2015 Pennsylvania State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Penn State's Agricultural Experiment Station (AES) and Cooperative Extension Service (CES) operate in concert within the College of Agricultural Sciences to address present and future needs in agriculture at local, state, national, and international scales.

The College has been proactive in its planning. With our revised departmental structure in place, we have taken bold measures to reduce costs, increase operational efficiencies, and maintain the highest possible level of services for our students and stakeholders.

Our research efforts, as outlined in the College's 2014-2019 strategic plan and our Plan of Work, fall into the planned programs below. The College considers the planned programs to be dynamic and to allow for the development and integration of new scientific approaches. Departmental annual reviews and strategic plans, as well as their signature research areas, also inform the planned programs.

Advanced Agricultural and Food Systems-Transforming thinking and practice in agricultural and food systems through research and extension programming focused on productivity, sustainability, and adaptability.

Biologically Based Materials and Products-Discovering novel approaches to using genetic systems and biological materials for value-added commercial and consumer products. Laying the groundwork for biobased energy and industries in Pennsylvania.

Community Resilience and Capacity-Helping communities improve their economic resilience, create sustainable infrastructures, and promote their local economy through value-added opportunities, new business development, and improved efficiency in established operations.

Environmental Resilience-Providing innovative research and extension programming to enhance and protect managed and natural ecosystems, ecosystem services, and human well-being. Exploring potential issues resulting from global climate change, and possible mitigation and adaptation.

Global Engagement-Providing global solutions to challenges in agriculture, health, and sustainability that impact the future of an interconnected world.

Integrated Health Solutions-Advancing and improving the health of animals and communities through research and extension programming into preventive, corrective, diagnostic, and predictive solutions to challenges presented by food safety, lifestyle, diseases, pests, and toxins.

Positive Future for Youth, Families, and Communities-Providing a wide range of evidence-based programming to support healthy families, build positive youth skills, and strengthen intergenerational relationships within rural and urban communities.

We developed the planned programs by analysis of cross-cutting emerging themes across the College. We solicited and received input from broad internal and external stakeholder feedback, such as from the College leadership advisory groups, topical faculty focus groups, college employees, and the Penn State Ag Council.

We are energized by the interdisciplinary and global nature of the new planned programs. Diverse teams of faculty from the College of Agricultural Sciences are addressing complex societal issues that transcend disciplines to impact people on scales ranging from local to global.

Our planned programs capture the systems approach that we have identified as a key element for generating impact, uniting our research efforts with our extension education capacity. Penn State provides an environment that encourages interdisciplinary work and values outreach to stakeholders. The University has built a framework of university-wide consortia and institutes (e.g., Life Sciences; Energy and Environment; Social Sciences--Children, Youth, and Families; Materials; Ethics; Sustainability), and the College of Agricultural Sciences plays an integral role in these organizations. This interdisciplinary philosophy has reinforced the natural tendency of our faculty and extension educators to work cooperatively to solve problems. Coupled with the joint research-extension appointments of many of our college faculty, our work effectively unites fundamental knowledge with practical solutions delivered to stakeholders. The net result is a tangible benefit in economic prosperity and quality of life for Pennsylvania citizens and beyond.

Our programs continue to focus on high profile problems that, in addition to their impact in Pennsylvania, frequently represent regional, national, and international priorities. Penn State's poultry team is a critical part of the PA highly pathogenic avian influenza task force, along with USDA, PA Department of Agriculture, and others. The task force is working to educate all stakeholders about this potential threat to the state's large poultry industry. Team members are ready to help with testing, depopulation, disposal, composting, vaccination, and a return to business in the event of an outbreak.

The Marcellus team's strong reputation for collaborative work with the U.S. State Department, U.S. Department of Energy, the PA Department of Community and Economic Development, and other state and federal agencies has generated exceptional recommendations for international groups to seek us as unbiased, factual, and unique educational partners. In FY 14/15, governmental delegations from Indonesia, Lithuania, the U.K., Algeria, Bulgaria, Romania, Brazil, Australia, Japan, Argentina, Canada, and Holland visited with the Penn State Marcellus team in PA and indicated that the information learned would influence government policy in their respective country.

PA AES and CES must be responsive to new societal needs, investing our federal funds in a manner that furthers national agricultural goals, but also addressing the local implications of those national priorities. Our outstanding pollinator research group has determined through analysis of beehive samples that inactive ingredients in pesticides seem to do more damage to bees than the active ingredients. Effects of exposure include learning impairment for adult bees and chronic toxicity to larva. The group is calling for risk assessment studies on pollinators for certain pesticide co-formulants.

