. Extension education for all citizens is also provided nationally online through eXtension.org.

Moreover, with support from more than 600,000 volunteers, 4-H—USDA's 105-year-old youth

development program administered through NIFA—engages more than 6.5 million young people every year and teaches them life skills through hands-on learning and leadership activities.

10.3. Current Technology Transfer Goals, Objectives, and Measures of Success (Metrics)

Applicants or recipients of NIFA grants that support basic science research – including the Agriculture and Food Research Initiative (AFRI) and the Sustainable Agriculture Research and Education (SARE) program – are encouraged to explore potential commercialization through the Small Business Innovation Research (SBIR) program. Conversely, small business owners or other grant recipients are encouraged to use NIFA-funded basic research programs to enhance innovation and competitiveness in their commercial operations.

Each land-grant university funded by NIFA has a university technology transfer office to promote, support and improve technology transfer from academic and nonprofit institutions. They often manage and license innovations derived from research at their universities (including research funded by NIFA) and are a good source to link small businesses with university faculty. Moreover, the Cooperative Extension System Offices are a nationwide, non-credit educational network. These offices are staffed by one or more experts who provide useful, practical, and research-based information to agricultural producers, small business owners, youth, consumers, and others in rural areas and communities of all sizes.

10.4. Strengthening Current Activities and New Initiatives

NIFA plans to promote SBIR funding opportunities to USDA intramural research CRADA partners through a partnership between NIFA’s SBIR national program leaders and the Agricultural Research Service (ARS) Office of Technology Transfer.

Through a partnership with ARS, NIFA will inform those who have applied to the NIFA SBIR program of potential partnership possibilities and benefits with ARS scientists. Notification to the SBIR applicant would be made after NIFA SBIR program managers have completed disposition of SBIR applications.

- Joint intellectual property potential (ARS can file patent applications for CRADA partners and only charges the partner for filing fees, patent application and prosecution completed by registered USDA patent agents provided free of charge saving small businesses substantial costs)
- CRADA partners can work with ARS to utilize the benefits of the ATIP Foundation

Partner with ARS for their joint ARS / ATIP “Forum” series

- NIFA’s relationship with the Cooperative Extension System and the Regional Rural Development Centers will enable improved coordination and partnership with ARS intramural research to improve technology transfer that is relevant to stakeholders. This will increase the likelihood of success of technology transfer by the agricultural sector partners of USDA.
- Partner with ARS on forums on bioenergy feed stock development
- Partner with ARS, Rural Development, and ATIP Foundation to coordinate economic development funding from public and private sources

10.5. NIFA response to Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses

USDA 27: New Metrics (beginning FY 2013) on NIFA outcomes:

A form will be developed to request information from NIFA awardees on: 1) number of new jobs created

by

a small business as the result of receiving SBIR grant funds; 2) increase in sales of technology or services developed by a small business as the result of receiving SBIR grant funds; and 3) sale to other businesses of licenses to technology developed by a small business as the result of receiving SBIR grant funds.

The data on the patents issued based upon Competitive NIFA Funding has been collected for FY2012 and is now being reported (see Table 1).

Table 1. Patents Issued in FY2012 based upon Competitive NIFA Funding.

Institution	Award Number/Proposal Number	Patent Number	Invention Description
Oregon State U.	2002-34125-10625	8,268,102	Methods for making Formaldehyde-free lignocellulosic adhesives and composites by adhering lignocellulosic substrates together.
Montana State U.	2001-35316-11109	8,246,965	Bacillus isolates and methods to protect against plant pathogens by inducing systemic acquired resistance to infection in a plant. This is done by applying a composition comprising a Bacillus control agent to plant where the plant is capable of producing defense proteins against pathogens.
U. of Arkansas	2008-36100-06005	8,216,551	A minimally invasive methods for monitoring and evaluating cellular and tissue responses, particularly immune responses in vivo to agents in birds.
Forest Concepts, LLC, WA	2005-33610-15483 and 2006-33610-17595	8,205,546	Engineered top infeed hopper system to receive woody biomass materials into a baling chamber.
UC Berkley	2001-52104-11228	8,158,383	Methods of designing and generating protein variants that have altered properties compared to a parent protein.
Wisconsin Alumni Foundation	2000-35204-9311	8,158,371	Assay for antibodies to Mycobacterium paratuberculosis and a diagnostic kit for the detection of an immune response to a paratuberculosis-specific antigen in a mammal.
Louisiana State U.	2009-36100-06293	8,147,820	A Highly sensitive and specific assay for identification of pathogen, Francisella in fish and a “live vaccine” against fish pathogen Francisella have been developed.
Iowa State U.	2001-135503-10814	8,142,832	A novel procedure with simple steps to obtain high amounts of vegetable protein fractions containing improved functional properties has been developed.
UC Berkeley	2005-35301-15891	8,134,047	A method for reducing or mitigating gene silencing of a transgene in corn.
Amelgo, LLC, KY	2007-35206-17898	8,133,916	A method to control milk production
UC Davis	2002-34442-12461	8,124,837	Genetically engineer the plants by a protein from Peirce’s disease causing pathogen that is involved in causing disease to protect the plant from Pierce disease.
Texas A&M U.	2003-35205-12825	8,105,776	A method for identifying hornless cattle.
Wisconsin Alumni Research	2004-35201-14121	8,029,902	This invention provides bactericidal substrates and methods of functionalizing the surface of the substrates.

Foundation			These substrates have potential uses in food processing, medical and biotechnology industries.
Huntsville, AL	1996-02658	8,217,228	Allergen-free peanut seeds are produced by recombinant methods.

USDA 28: Partner with ARS and the Animal and Plant Health Inspection Service (APHIS) at USDA on the National Plant Diagnostic Network, and the National Animal Health Laboratory Network

In FY2013, we expect to:

- 1) Develop competitive funding opportunities to include ARS scientists in the development of diagnostic assays and validation protocols that are needed to support APHIS regulatory surveillance efforts for foreign and emerging plant and animal diseases.\
- 2) Coordinate APHIS regulatory and ARS research efforts with relevant components of the Cooperative Extension Service in order to better identify producer needs and the transfer of relevant technology

10.6. Downstream Outcomes

RT Solutions received support from the USDA SBIR program to investigate the feasibility of using earthworms to process animal manure into a value-added product called vermicompost. Modern dairy farms are getting larger (often over 1,000 head of cattle on one farm) and while this improves the economics of milk production, it also results in excessive amounts of animal manure that needs to be disposed of in an environmentally acceptable fashion. The dewatered and partially composted manure is added to the earthworms. The earthworms feed on the compost (actually the bacteria and fungi in the compost) for about a month and the resulting product is called vermicompost. Plant growth studies have shown that vermicompost supports better plant growth than regular compost and it suppresses certain plant diseases and thus it is in high demand by plant nurseries and golf courses. RT Solutions expects to sell nearly two million pounds of vermicompost a year.