The College continues to focus our program deliverables, align program priorities with budget realities, excel in research and education on topics of greatest importance to Pennsylvania citizens, operate as a cohesive organization, and be more efficient in our operations.

An explanatory note regarding the report that follows:

- In the planned program descriptions, we highlight specific projects with notable results. Many more projects are underway that are not specifically mentioned in the state-defined outcomes.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	337.9	0.0	552.8	0.0
Actual	460.9	0.0	587.6	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel
- External Non-University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

2. Brief Explanation

Both CES and AES programs undergo comprehensive review utilizing a number of merit review processes.

Internal university panels will be used to review AES projects. The Hatch, McIntire-Stennis, Animal Health, and State projects will be internally reviewed at initiation by at least two qualified faculty. In addition, external university panels are used for Multistate Research Project (MRP) activities. Both extension and academic faculty are encouraged to participate to meet the jointly agreed objectives. These projects are reviewed multiple times through the five-year duration.

External non-university panels are used as new Penn State extension programmatic issues or AES projects are implemented. Stakeholder and/or program advisory groups provide ongoing review of programs to ensure a focus on priority needs as identified by advisory groups. Reviewers' comments provide mechanisms for improving our educational and research programs.

Combined internal and external university panels are assigned to each of the programmatic issues. These panels are integrated, multidisciplinary State Extension Teams (SETs) made up of field-based extension educators and faculty with split appointments in both extension and research. Team members broadly represent all parts of the Commonwealth, and faculty members are chosen to represent relevant research and extension perspectives. Extension Program Leaders provide overall leadership to the SETs, and programs are reviewed by extension administrators. State administrators and academic unit leaders serve as liaisons to each team. Each SET developed a program plan, based on logic model components, that will guide extension programming and applied research efforts.

Combined internal and external university and external non-university panels will be used to create advisory committees for each program team. These panels will assist in identifying issues where expertise

can be applied in program efforts. The work plans will be developed and revised with input from the advisory committees.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Other (County Extension Boards)

Brief explanation.

College administration and faculty advisory groups conferred regularly with key stakeholder groups. The Penn State Ag Council (http://agcouncil.cas.psu.edu) provided us with direct contact to nearly 100 member organizations and groups representing the agricultural industry across Pennsylvania. Also part of the Ag Council membership are such organizations as the Chesapeake Bay Foundation and the County Commissioners Association of Pennsylvania. We sought input for all sectors representing the interests of Pennsylvania citizens. In addition, college leadership met multiple times per year with individual stakeholder groups, such as the Pennsylvania Farm Bureau, PennAg Industries, Pennsylvania Forest Products Association, Pennsylvania Department of Agriculture, etc.

Also in our stakeholder base are state and federal partners, with whom we had regularly scheduled meetings. Examples include Pennsylvania Department of Agriculture, the Pennsylvania Department of Environmental Protection, the Pennsylvania Department of Health, and the US Department of Agriculture's Agricultural Research Service and Animal and Plant Health Inspection Service.

Listening sessions, such as routine meetings with the Penn State Agricultural Council, were held to seek input from the representative traditional and non-traditional stakeholders. The broad representation of the Penn State Agricultural Council was constantly reassessed to ensure that new and traditionally underserved audiences are included.

Targeted invitations to traditional and non-traditional stakeholder groups and/or individuals were used heavily in our extension efforts. Invitations were extended to these stakeholders and members of the general public to identify industry representatives and/or individuals that would formulate program advisory committees (e.g., Ag Business/Economic and Community Development Advisory Committee, Intergenerational Initiatives Advisory Group, StrongWomen program leaders, PROSPER program collaborators, etc.).

Surveys of traditional and non-traditional stakeholder groups and/or individuals were used to collect more detailed information from stakeholders. Sophisticated survey instruments and/or focus groups meetings were implemented and the data collected were summarized and analyzed.

Stakeholder input was continually sought to help set the course for CES and AES programs. Our primary stakeholder input was received through Cooperative Extension. More statewide extension

programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. The results of these assessments were incorporated into our Extension Program SharePoint site and our Extension Program Activity System (EPAS).

Across the state, 197 local extension board member volunteers were engaged.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use External Focus Groups
- Other (External Consultants)

Brief explanation.

Advisory committees, such as program advisory committees at the county, district, and state extension team (SET) level and the University Industry Advisory Committee, assisted our programs with identification and selection of stakeholder individuals and groups. Program advisory committee members were selected to represent program areas, emerging issues, geographic areas, and population diversity. These groups helped extension educators with program design and implementation, which may include identifying resources to support the programs, tailoring the content to specific audience needs, and marketing the programs to targeted audiences and communities.

External focus groups, such as the County Extension Boards, were representative of demographics of the county/district in which they serve, and where appropriate, Hispanics, African Americans, Asians, Anabaptists, or other minorities serve on the groups and provide input to extension programs. Our programs met the needs of traditional agricultural information consumers (i.e., farmers, rural residents), as well as homeowners, newer audiences in urban areas, and, increasingly, those historically underserved by extension.

Penn State Ag Council meetings were publicly announced, and broad representation was constantly reassessed to ensure the inclusion of new and traditionally underserved audiences.

External consultants (i.e., Aspen Group, Fieldstone Innovations, etc.) were contracted to assist in identifying industry stakeholders that can provide leveraging dollars and research opportunities for faculty, and help establish long-term working relationships.

Some extension programs, such as the Center for Private Forests, sought affiliate members and organizations as direct collaborators.

The reorganization of our college in 2013 from twelve departments into nine presented new opportunities to engage or re-engage stakeholders and to fine-tune our stakeholder groups. It also afforded the opportunity to establish new stakeholder groups, such as the BioRenewable Systems Advisory Committee.

Maintaining contact with alumni is an important strategy throughout the College. This helps meet our students' needs for career networking, builds direct links to our stakeholder groups and industries,

and increases the likelihood of leveraging funds in the future. Alumni and friends banquets and football tailgates were common throughout the College, and enjoyed continuing high attendance.

Our faculty served on dozens of state and federal government and professional association boards and groups. Their selection and election to these roles reflects their stature in their fields. They will continue this service.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Survey of traditional Stakeholder individuals
- Survey of the general public
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public

Brief explanation.

To collect stakeholder input, educators or faculty held regularly scheduled meetings, such as advisory groups and Penn State Agricultural Council. Meetings and/or surveys occurred with members of traditional or non-traditional groups, but all are viewed as stakeholders.

Phone and email requests for information from county extension offices provided additional measures of clientele needs. If similar information was requested repeatedly, that is a sign that an issue is of concern to the public.

Individual meetings resulting from office visits, farm visits, etc., allowed stakeholders to provide feedback. During and after extension educational programs, participants may request additional programs or updates, or suggest new topics about which an educational program would be helpful. This input may be verbal only or collected in meeting survey instruments. To collect more detailed information from traditional and non-traditional stakeholders, sophisticated survey instruments or focus group meetings were implemented and the data collected were summarized and analyzed.

More extension programs are collecting long-term follow-up data, surveying participants three months or more after an educational event to gather information about actual changes that have been made, and the associated costs and added values. More extension programs are also translating their results into estimated economic impacts.

Our Ag Council delegates assisted us with identifying and prioritizing a small number of specific learning objectives for extension programs. These were used to populate a post-program evaluation and a longer term customized survey to be sent to individuals approximately 9-12 months after they had completed the extension program(s). The post-program evaluation asked participants what they expected to achieve on specific objectives. The longer term survey garnered self-reports of impacts the individuals have achieved. If an individual attended more than one program, their survey included questions addressing the expected impacts from all programs.

Most departments and extension programs held at least annual meetings with stakeholders to share

updates and gather feedback.

All departments and extension programs maintained websites and distributed regular electronic and/or hard-copy communications and/or social media messages to stakeholders. These avenues allowed stakeholders to provide feedback on new developments.

Many programs held regular field tours (e.g., pasture walks) and site tours, which allowed them to see conditions on the ground and hear from stakeholders directly. For example, the Department of Food Science held regular tours of food industry plants and sites to learn about real-life issues and challenges and to engage one-on-one with stakeholders.

The dean's industry tour series brought some of the College's leaders into some of the state's largest agricultural industry facilities to learn about their challenges and about how Penn State researchers might help. Tours have visited dairies and farms of all types and sizes, paper producers, Marcellus shale natural gas facilities, urban stormwater management projects, and some of Pennsylvania's largest snack food and candy makers.

Some extension offerings meet regulatory requirements, such as the ServSafe course for retail food service and restaurant managers. The fact that companies send employees to participate in these courses year after year indicates a degree of satisfaction with the value of the programs.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities
- Other (How and Where Programs are Offered)

Brief explanation.