Rainbow Organic Farms received support from the USDA SBIR program to develop quality certification programs for all natural and organic beef and free range poultry. After developing these programs they established the Good Natured Family Farms (GNFF) alliance of small farmers in eastern Kansas and western Missouri that sell beef, poultry and many other agricultural products through a network of grocery stores in the Kansas City area. The GNFF program provides extra income for the participating farmers and a series of quality products for the consumers in Kansas City. All of the products sold under the GNFF label are local, fresh and of a higher quality than comparable products. The GNFF alliance started with 30 farms and today over 160 farms participate and total sales have increased to nearly \$6 million a year.

Forest Concepts received USDA SBIR support to develop WoodStraw[®], which is made from low grade waste wood veneer and resembles oversized pick-up sticks. WoodStraw[®] is an erosion control material that is a replacement for grass straw. Grass straw is light weight and can easily be blown away in high winds and also contains weed seeds. By contrast, WoodStraw[®] is much heavier and thus more permanent and contains no weed seeds. It can be spread by hand, straw blower or helicopter. It can easily be baled and thus transported by truck to where it is needed. Compared to grass straw, WoodStraw[®] provides superior performance in watersheds, forest lands and road construction sites. In initial field trials, WoodStraw[®] reduced erosion by more than 98%. It has proven especially effective in reducing erosion in areas that have been impacted by forest fires. WoodStraw[®] has been sold in many western states with total sales of well over \$1 million. It offers a

sustainable, ecologically compatible year-around erosion control product at a competitive price.

The Nitrate Elimination Company is located in the Upper Peninsula region of Michigan and has used USDA SBIR support to develop test kits for the measurement of nitrate in soil, water and crops. Nitrate is an essential nutrient for plant growth but it can be toxic to farm animals and infants when present in high levels in plant forage or in water supplies. Previous tests for nitrate made use of cadmium chemistry. The test kits developed by this company utilize the nitrate reductase enzyme and thus avoid the potential for environmental contamination from cadmium. They also allow farmers to more accurately apply nitrogen to their fields in order to obtain maximum plant growth without applying excess nitrate that would increase the cost to the farmer and lead to environmental contamination with toxic levels of nitrate.

University of Hawaii, Manoa - The goal is to create an ornamental trade in Hawaii and Oregon for the ohelo berry, a native Hawaiian plant that is currently harvested in the wild. The study will work on propagation, molecular fingerprinting, host-pathogen relationships, horticultural management and economics for production, develop a seed base production protocol, as well as provide outreach and extension to farmers and other stakeholders. Extension outreach to farmers and stakeholders were achieved by working with the UH-CTAHR Cooperative Extension, CTAHR-CES. Seeds, plants and educational materials were distributed free of charge via attendance at 11 meetings of interested farmers and nurserymen. Also the team published three UH Extension bulletins.

Carnegie Mellon University - The specialty crops industry is facing a crisis of increasing labor costs and shortages of available labor, putting farms at risk of economic failure. Increasing labor efficiency is vital to the survival of this important industry. Our goal is to work with the specialty crop industry to fulfill its vision of significantly reducing the cost of production of US fruit by developing a comprehensive automation system. Our objectives include developing, integrating, testing, deploying, and assessing a carefully chosen set of information, mobility, manipulation and plant science technologies, assessing their socio-economic utility, and transferring results to the end users via commercialization and outreach. Outreach and commercialization are integral parts of the proposed project and will start at the very outset. Held four AgTools Academies in the PNW reaching 97 apple, pear, and cherry growers. The goal was to assist growers to manage their financial, marketing and production risks when establishing new orchards and purchasing technologies. One-third of the participants were from small farms and about half from large farms. Completed in-depth case studies of 17 producers to assess knowledge, perceptions, and attitudes, based on diffusion of innovation research, regarding implementation of three CASC technologies. Made a cumulative total of 11,908 direct contacts through field days, tours and presentations. Redesigned web site (<http://www.CasCrop.com>) to improve usability and refine the material for the final project year; posted a cumulative total of 38 videos, with "APM vs. ladder" (1,181 views), "Vision Robotics Automated Scout" (596 views), and "Augmented Harvesting Overview" (598 views) generating the most views. Trained a cumulative total of 40 trainers, including 25 from other institutions. Trained a cumulative total of 84 students in CASC projects, who now have an interest in engineering solutions for specialty crops.

Penn State University - The blossoms or fruitlets of fruit trees must be thinned to enhance the size of the remaining fruit. Traditionally, thinning has primarily been accomplished through the use of hand labor, by chemical means or just simply allowing the thinning to take place naturally. The USDA "Engineering Solutions for Specialty Crop Challenges" workshop report lists mechanical fruit thinning as a top priority (3 on a 0 to 3 scale) for mechanization. This project will address the mechanized thinning engineering challenge through five clearly defined objectives, including providing technology transfer of pilot prototype units and the evaluation of sociological implications

and economic impact of implementation of the devices. Field days and demonstrations were attended by 160 industry members, and meeting presentations were attended by 850 industry members. A specific field day in SC on modifications to the design of the string thinner to make it adaptable to tree architectures in the Southeast was attended by 100 growers. Presentations on 4 replicated trials in peach orchards in Pennsylvania with the Darwin string thinner were given for 1025 growers at 1 in-depth workshop, 3 national meetings, and 1 international convention. Demonstrations and presentations were held for a spinning brush for removing selected blossoms at extension outreach, industry, and professional conferences, including the Washington State Horticultural Association, California Cling Peach Industry, Southeast Professional Fruit Workers, Mid-Atlantic Fruit and Vegetable, International Fruit Tree Association, Cherry Institute, NCW Stone Fruit Day and NE Agricultural and Biological Engineering meetings. Additional outreach efforts included trade journal articles, videos, posters, PowerPoint presentations, extension bulletins, posted at the project website (<http://abe.psu.edu/scri>).