• Budget Process: Availability of funding from certain extramural funding sources influenced resource allocations.
• To Identify Emerging Issues: Stakeholder feedback helped to identify emerging issues that would benefit from extension programming and/or research when multiple stakeholders indicated the same need.
• Redirect Extension Programs: Information collected from stakeholders was used to adjust issue areas that determine Cooperative Extension programming. We engaged representatives of the Penn State Agricultural Council as key team members on our internal implementation teams. This served to inform our programs on the real-world demands for new information and programs.
• Redirect Research Programs: Information collected from stakeholder groups, such as industry associations, was used to directly influence applied research activity through local decisions about priorities. We engaged representatives of the Penn State Agricultural Council as key team members on our internal implementation teams. This informed our programs on the real-world demands for new information and programs.
• In the Staff Hiring Process: Information collected from stakeholders influenced hiring decisions for faculty and extension educators to address unmet needs. Stakeholder feedback also indicated

where volunteers and donors would be interested in assisting with programs and initiatives.

- In the Action Plans: Our mission is to serve our stakeholders, so we analyzed the information gathered from stakeholders and adjusted our action plans as needed to meet their needs.
- To Set Priorities: Our stakeholders' priorities must be our priorities, and we adjusted our programs as needed.
- Other - How and Where programs are offered: Stakeholder input directly affects how we offer our extension programs. Feedback indicated that additional methods of program delivery were needed as demands for resources and/or time increased. As a result, educational opportunities are being offered via other methods - podcasts, online webinars, synchronous and asynchronous means - migrating away from the traditional classroom setting. In addition, stakeholder input helped determine the locations and times that extension programs are offered. With the restructuring of extension into statewide efforts (previously county-based), stakeholder need was a deciding factor in where programs are held.

Brief Explanation of what you learned from your Stakeholders

Stakeholder input directly affects how we offer our extension programs. Feedback indicated that additional methods of program delivery were needed as demands for resources and/or time increase. As a result, educational opportunities are being offered via other methods, such as home-study courses, pasture walks, podcasts, and online webinars, via synchronous and asynchronous means, besides the traditional classroom setting. In addition, stakeholder input helps determine the locations and times that extension programs are offered.

Globalization of research efforts, outcomes, and extension is increasingly important. As more and more people travel and the Internet and mobile phones break down barriers to information, scientists are realizing that a crop or technique that works in Pennsylvania might be adaptable to places in Africa, for instance.

Research commercialization, engagement with industry, and economic development are important to our stakeholders. As grant funding becomes tighter, there is greater pressure to raise funds by commercializing research innovations. Some of our programs, such as the Biologically Based Materials and Products team, the Marcellus Education Team, and the Food Science team, are more heavily engaged in this area than others.

The Food Safety Modernization Act and Good Agricultural Practices regulations continue to challenge our stakeholders and drive new and continuing programs. The most recent calls are for training in agricultural water management to meet GAP guidelines.

We are also seeing the tremendous benefits of interdisciplinary teams in solving problems. A group of experts who all bring to the problem a part of the solution can often move beyond the sum of their knowledge. However, this type of collaboration raises new questions as often as it brings about solutions.

We learned that participants need adaptations in programs because many have little money or time available for travel. We have responded with more web-based, home-study, and asynchronous options, and with more programs at the times and in the locations that our audiences prefer.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
10627756	0	7676879	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	10849561	0	7774151	0
Actual Matching	18084966	0	25104480	0
Actual All Other	20765643	0	34182474	0
Total Actual Expended	49700170	0	67061105	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	1958518	0	484026	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	110.8	0.0	32.0	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extension will partner in addressing the issues surrounding childhood obesity and chronic health problems to develop and deliver solutions for our communities. Research programs will focus on unraveling the complex underlying causes of chronic health problems as well as understanding the nutritional composition of foods that contribute to a healthy lifestyle. Economic and policy analyses will

inform efforts to promote sustainability within and beyond our communities. Educational programs, interactive physical activity, and activities designed to attract youth will be conducted in schools, out-of-school locations, camps, and communities. Evidenced-based practices will be utilized to ensure that the programs will be effective and produce positive results. Program partnerships will be strengthened with collaborations within the university, counties, communities, state, other universities, and nation.

A health-centered approach that focuses on the whole child--physically, mentally, and socially--will be used rather than a weight-centered approach. The emphasis is on living actively, eating in normal and healthy ways, and creating a nurturing environment that helps children recognize their own worth and that respects cultural food and family traditions.

A series of educational events and activities will be utilized to reinforce educational information and appropriate behavior practices. Parental and leader involvement will be included as an integral part of programs, highly encouraged and supported. The Harvest 4-Health program in collaboration with the state 4-H program and Master Gardeners, will emphasize growing foods for healthy eating and gardening activities that promote physical activity.

2. Brief description of the target audience

Target audiences include health care professionals, health- and nutrition-related researchers, nutritionists, youth, 4-H members, teachers, school nurses, community groups and volunteers, community recreation and sports directors, parents, and after-school and daycare providers.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Government Regulations
- Competing Public priorities
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	8.9	0.0	25.9	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

The "Climate Change and Renewable Natural Resources" extension program will reach private forest landowners (responsible for 12 million forested acres across the Commonwealth) to increase working knowledge on forest management options for increasing carbon sequestration, mitigation of long-term climate change, reduction of carbon emissions, and potential participation in environmental markets

for ecosystem services. This program will increase understanding of climate change impacts on Pennsylvania's natural resources and increase the ability of forest managers/owners to participate in emerging markets and to offset emissions through improved forest management practices.

Various modes of delivery will be employed for programs within this planned program to incorporate research and extension. The Agriculture and Environment Center (AEC) will offer web and field-based training for practitioners and others who seek to improve water, air, and land quality in working and other landscapes. All programs are designed to highlight and explain the science that informs the research, application, and practices that improve environmental outcomes by preventing or reducing emissions of legacy (nutrients and sediments) and emerging contaminants.

Researchers in Animal Science; Plant Science; Ecosystem Science and Management; Agricultural and Biological Engineering; and Agricultural Economics, Sociology, and Education serve as the content specialists for framing the extension messages for whole farm emissions reduction and GHG mitigation.

Research approaches will identify risk management and communications that will inform working land management options for adaptations of agriculture to climate change, develop tools (online tutorials, information sheets, calculators, etc.) to assist the suite of local, state, and federal agencies and collaborating nongovernmental agencies in the evaluation and selection of management strategies for multiple scales ranging from individual farms/working lands to watersheds and larger basins. Regionally unique collaboration will be sought which will team researchers, extension educators, environmental/conservation/agricultural nongovernment organizations (NGOs), and federal, state, and local governments to find effective solutions to problems and resolution to issues. This approach will broadly seek active stakeholder engagement in both the research elements and tool development.

2. Brief description of the target audience

Target audiences include municipalities, planning agencies, citizens groups and associations, farm and forest managers, conservation practitioners, agriculture and forest industry, local municipalities, energy consumers, civic groups, green industries, nongovernmental organizations, policy makers, and local, regional, state, and federal agencies.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Safety

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	19.1	0.0	12.8	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

High priority will be placed on conducting research to identify causal pathogens. Rapid detection of pathogens combined with an information network to trace the problem to the source is critical for timely intervention. Ensuring the health of Pennsylvania food animals will be an important activity.

Research efforts will be directed toward identification of the bioactive roles for nutrients in normal and abnormal human metabolism and the impact of production and processing methods on nutrient composition of foods. Novel processes for food safety and for production and bioprocessing of bio-based value-added products will be studied, as well as methods to improve the shelf life of processed foods. Dissemination of these research findings as new or continued extension programming will provide a means for individuals, industry, and communities to learn and change.

Workshops will address food safety for producers and processors. The Dairy Hazard Analysis and Critical Control Point (HACCP) Workshop includes the development of the required prerequisite programs, such as Good Manufacturing Processes (GMPs) and Sanitation Standard Operating Procedures (SSOPs), conducting a hazard analysis, identifying critical control points, monitoring procedures, establishing critical limits and corrective actions, and verifying and record keeping procedures. The Food Defense Workshop covers the fundamentals of assessing and managing the risk associated with intentional contamination in food manufacturing facilities. The Food Microbiology Short Course provides insight into the most recent developments of food-borne pathogens, toxins, and contaminants that may occur in a food plant environment. The Better Process Control School (BPCS) certifies supervisors of thermal processing systems, acidification, and container closure evaluation programs for low-acid and acidified canned foods.

Extension programs will be focused on providing the food industry with practical and timely training and recommendations on how to manage the risks with emphasis on prevention and preparedness. The Penn State Food Safety website will serve as a portal for educational information on workshops, seminars, and newsletters that are directed toward specific target audiences for the purposes of education, information sharing, and networking. Maintaining an open dialogue with food professionals in the private food industry will help to focus and emphasize which diet, food, nutrition, and food safety issues should be current priorities.

From the industry perspective, the main protector of our food supply is not regulatory authorities, but the food industry itself. Opportunities provided by extension, which include topics such as Good Agricultural Practices (GAPs) for local producers, HACCP training for food and animal products processors and food services, ServSafe® for retail food, and extensive consumer education, will be conducted. Non-English- speaking worker training will be an important focus of GAPs programs.