USDA/ARS/SAA/USHRL - In the past 10 years, Squash vein yellowing virus (SqVYV)-induced watermelon vine decline (WVD) and other whitefly-transmitted viral diseases have resulted in millions of dollars in lost revenue. The goal of this project is to develop management strategies that effectively control SqVYV and other whitefly-transmitted viruses of vegetable crops in the Southeast. In addition, this project will use the information obtained to develop a decision support system for tracking whiteflies and virus and delivering management recommendations in Florida. The development of a decision support system. The decision support system is the deliverable that extends the research proposed in the grant and has the potential of commercialization. AgScouter is a web-based and smartphone technology platform for collection, analysis, and delivery of scouting information and is being developed with ZedX Inc. Progress in the development of AgScouter was presented at the annual Florida Tomato Institute meeting in Naples, FL on September 5, 2012. The early developments in AgScouter were introduced at the 2010 and 2011 Florida Tomato Institute meetings. AgScouter was recently featured in the August 2012 Edition of Citrus and Vegetable magazine. With these recent promotions we have gotten several requests to develop AgScouter in other systems and geographical areas of the country, particularly California vegetable and grape production.

USDA/ARS/MWA/OARDC - Current application technology for floral, nursery, and other specialty crop production wastes significant amounts of pesticides. The proposed research is to develop two affordable intelligent spray systems for floral and nursery crops, and these developments are adaptable to other specialty crops. Outputs to communities for this annual report period are: (1) disseminated to extension educators and professionals a chemical reduction concept using intelligent sprayers to control pests and diseases; (2) completed consultations with leading nursery and greenhouse growers in Ohio, Oregon, Kentucky, Tennessee and many other states to update the progress on intelligent sprayer development; (3) provided formal presentations on the development of new sprayer components and test results at the 2012 Annual International Agricultural and Biological Engineering Meeting, the 2012 American Phytopathological Society Annual Meeting, the 2012 American Society for Horticultural Science Annual Meeting, the 6th National Small Farm Conference, the 2012 International Commission of Agricultural and Biosystems Engineering (CIGR) - International Conference of Agricultural Engineering in Spain, the American Chemistry Society 244th National Meeting, the Ohio Green Circle Growers Association Annual Tour, the Tennessee Nursery and Landscape Association Field Days and Short Course, the Tennessee Agricultural Professional Associations Meeting; (4) demonstrated the capabilities of the intelligent sprayer for State of Ohio and the U.S. Representatives, and the Ohio Northeastern Regional Representative for Senator Sherrod Brown; (5) demonstrated the new sprayer at the Central Environmental Nursery Trade Show, and Nursery Field Days; (6) Introduced the new intelligent sprayer prototypes to

domestic and international growers, sprayer manufacturer engineers, chemical company representatives, and spray application technology specialists when they were visiting the USDA-ARS Application Technology Research Unit at Wooster, Ohio.

10.7. Outreach Activities

- Participated in three ARS / ATIP Agricultural & Business Innovation Forums in Ohio (8/9/2012 & 8/23/2012) and Maryland (3/15/2012) providing information on the SBIR program to potential ARS commercial partners.
- Held annual National SBIR Conference in Portland OR, with formal presentations on the USDA and met one-on-one with 25 or more small business entrepreneurs (11/13-15/2012).

11. The Natural Resources Conservation Service (NRCS)

<http://www.nrcs.usda.gov>

11.1. Mission Statement

The Natural Resources Conservation Service (NRCS) is not generally considered a research agency—the thrust of its mission is to help private landowners address natural resource concerns on their lands. In order to carry out this mission, however, NRCS has become perhaps the country’s premier agency for transfer of natural resources conservation technology. NRCS maintains approximately 160 National Conservation Practice Standards

(http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/ncps/?cid=nrcs143_026849).

These standards and supporting documents are NRCS’s principle vehicle for transferring the latest science and technology directly to America’s farmers and ranchers.

11.2. Nature and Structure of Programs

Once resource needs on private farms and ranches have been identified, the agency works closely with the Agricultural Research Service and numerous universities to develop and fine tune the science and technologies needed to help farmers conserve, protect, and enhance, their natural resources. The NRCS also conducts conservation field trials to strengthen NRCS technology when formal research is not available. As appropriate, these trials are conducted on working farms and ranches, in cooperation with other agencies and organizations. A field trial is a study designed to examine the adequacy or adaptability of a conservation practice, technology, procedure, or material. It may also be used to introduce promising conservation practices or technologies into areas where they are not now accepted as a solution to a local soil, water, or related natural resource problem or condition. Field trials can be useful to transfer technology, to update the local technical guide, or to show the need for formal research.

Although NRCS is not known as a research agency, it does carry out or support research through two main vehicles—its Soil Science Division, and through its Conservation Innovation Grants Program.

11.3. Downstream Outcomes: Soils Research and Technology Transfer

The NRCS Soil Science Division is authorized by the Secretary to conduct research on the use and behavior of soils to facilitate soil classifications and distribution of information through the Web Soil Survey and other vehicles of data dissemination. Below are some examples of research and Technology Transfer that are currently underway.

Rapid Assessment of U.S. Soil Carbon for Climate Change and Conservation Planning

Soils are the largest global storehouse of terrestrial carbon and have potential for mitigation of anthropogenic atmospheric carbon dioxide. Additionally, many other important processes, including water infiltration, nutrient cycling and loss, and soil erodibility, are strongly influenced by the amount of carbon in soils. To aid land managers, policy makers, and conservationists to make sound recommendations for management options to increase the amount of carbon in soils, scientists with the NRCS Soil Science Division, in cooperation with scientists from multiple universities, are completing a nationwide inventory of soil carbon across all types of land cover. This inventory at more than 6,000 sites will, in addition to providing a statistically reliable estimate of the a

mount of carbon in U.S. soils for global carbon accounting, provide baseline data for into evaluations and design of management systems for practical maximization of soil carbon stocks, evaluation of ecosystem processes related to soil carbon, and will be used to enhance model based conservation planning. *National Soil Survey Center, Lincoln, NE*

National Wetland Condition Assessment Hydric Soil Analysis

The nation's wetlands are important landscape components and perform important ecosystem services including flood mitigation, regulation of carbon and nutrient dynamics, and sediment and contaminant sequestration. Many of these important wetland functions are mediated by hydric soils in the wetland. Soil Science Division soil scientists are cooperating with the U.S. Environmental Protection Agency in a nationwide project to evaluate the condition of the nation's wetlands. The project entailed field evaluations and sampling of soils in 1,000 wetlands. Properties of soils in the sampled wetlands were evaluated in the NSSC Kellogg Soil Survey. These data along with other ecosystem data collected at the sites will be used to develop a comprehensive assessment of the condition of nation's wetlands. *National Soil Survey Center, Lincoln, NE*

Field Book for Describing and Sampling Soils

One of the more critical components of effective evaluations of field properties of soils is consistent description of landscape components and morphological properties. Soil Science Division soil scientists completed an extensive revision the Field Book for Describing and Sampling Soils, a widely used internationally accepted standard document containing definitions and descriptions of soil and landscape features. Publication and distribution of the document is expected in early 2013. *National Soil Survey Center, Lincoln, NE*