2. Brief description of the target audience

Target audiences include human service providers, managers and volunteers of nonprofit organizations, community groups, general public, animal producers, state and local government employees and agencies, youth, produce growers, and owners, operators, managers, and employees of retail and food service or production operations.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Global Food Security and Hunger

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	32.9	0.0	140.8	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extension will partner to identify the changing needs of individuals, families, businesses, communities, and larger populations. Increased market analysis and needs assessment will determine the critical questions and needs of various populations that can be addressed and solved through the land-grant mission. Program advisory groups and other government and nongovernment

stakeholder groups will be encouraged to work collaboratively across disciplines. Transdisciplinary teams will take a more global approach to problems that affect global food security and hunger. There will be an effort to help society understand the interconnected nature and complexity of the food and agriculture system and how the decisions and actions of a single individual may affect others downstream, downwind, across the community, or on the other side of the globe.

We have become a more global community, and we must continue to educate our audiences about the complex food and agriculture system. At the local level, research and extension programs will help producers increase yields and improve the sustainability of production agriculture. Extension education will improve the competitive edge for food producers, processors, distributors, and retailers. Consumer nutrition education will result in a population that is more capable of making food purchasing decisions that will provide a more nutritious, safer, more economical, and healthier diet. Processors will be educated to improve quality control management.

A variety of educational methodologies will be deployed including one-on-one, group education, conferences and workshops, published information, web-based information, and web-based interaction. Teams of scientists, educators, and industry and agency representatives will collaborate to provide a more comprehensive approach than what can be accomplished by any one entity. Market enhancement at the local, regional, and worldwide levels will be a priority. State Extension Teams that focus on animal and plant systems, renewable natural resources, agricultural entrepreneurship, food and health sciences will be engaged in this important program area. Key program priority initiatives that will address this issue include animal welfare and environment, water quality and quantity, food safety and quality, sustainable agricultural businesses, pest prediction and response, and childhood obesity.

2. Brief description of the target audience

Target audiences include agricultural producers, farmers, landowners, commodity organizations, agriculture services/businesses, nonprofit associations/organizations, community groups, consumers, general public, government personnel, human service providers, special populations (at-risk and underserved audiences), students/youth, volunteers/extension leaders, international agencies, international universities, international researchers, global populations, and local, state, and federal agencies.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Sustainable Energy

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	9.1	0.0	13.3	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Plans for Marcellus and Utica shale education programs going forward include outreach and research on a variety of related topics from across Penn State. The Marcellus Shale Center for Outreach and Research has been established to bring the university's broad research and outreach capability together to address issues associated with gas extraction. Educational programs will utilize the expertise

available within the Marcellus Education Team, from other researchers across the University system, and colleagues at land-grant institutions in the Appalachian basin impacted by Marcellus shale development.

From the outreach side, we are planning to enhance and expand the delivery of information via webinars, video conferencing, online content, and through planned in-person seminars. Increased use of public media as an outreach tool is currently expanding, and we have in motion several projects with the public broadcasting units at Penn State to reach the constantly expanding stakeholder audiences throughout the Commonwealth. Research programs will focus on natural resource policies that affect public and private lands as well as energy impacts on natural resources and society. Many of our projects stress management aspects of forest ecosystems, as these represent a significant renewable energy source for both now and in the future. Other projects are directed to feedstock improvement and the continued development of nonfood crops as feedstock sources for sustainable energy. We will continue to participate as strong contributors to the considerable work in sustainable energy that is ongoing across the university.

2. Brief description of the target audience

Target audiences include general public, landowners, energy project developers, state and federal agencies, extension educators, state and local community leaders, energy companies, entrepreneurs, and researchers.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Economic and Community Development

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	68.0	0.0	23.5	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research will be conducted on the sociological aspects of civic engagement, network analysis, and community and family resilience that affect our communities. A significant portion of our research portfolio includes economic studies across a wide range of topics, including rural economic development, marketing, entrepreneurship, and sustainability within the food system. Extension education programs will

focus on the programmatic needs of our stakeholders in the areas of value-added agriculture, issues associated with Marcellus shale gas drilling, municipal planning, and regional and local food systems.