Soil Property Map by Digital Mapping Techniques

Accurate inventory to the spatial distribution of soil properties is essential for reducing and preventing soil degradation by erosion, salinization, and other processes. These essential inventories require considerable investment of time and resources to complete by traditional methods. The advent of advanced GIS software and hardware, development of landscape models to describe soil properties using environmental covariants, and widespread availability of accurate elevation and similar geographic data, however, have allowed development of rapid methods to inventory the soil resource with digital techniques. Soil Science Division soil scientists are cooperating with scientists from West Virginia University and the University of Sydney, Australia to test this methodology against soil data available in the U.S. General Soil Map (STATSGO2) that were collected by traditional field techniques. Data and relationships developed in this project will also contribute to the objectives of the GlobalSoilMap project, an international effort to developed a global database of the spatial distribution of soil properties important for sustainable land management. *National Soil Survey Center, Lincoln, NE*

Ground Penetrating Radar Evaluations of Soil Water Movement

Water movement into and through soils is a major driver of a multitude of important ecosystem services including soil water storage for plant growth, aquifer recharge, stream discharge, mineral weathering, nutrient cycling, and transport of natural and anthropogenic materials. Thus, understanding and predicting this process is critical for maintaining and enhancing long term sustainability of ecosystems including those used for agriculture and forest production. Soil Scientists from the Soil Science Division are cooperating with scientists at Penn State University to evaluate use of ground penetrating radar as a rapid and non-destructive method to evaluate pathways and amounts of water movement through soils in the NSF funded Shale Hills Critical Zone Observatory. Results from this project will improve our ability to predict and manage soil water relationships. *National Soil Survey Center, Lincoln, NE*

Phosphorus Behavior in Soils

Phosphorus is one of the leading causes of water quality decline in the US through algal blooms and hypoxia in surface waters. To adequately protect surface waters nationwide, practices to minimize phosphorus losses and runoff from agricultural lands must be applied effectively and efficiently. Soil Scientists in the Soil Science Division are cooperating with scientists at the University of Nebraska – Lincoln to evaluate phosphorus retention in and release from sediment derived from soils across the nation with a wide range in properties. Results will be extrapolated to all soils in the nation through the Soil Survey Geographic (SSURGO) Database to inform phosphorus management related decision-making at the watershed, farm and field scale and will provide valuable input to developers of field-level models that simulate water, soil and nutrient movement from agricultural lands. *National Soil Survey Center, Lincoln, NE*

11.4. Outreach Activities

11.4.1 World Soil Resources - Technology Transfer

NRCS's Soil Science Division also provides critical technology transfer services to countries around the world. Below are a few examples:

Haiti

NRCS and the Haitian Ministry of Agriculture, Natural Resources, and Rural Development (MARNDR) initiated a soil survey pilot project to build in-country capacity to identify soil resources and utilize the information to increase food security and conservation of natural resources. Eighty people attended a stakeholder's workshop was held to identify needs and expected outcomes in September 2012. The project is managed and funded by USDA-FAS.

Mexico

NRCS and the Mexican National Institute of Statistics and Geography (INEGI) are collaborating on data and technology exchanges to contribute to the North America node of the globalsoilmap.net initiative. Both countries are applying the globalsoilmap.net specifications to their respective soil information systems to generate gridded spatial soil property data suitable for large watershed and continental scale analysis. The data will be compared in an area along the Arizona and Sonora state borders.

Afghanistan

USDA sent another shipment of the report "A Brief Survey of Soil Fertility of Agricultural Land in Farah and Kunar Provinces" to Afghan Provincial Reconstruction Teams to assist in agriculture reconstruction efforts. This report is based on published information and 14 soil profiles collected and analyzed by NRCS employees in 2009.

Puerto Rico and U.S. Virgin Islands

NRCS contributed Puerto Rico and U.S. Virgin Island soil information to the Latin America and Caribbean Soil Atlas. The Atlas is being published by the Joint Research Centre (JRC) of the European Commission to increase public, policy and scientific soil awareness and education.

11.4.2. NRCS Conservation Innovation Grants (CIG)

Another important vehicle for development of conservation technology that NRCS will then transfer to farmers and ranchers is Conservation Innovation Grants

(<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/>)

CIG, a component of NRCS's Environmental Quality Incentives Program (EQIP), is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, EQIP funds are used to award competitive grants to non-Federal governmental or nongovernmental organizations, Tribes, or individuals.

CIG enables NRCS to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with Federal, State, and local regulations. NRCS administers CIG. Much of what NRCS learns from CIG is incorporated into conservation practice standards, used by the field conservationists and technicians to address resource concerns on private farms and ranches.

Since CIG's inception in 2004, NRCS has awarded nearly 500 national-level CIG grants. There is also a State-level component that NRCS State offices may use to award smaller grants for State-specific resource concerns.

A sample of project results is provided below. Lists and brief summaries of funded projects are available on the CIG Web site (<http://www.nrcs.usda.gov/technical/cig/index.html>).

Irrigator Pro Software Offers New Irrigation Water Management Tool

To reduce the use of irrigation water in growing corn, cotton, and peanuts, the Georgia Soil and Water Conservation Commission tested the use of Irrigator Pro software with support from a Conservation Innovation Grant. Researchers tested the software, which incorporates a computerized irrigation scheduling system with center pivot irrigation, on 53,000 acres in order to obtain scientific data to help farmers make better decisions about irrigation water management and water conservation. Among the findings: every inch of water saved on 53,000 acres is a savings of more than 1.4 billion gallons of water; if half is pumped with electricity and half with diesel, the energy cost savings per inch of water saved is approximately \$290,000.

Farmers who used Irrigator Pro recognized the technology's potential for both water and energy savings. Most continued to use it after the project, and additional growers continue to adopt it since the project ended in 2008. As a result of the project, NRCS Georgia now suggests the use of Irrigator Pro as a water management tool for use in conjunction with retrofitting or up-grading existing center pivot irrigation systems to efficiently use water.

Prescribed Fires May Help Restore Texas Rangeland Ecosystems

A three-year study of the effects of using prescribed fires on Texas rangelands suggests that such burns may have ecological, economic, and social benefits. With support from the NRCS Conservation Innovation Grant program, the Texas Agricultural Experiment Station conducted the study in four contiguous counties in each of three eco-regions in Texas. The station set up three demonstration sites, conducted focus groups, and mailed a survey to 1,200 landowners in the twelve counties to determine whether prescribed fire, particularly extreme fire applied during the growing season, is an effective tool to restore ecosystems in the southern plains. Among the findings:

- Extreme fire—i.e., fire exceeding NRCS's guidelines for prescribed fire with respect to temperature, humidity, wind speed, and fuel moisture content—reduces the density of invasive woody plants without destroying the herbaceous understory.
- The behavior of fire fueled by live plants is determined more by the amount of moisture in the plants than by the fire's temperature.