2. Brief description of the target audience

Target audiences include general public, county and municipal planning commissioners, zoning officials, elected officials, policy makers, engineers, agencies and organizations, attorneys, residents, natural gas company personnel, farmers, local merchants, civic leaders, and legislators.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year **Actual**

2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Environmental Management

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	40.2	0.0	85.6	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

A broad range of research and extension activities will be performed in this program area. Policy-makers will be provided with science-based recommendations for regulations and best practices in environmental stewardship. The Pennsylvania Discovery Watersheds Initiative addresses nonpoint source pollution stemming from residential, agricultural, forested, commercial, and municipal sectors. Community-

based tools will be developed to: a) reduce pollutant loads, b) improve local water quality, and c) remove stream impairments. This program will extend lessons learned from targeted pilot watersheds (USDA Showcase Watershed, Conewago Creek) and utilize e-newsletters, webinar trainings, best management practices (BMPs), and innovations in policy, monitoring, and other components of successful watershed programs.

The Pond and Lake Management Program will focus on improving management of water bodies that are important agricultural and recreational resources, but also represent both sources and sinks for water pollutants. This program seeks to educate pond and lake owners about proper construction, management, and state regulations.

The Safe Drinking Water program will educate private water system owners about the proper location, construction, and management of their drinking water supply. General water supply management programs will focus on emerging contamination issues, such as Marcellus shale natural gas drilling and pharmaceuticals in water, and the management of on-lot septic systems. This program utilizes trained volunteers and educators to present drinking water clinics, webinars, online home study courses, portable classrooms, and one-on-one interactions.

Community and Urban Forestry programs will educate the public on consumptive land development patterns and how they affect sustainable natural resources and their provision of ecosystem benefits. Other urban programming will focus on the development of green infrastructure. New odor and nutrient management methods will be developed and implemented to facilitate the balance between agriculture and the environment, enabling productive and integrated animal agriculture that protects and sustains environmental quality.

The Sustaining Pennsylvania's Forests program will focus on how to maintain the health and sustainability of woodlots to provide for future forest health and productivity, including well-planned and executed timber harvests; new value-added, bio-derived products from sources such as woods; and economic analyses of the generation of these products as potential business opportunities in Pennsylvania.

2. Brief description of the target audience

Target audiences include agricultural producers, natural resources managers, policy-makers, nongovernmental organizations, private forest landowners, wood products producers, municipalities, planners, legal professionals, gas drilling company employees, and local, regional, and state agencies.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Food and Fiber Systems

☐ Reporting on this Program

Reason for not reporting

Revised programs after original POW was submitted.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	49.0	0.0	218.9	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

AES research will provide new discoveries and applications to enable solutions to the myriad challenges faced by plant and animal production, processing, and utilization by connecting research questions and approaches in a systems fashion. Beyond technical solutions, our scientists will also conduct research into the sociological, economic, and financial impacts of new and alternative scopes for

farm operations. A large component of this program will involve research and outreach on the biology and management of agricultural pests, reproductive biology of animals, and animal welfare. Extension Program Teams will develop educational materials that translate research into information applicable to solve current and emerging issues for food and fiber systems. Stakeholder groups will create partnerships with extension to extend resources and provide support and advocacy for the needs of agriculture. Multidisciplinary educational intervention will address complex production, marketing, environmental, economic, and societal issues that influence agriculture. Programs will strive to maintain the level of agriculture production, and thus, the economic drivers for individuals, communities, commodity groups, consumers, and the state and nation.

2. Brief description of the target audience

Target audiences include agricultural producers, policy-makers, state and federal agencies, extension educators, agricultural consultants, commodity groups, consumers, teachers, youth, volunteer leaders, parents, farm owners, farm managers, and agribusiness.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2015	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Advanced Agricultural and Food Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
112	Watershed Protection and Management	5%		5%	
301	Reproductive Performance of Animals	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
306	Environmental Stress in Animals	5%		5%	
307	Animal Management Systems	5%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%		5%	
401	Structures, Facilities, and General Purpose Farm Supplies	5%		5%	
402	Engineering Systems and Equipment	5%		5%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
502	New and Improved Food Products	5%		5%	
511	New and Improved Non-Food Products and Processes	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
602	Business Management, Finance, and Taxation	5%		5%	
603	Market Economics	5%		5%	
604	Marketing and Distribution Practices	5%		5%	
605	Natural Resource and Environmental Economics	5%		5%	
610	Domestic Policy Analysis	5%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		5%	
723	Hazards to Human Health and Safety	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	24.7	0.0	20.5	0.0
Actual Volunteer	122.8	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
3466123	0	2982271	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
5427212	0	7948699	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
2932260	0	5821154	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extension program areas employ a systems-based approach to address the complex issues surrounding advanced agricultural and food systems. The drivers for the food and fiber systems are undergoing a fundamental shift that increasingly emphasizes consumer needs and desires. Research and extension programs focus on the farm-to-fork continuum, with emphasis on research-based educational programs for producers and consumers. Our work is responsive to consumers demanding that safe, wholesome food is produced in an environmentally and ethically responsible manner. Increasingly, this translates into growth in organic agriculture and locally grown and raised products. With agriculture as the largest industry in Pennsylvania, Penn State will continue to provide educational science-based programs that improve the profitability and sustainability of production agriculture. An area of growth involves efforts to meet the needs of the emerging specialty brewing industry for specialized grain and apple varieties.

Actions to increase the value of goods and services within the food and fiber sector increase profitability at the local and regional levels. These efforts address the changing societal awareness and interest in animal welfare. Agencies and the consuming public have a heightened awareness and expectation for environmental stewardship in plant and animal production. Producers are informed and educated on best management practices that increase the profitability and sustainability of food and fiber systems in an environmentally acceptable manner.

Consumer desires for high quality, pest- and pathogen-free agricultural products that are produced with a minimum of pesticides are a continuing challenge. Effective pest management strategies in both plant and animal agriculture have been at the heart of Penn State excellence for years. As new pests emerge and as knowledge and rules change, we face a continued need to devise new strategies that acknowledge these changes and take advantage of emerging technologies. The development of monitoring and predictive tools to assess pest presence and spread, the accurate identification of pest species, and the integration

of pest control in other management decisions are all key areas in our AES and CES portfolios.

The major focus of the poultry research and extension team was preparing for and educating about a potential outbreak of highly pathogenic avian influenza. Agents have helped farms write plans to address all aspects of this potential crisis.

There is a focus on mechanization to increase efficiency. A team has been investigating the potential to use electrolyzed oxidizing water for cleaning-in-place of milking systems. The tree fruit and grape team continues to research and develop precision pruning technology.

Another important theme is meeting the needs of traditionally underrepresented audiences, such as female and young farmers, and growers and farm workers whose first language is not English.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Non-Governmental Organizations
- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension.

At least some members of most extension teams answer Ask an Expert questions and use eXtension resources as reference materials to address client questions and acquire personal knowledge when appropriate.

One team member was selected to be a part of eXtension's i-Three Issue Corps with a project for food systems.

The work of the NE-SARE dairy cropping systems team was showcased in an article and videos posted on eXtension (http://articles.extension.org/pages/67614/sustainabledairycroppingsystems).

Poultry team members participated in giving four webinars in association with eXtension during the past year.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	333601	106934	652636	7569

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	9

Patents listed

Serial No. 62/190,303; Filed 7/9/2015; Title: Harvest Assist Device for a Bruisable Product

Serial No. 14/665,229; Filed 3/23/2015; Title: Process and Treatment System for Treating High Phosphorous Containing Fluid

Serial No. 14/810,317; Filed 7/27/2015; Title: Compositions and Methods for Bed Bug Control Using Entomopathogenic Fungi

Serial No. 62/148,310; Filed 4/16/2015; Title: Laser Detection of Fluorescent Marked Substrates

Serial No. 14/768,339; Filed 8/17/2015; Title: Methods for Improving Drought Tolerance in Plants

Serial No. 14/646,250; Filed 5/20/2015; Title: 3D Laser Ablation Tomography and Spectrographic Analysis

Serial No. 62/065,093; Filed 10/17/2014; Title: Methods and Compositions for RNA Guided Multiplex Genome Editing and Other RNA Technologies

Serial No. 62/233,766; Filed 9/28/2015; Title: Methods and Compositions for Genome Engineering and Precision Breeding of Transgene-Free, Genetically Improved Mushrooms and Higher Fungi

Serial No. 62/201,836; Filed 8/6/2015; Title: Benzoxaborole-containing Coating Resistant to Cellulose-support Fungus

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	44	147	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	133983

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in dollar value of Mid-Atlantic area specialty crops, including nursery and greenhouse crops, for every 1% increase in production by Hispanic/Latino and younger growers
2	Potential cost savings if a new patented test that tells dairy farmers whether a cow is carrying an embryo or failed to conceive and requires re-insemination to become pregnant were used once on just 10% of the dairy cows in PA
3	Percentage reduction in operating cost of one complete cleaning cycle, including the material cost and energy consumption, using blended electrolyzed oxidizing water over commercial one-step cleaning chemicals for cleaning-in-place of milking systems
4	Cost in 2010 dollars of implementing the Chesapeake Bay states' watershed implementation plans between 2011 and 2025 to achieve the total maximum daily load and meet applicable federal water quality standards by 2025
5	