- Extreme fire applied as an initial woody plant treatment followed by cool-season maintenance burns was better economically than other common treatments of invasive plants.
- Landowners generally have favorable views of prescribed fire, including extreme fire, as a management tool. Members of prescribed burning associations are significantly more favorable than non-members.

The three-year study has increased understanding of the impacts of extreme fire, particularly from the landowner perspective.

Air and Water Quality Guidelines and Practices Advance Winegrowing Sustainability

The California Sustainable Winegrowers Alliance was established in 2003 to advance environmental stewardship among the state's growers and vintners, and soon created a Code of Sustainable Winegrowing Practices, including a workbook of best management practices to help vineyard and winery operations assess and improve their sustainability. With support from an NRCS Conservation Innovation Grant, the Alliance developed numerous air and water quality innovations, including an air quality chapter and assessment tool for the workbook and air quality and water quality demonstration sites to showcase innovative technologies and practices.

Two subsequent Conservation Innovation Grants (including one still in progress) focus on developing and implementing tools and metrics for evaluating environmental sustainability, training growers in using the tools to correctly plan and implement conservation practices, developing incentive programs to reduce energy and water use, and improving the tools and programs in ways that make them transferable to other commodities. Elements of the Winegrower Alliance program have been adapted for similar sustainability initiatives in specialty crops, including almonds, hazelnuts, raisin and table grapes, pears, cut flowers, and others. Because the Alliance program trains growers in conservation practices that reduce energy use, maintain soil fertility, and increase water use efficiency (essential in a drought-prone state), NRCS uses it in developing conservation plans with growers, thereby saving time and cost.

Self-Assessment Tools Help Farmers Evaluate Energy Use and Renewable Energy Potential

With a Conservation Innovation Grant, the University of Wisconsin worked with NRCS information technology staff to develop a series of Web-based energy self-assessment tools that farmers in the upper Midwest can use to evaluate their baseline energy use and the potential cost-effectiveness of various energy conservation measures. In addition, the project developed several renewable energy tools to help farmers assess renewable energy potential on their farms.

The assessment tools provide more sophisticated energy self-evaluation tools than previously available. Ten energy efficiency tools include assessments of energy use related to dairy farming, grain drying, greenhouses, irrigation, lighting, livestock production, maple syrup production, potato storage, ventilation, and water fountain use.

The tools for evaluating renewable energy potential include assessments of biogas, biomass, solar photovoltaics, solar water heating, water pumping, and wind. The tools are currently maintained by the *University of Wisconsin* on an external Web site and will be transferred to a USDA server in 2013

Internet Access and Real Time Data May Improve Irrigation Effectiveness

In a test to determine whether real-time soil moisture data can help producers improve irrigation scheduling and water usage, the Flint River Soil and Water Conservation District (SWCD) of Georgia installed a remote soil moisture monitoring (RSMM) telemetry network with support from an NRCS Conservation Innovation Grant. The network gathered soil moisture data at the field level, along with irrigation activity, and transferred it via the Internet to nine participating farmers.

The network consisted of five primary components and provided service to 17 center pivot irrigation systems on 2,467 irrigated acres, resulting in an estimated 15 percent water savings due to improved irrigation scheduling. This is equivalent to reducing annual use by more than 7.5 million gallons of water. The project demonstrated that such technology is a viable option for farm operators if funding is available to assist with installation and monitoring. Nevertheless, the limits of the existing technology at the time of the project inhibited the information from being transferred consistently in “real” time.

Now such barriers in technology have been overcome and producers have the option of using RSMM equipment that connects the field to the Internet via wireless broadband, satellite, or cell-based radios. More than 80 new RSMM deployments throughout the 27-county area of the Lower Flint River Basin have been funded by federal and private resources. As the value of Internet connectivity in the farm setting is demonstrated, it is contributing to the growth of rural wireless broadband in the region, which in turn encourages the development of even more conservation-based technologies.

High-Impact Targeting Can Reduce Sediment and Nutrient Erosion

With a Conservation Innovation Grant, the Michigan Department of Agriculture teamed up with Michigan State University Institute of Water Research (IWR) and several local conservation districts to develop a geographic information system (GIS) tool to address erosion in high-risk areas in the Great Lakes Basin. The resulting High-Impact Targeting (HIT) system uses GIS data and computer modeling to identify precisely, down to the field level, which areas have the greatest erosion and pollution problems. Such precision allows scarce conservation resources to be used for greatest impact.

HIT is simple, fast, and cost-effective way to identify high-priority areas most likely to contribute to sedimentation. The online tool allows users to view sediment and erosion data for certain watersheds and their sub-basins, simulate best-management-practices scenarios at watershed scales, prioritize watersheds, and map high-risk areas. HIT can calculate the sediment and phosphorus loadings to surface waters from upland agriculture as well as potential reductions in pollutant load from implementing best management practices on a portion of the polluting area.

IWR continues to work with NRCS and other partners to improve and extend HIT. The Michigan Department of Environmental Quality encourages the use of HIT in developing watershed management plans. NRCS; state, local, and regional governments; soil conservation districts; farmers; watershed organizations; and conservation organizations can use it to target places where intervention is most needed.

Variable Rate Irrigation Offers Potential to Reduce Water Usage

With the support of an NRCS Conservation Innovation Grant, researchers at the University of Georgia Research Foundation, Inc., demonstrated and tested the impact in actual farm situations of adding Variable-Rate Irrigation (VRI) technology to traditional spray-type center pivot irrigation systems. They found that VRI has the potential to reduce water usage by 12 to 20 percent.

Center pivot irrigation, a reliable tool that has ensured good yields in many settings, distributes water uniformly in non-uniform fields. Most fields vary in soil type, topography, drainage, and number of crops planted, among other factors, making uniform water application relatively ineffective. In contrast, VRI systems use computer technology and Global Positioning System (GPS) technology to apply only the amount of water needed to differing sections of the same field. In the CIG-funded project, researchers installed VRI systems on 19 center pivot systems, and then tested their benefits, effectiveness, and practicality by collecting flow volumes, field moisture values, and uniformity data.

Since the CIG project ended in 2006, VRI has become an accepted NRCS practice in several states and eligible for financial assistance. In addition, NRCS partners have promoted more adoption of VRI for water conservation reasons. More recently, VRI controls are being installed with CIG financial assistance on center pivot irrigation systems on dairy farms to help farmers keep effluent out of environmentally sensitive areas. In addition, mainline irrigation system manufacturers now offer their own versions of “variable-rate irrigation,” giving farmers additional options in this emerging technology area.

11.5. Publications

Research and laboratory staff published 14 articles in refereed journals and made 20 presentations at scientific meeting.

12. Rural Development (RD)

<http://www.rurdev.usda.gov/Home.html>

12.1. Mission

Rural Development is the leading advocate for rural America. The mission area supports rural communities and enhances quality of life for rural residents by improving economic opportunities, community infrastructure, environmental health, and the sustainability of agricultural production.

To support rural regional economic prosperity, USDA Rural Development provides job training and business development opportunities for rural residents, including cooperative business development, community economic development and strategic community planning and faith-based and self-help initiatives.

Today, USDA broadly defines technology transfer as the adoption of research outcomes (i.e., solutions) for public benefit. Successful adoption of USDA knowledge and research outcomes typically requires complementary assets and services provided by multiple agencies in USDA, including agencies that are not primarily engaged in direct research in the physical and life science arenas. USDA Rural Development is one of these agencies.

USDA Rural Development offers programs to provide the educational opportunities, training, technical support, and tools for rural residents to adapt research outcomes by starting small businesses and to access jobs in agricultural markets, the green economy, and other existing markets, as well as acquire training in vocational and entrepreneurship skills they can use in the marketplace and business sector. USDA Rural Development, in cooperation with our public and private partners, is connecting rural residents to the global economy by increasing access to broadband; facilitating sustainable renewable energy development; and developing regional food systems. Such investments support our long-term national prosperity by ensuring that rural communities are self-sustaining, repopulating, and thriving economically.

In collaboration with lenders, local governments, Tribal groups, and intermediaries, USDA Rural Development provides grants, loans, loan guarantees, and loan and grant combination programs to small businesses, farmers, and ranchers who are utilizing innovate research to create quality jobs in rural communities. Together, with our 47 Rural Development State Offices, government agencies, commercial lenders, and partnering organizations, USDA Rural Development remains committed to building a secure future for the communities of rural America.

12.2. Seven Strategies for Economic Development (many of these strategies have been used to adapt innovate technology in rural communities)

- Strategic Partners
- Capital Markets
- Regional Food Systems
- Regional Collaboration
- Community Building
- Alternative Energy
- Broadband and Continuous Business Creation

12.3. Programs

There are three programs that are primarily used by USDA Rural Development to assist rural businesses and cooperatives in the adaptation of innovative technology or the manufacture of products that derived from innovative technology: (1) the Business and Industry Guaranteed Loan Program, (2) the Intermediary Relending Program, and (3) the Rural Business Enterprise Grant Program.

12. 3.1. BUSINESS AND INDUSTRY GUARANTEED LOANS (B&I)

The purpose of the B&I Guaranteed Loan Program is to improve, develop, or finance business, industry, and employment and improve the economic and environmental climate in rural communities. This purpose is achieved by bolstering the existing private credit structure through the guarantee of quality loans which will provide lasting community benefits. It is not intended that the guarantee authority will be used for marginal or substandard loans or for relief of lenders having such loans.

A borrower may be a cooperative organization, corporation, partnership, or other legal entity organized and operated on a profit or nonprofit basis; an Indian tribe on a Federal or State reservation or other Federally recognized tribal group; a public body; or an individual. A borrower must be engaged in or proposing to engage in a business that will: provide employment; improve the economic or environmental climate; promote the conservation, development, and use of water for aquaculture; or reduce reliance on nonrenewable energy resources by encouraging the development and construction of solar energy systems and other renewable energy systems.

Loan purposes must be consistent with the general purpose contained in the regulation. They include but are not limited to the following:

- a. Business and industrial acquisitions when the loan will keep the business from closing, prevent the loss of employment opportunities, or provide expanded job opportunities.
- b. Business conversion, enlargement, repair, modernization, or development.
- c. Purchase and development of land, easements, rights-of-way, buildings, or facilities.
- d. Purchase of equipment, leasehold improvements, machinery, supplies, or inventory.

The B&I Guaranteed Loan Program is a “win-win” for rural American businesses and banks that serve rural communities. The program provides loan guarantees to commercial lenders, increases their legal lending limits, and expands their lending portfolio. With increased lending capabilities, banks can provide more loans and larger loans. The program also benefits lenders through the sale of the guaranteed and non-guaranteed portions of the loans on the secondary market.

The B&I program provides protection against loan losses, which can encourage lenders to extend credit to borrowers so they can establish, expand, or modernize their rural businesses. Most loan guarantees issued by Rural Development are for 80 to 90 percent of the amount of the loan.

There are four important reasons investors choose to work with Rural Development. First, the full faith and credit of the U.S. Treasury backs each loan guarantee. Second, many lenders consider the B&I program to be a relatively risk-free way to expand portfolios. Third, the B&I Guaranteed Loan Program helps lenders achieve Community Reinvestment Act requirements. Finally, the partnership between Rural Development and private lenders helps improve the economic health of rural communities by creating opportunities for investment.

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B&I GUARANTEED LOAN - 3 YEAR ACTIVITY ¹						
States	2009		2010		2011	
	Amount	Number of Loans	Amount	Number of Loans	Amount	Number of Loans
Alabama	2,400,000	1	75,448,184	22	36,759,800	9
Alaska	24,268,750	9	26,917,611	19	3,506,478	5
Arizona	18,832,680	7	28,719,893	11	19,638,714	8
Arkansas	1,350,000	2	39,304,000	10	30,084,500	10
California	95,816,320	47	173,100,011	70	44,396,991	31
Colorado	10,566,500	4	30,849,800	9	13,883,500	5
Connecticut	2,450,000	3	19,000,000	4	6,380,000	3
Delaware	2,153,627	2	850,000	1	420,000	1
Florida	39,366,700	10	79,745,464	21	28,821,327	9
Georgia	58,034,035	16	155,379,004	45	82,394,000	22
Hawaii	9,913,000	2	26,672,000	3	4,400,000	2
Idaho	35,700,339	31	54,127,517	33	28,004,675	15
Illinois	24,577,750	14	68,385,013	23	36,851,600	7
Indiana	14,350,693	6	38,549,362	18	29,746,100	9
Iowa	79,094,125	20	110,580,331	41	24,133,140	10
Kansas	7,370,000	5	56,724,900	19	18,004,900	12
Kentucky	17,266,000	5	87,528,177	21	41,170,000	6
Louisiana	46,952,500	11	115,108,700	25	126,976,800	20
Maine	4,965,000	6	8,322,800	5	14,920,245	8
Maryland	1,305,000	3	19,988,385	9	17,413,100	5
Massachusetts	14,562,500	4	16,427,250	7	18,330,000	4
Michigan	11,961,900	7	135,856,375	54	36,898,080	15
Minnesota	19,365,000	6	38,155,133	17	11,375,000	9
Mississippi	4,000,000	1	51,538,474	14	29,998,000	5
Missouri	36,655,000	16	86,415,000	41	40,453,000	29
Montana	19,361,000	5	31,996,698	12	14,367,000	3
Nebraska	11,993,528	19	68,743,969	21	17,188,999	12
Nevada	-	-	21,563,800	8	9,058,500	4
New Hampshire	4,500,000	1	14,079,920	5	2,800,000	2
New Jersey	-	-	11,100,000	2	9,440,000	4
New Mexico	10,479,120	6	9,500,876	5	10,692,000	3
New York	26,750,675	15	123,912,317	52	35,532,302	18
North Carolina	32,993,800	17	94,518,212	50	46,352,000	24
North Dakota	18,387,000	7	22,178,200	21	22,769,949	11
Ohio	44,549,721	16	84,519,210	29	48,365,150	21
Oklahoma	66,325,000	17	101,689,883	25	44,209,950	14
Oregon	35,277,116	20	63,059,617	30	43,845,108	25
Pennsylvania	54,113,900	16	81,121,629	22	23,496,000	8
Puerto Rico	-	-	14,779,134	5	9,836,250	5
Rhode Island	-	-	1,766,000	1	-	-
South Carolina	47,021,496	22	62,974,987	24	42,595,000	17
South Dakota	6,638,250	10	4,608,160	7	8,838,000	4
Tennessee	16,922,584	8	102,346,845	30	57,827,304	12
Texas	50,599,965	16	134,259,920	27	43,000,281	14
Utah	8,595,265	6	11,598,375	6	14,495,301	8
Vermont	1,178,260	2	16,471,940	4	13,336,000	4
Virgin Islands	12,450,000	2	13,750,000	2	4,750,000	1
Virginia	12,170,500	6	47,384,129	22	30,018,000	7
Washington	20,464,500	8	47,497,953	15	21,396,000	13
West Virginia	16,689,000	10	46,659,700	16	32,472,300	9
Western Pacific	5,000,000	1	6,512,500	3	-	-
Wisconsin	133,412,059	32	145,847,033	39	35,089,000	8
Wyoming	5,468,000	6	9,731,000	5	656,000	1
Totals	\$1,244,618,158	506	\$2,937,865,391	1,030	\$1,387,386,344	511

¹Includes ARRA funding.

12.3.2. INTERMEDIARY RELENDING PROGRAM (IRP)

The purpose of the IRP program is to alleviate poverty and increase economic activity and employment in rural communities. Under the IRP program, loans are provided to local organizations (intermediaries) for the establishment of revolving loan funds. These revolving loan funds are used to assist with financing business and economic development activity to create or retain jobs in disadvantaged and remote communities. Intermediaries are encouraged to work in concert with State and regional strategies, and in partnership with other public and private organizations that can provide complimentary resources.

The following entities are generally eligible to apply for loans from intermediary lenders provided they owe no delinquent debt to the Federal Government:

- Individual citizens or individuals who have been legally admitted to the U.S.,
- Those located in a rural area defined as an area with a population of 25,000 or less,
- An entity that is able to incur debt, give security, and repay the loan,
- A corporation, partnership, LLC, individual, non-profit corporation, public body.

IRP funding may be used for a number of purposes but to be eligible, ultimate recipients must be located in a rural area. Under the IRP, a rural area is any area that is not inside a city with a population of 25,000 or more according to the latest decennial census. Some examples of eligible projects are:

- The acquisition, construction, conversion, enlargement, or repair of a business or business facility, particularly when jobs will be created or retained.
- The purchase or development of land (easements, rights of way, buildings, facilities, leases, materials)
- To purchase equipment, leasehold improvements, machinery, supplies
- Start up costs and working capital
- Pollution control and abatement
- Transportation Services
- Feasibility studies
- Hotels, motels, B&Bs, convention centers

The Intermediary Relending Program (IRP) helps rural communities alleviate poverty, increase economic activity, and increase employment. Under the IRP program, USDA Rural Development provides loans to local organizations (Intermediaries) for the establishment of revolving loan funds. The intermediary uses the revolving loan funds to finance business and economic development activities that will create and retain jobs in disadvantaged and remote communities.

USDA Rural Development encourages Intermediaries to collaborate with state, regional, public, and private organizations that provide complimentary resources. In FY 2011, IRP issued over \$19 million in loans, helped create/save almost 15,000 jobs, and assisted 649 small rural businesses, farmers, and ranchers. An intermediary may borrow up to \$2 million under its initial financing and up to \$1 million at a time thereafter. The total aggregate cap is \$15 million.

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INTERMEDIARY RELENDING LOAN PROGRAM - FY 2009 – FY 2011¹

States	2009		2010		2011	
	Amount	Number of Loans	Amount	Number of Loans	Amount	Number of Loans
Alabama	500,000	1	-	-	216,000	1
Alaska	-	-	-	-	159,000	1
Arizona	-	-	-	-	183,000	1
Arkansas	400,000	1	-	-	193,000	1
California	3,750,000	7	2,140,000	5	970,000	2
Colorado	750,000	1	812,296	3	175,000	1
Connecticut	-	-	500,000	1	-	-
Delaware	500,000	1	-	-	156,000	1
Florida	-	-	-	-	218,000	1
Georgia	750,000	1	-	-	589,000	2
Hawaii	-	-	-	-	-	-
Idaho	300,000	1	-	-	166,000	1
Illinois	2,500,000	3	1,000,000	1	505,000	2
Indiana	-	-	-	-	-	-
Iowa	728,219	2	1,128,000	3	183,000	1
Kansas	-	-	-	-	172,000	1
Kentucky	750,000	1	750,000	1	968,000	2
Louisiana	-	-	-	-	750,000	1
Maine	750,000	1	-	-	174,000	1
Massachusetts	750,000	1	-	-	161,000	1
Maryland	1,500,000	2	-	-	169,000	1
Michigan	-	-	-	-	200,000	1
Minnesota	-	-	750,000	1	1,446,000	3
Mississippi	-	-	-	-	-	-
Missouri	500,000	1	675,000	2	-	-
Montana	1,335,000	3	2,000,000	3	165,000	1
Nebraska	-	-	750,000	1	900,000	2
Nevada	-	-	700,000	1	-	-
New Hampshire	-	-	1,000,000	2	1,913,000	4
New Jersey	750,000	1	-	-	-	-
New Mexico	-	-	-	-	167,000	1
New York	1,050,000	2	2,100,000	3	966,000	2
North Carolina	3,000,000	4	2,416,480	4	-	-
North Dakota	1,350,000	2	-	-	158,000	1
Ohio	-	-	1,250,000	2	734,000	2
Oklahoma	750,000	1	750,000	1	188,000	1
Oregon	1,050,000	2	-	-	677,000	3
Pennsylvania	995,000	2	1,750,000	3	979,000	2
Puerto Rico	-	-	-	-	165,000	1
Rhode Island	-	-	-	-	-	-
South Carolina	1,828,219	3	1,800,000	3	750,000	1
South Dakota	1,500,000	2	4,500,000	6	1,661,000	3
Tennessee	-	-	750,000	1	-	-
Texas	1,500,000	2	750,000	1	998,000	2
Utah	-	-	-	-	160,000	1
Vermont	2,500,000	4	1,500,000	2	162,000	1
Virginia	-	-	500,000	1	207,000	1
Virgin Islands	-	-	-	-	-	-
Washington	-	-	2,750,000	4	184,000	1
W. Pacific Areas	750,000	1	-	-	-	-
West Virginia	750,000	1	250,000	1	-	-
Wisconsin	-	-	262,296	1	200,000	1
Wyoming	-	-	-	-	-	-
Totals	\$33,536,438	54	\$33,534,072	57	\$19,087,000	57

¹Includes ARRA funding.

12.3.3. RURAL BUSINESS ENTERPRISE GRANTS (RBEG) PROGRAM

The RBEG program provides grants for rural projects that finance and facilitate development of small and emerging rural businesses help fund distance learning networks, and help fund employment related adult education programs. To assist with business development, RBEGs may fund a broad array of activities. There is no maximum level of grant funding. However, smaller projects are given higher priority. Generally grants range \$10,000 up to \$500,000.

Rural public entities (towns, communities, State agencies, and authorities), Indian tribes and rural private non-profit corporations are eligible to apply for funding. At least 51 percent of the outstanding interest in any project must have membership or be owned by U.S. citizens or resident aliens. Rural is defined as any area other than a city or town that has a population of greater than 50,000 and the urbanized area contiguous and adjacent to such a city or town according to the latest decennial census. At least 51 percent of the outstanding interest in any project must have membership or be owned by U.S. citizens or resident aliens.

The RBEG program is a broad based program that reaches to the core of rural development in a number of ways. Examples of eligible fund use include: Acquisition or development of land, easements, or rights of way; construction, conversion, renovation, of buildings, plants, machinery, equipment, access streets and roads, parking areas, utilities; pollution control and abatement; capitalization of revolving loan funds including funds that will make loans for start ups and working capital; training and technical assistance; distance adult learning for job training and advancement; rural transportation improvement; and project planning. Any project funded under the RBEG program should benefit small and emerging private businesses in rural areas. Small and emerging private businesses are those that will employ 50 or fewer new employees and have less than \$1 million in projected gross revenues.

RURAL BUSINESS ENTERPRISE GRANT PROGRAM - FY 2009 – FY 2011 ¹						
States	2009		2010		2011	
	Amount	Number of Grants	Amount	Number of Grants	Amount	Number of Grants
Alabama	862,540	7	1,186,831	13	1,110,000	11
Alaska	731,023	8	273,837	4	751,000	6
Arizona	668,211	7	721,500	7	372,440	5
Arkansas	1,469,719	9	825,834	6	480,650	5
California	2,789,861	22	1,343,694	14	1,271,000	23
Colorado	366,050	7	411,662	9	368,700	11
Connecticut	212,580	4	256,749	6	223,000	4
Delaware	144,790	4	129,000	3	248,000	6
Florida	765,605	5	1,081,091	7	997,888	6
Georgia	3,155,675	36	1,397,925	17	1,371,999	15
Hawaii	482,668	4	188,056	3	161,000	4
Idaho	301,871	19	373,784	17	337,500	19
Illinois	1,640,384	17	921,955	10	911,000	11
Indiana	594,880	14	923,000	14	910,500	13
Iowa	1,228,549	19	656,250	9	572,800	8
Kansas	551,570	8	612,000	9	452,000	9
Kentucky	2,168,237	9	1,511,000	10	1,092,000	10
Louisiana	1,139,638	9	832,956	5	631,000	4
Maine	3,709,403	19	541,330	7	409,000	7
Maryland	1,657,338	9	312,000	5	1,571,767	7
Massachusetts	466,099	10	236,313	9	263,716	9
Michigan	1,348,670	32	1,371,000	36	1,399,488	37

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Minnesota	1,947,589	19	1,171,999	13	771,000	8
Mississippi	779,394	18	1,085,785	13	898,074	12
Missouri	1,349,200	20	1,062,000	23	959,170	25
Montana	393,953	15	306,000	14	427,585	17
Nebraska	747,939	13	522,030	8	828,177	10
Nevada	228,878	8	245,000	8	504,000	8
New Hampshire	760,817	11	276,000	6	277,560	7
New Jersey	261,340	3	246,900	3	167,308	3
New Mexico	1,234,050	5	386,999	4	529,177	10
New York	1,361,530	13	988,150	13	1,383,233	16
North Carolina	1,297,310	19	1,514,000	19	1,465,542	21
North Dakota	667,741	7	259,991	3	281,225	4
Ohio	1,662,829	13	1,345,000	10	1,302,000	13
Oklahoma	1,808,299	10	795,000	7	1,171,686	13
Oregon	1,866,669	37	618,136	42	867,392	32
Pennsylvania	1,111,520	13	1,268,900	14	1,227,102	14
Puerto Rico	836,310	7	566,704	3	609,313	4
Rhode Island	90,010	2	73,000	2	94,000	1
South Carolina	1,748,120	16	1,183,900	14	1,029,500	16
South Dakota	941,780	13	311,000	5	622,327	7
Tennessee	1,751,149	57	1,204,000	46	1,191,000	34
Texas	3,042,310	14	1,739,000	11	1,402,000	10
Utah	334,330	5	287,999	4	505,900	5
Vermont	2,023,677	22	311,257	11	862,483	15
Virginia	1,213,460	15	954,999	10	857,895	9
Virgin Island	-	-	-	-	-	-
Washington	971,028	12	626,000	8	734,000	14
West Virginia	1,338,630	10	647,000	5	502,000	7
West Pacific	175,000	4	135,373	2	50,000	1
Wisconsin	1,615,136	18	836,000	10	1,174,721	15
Wyoming	171,560	4	129,925	4	183,384	4
Totals	\$60,186,919	701	\$37,205,814	555	\$38,785,202	585

¹Includes ARRA funding.

12.4. Publications

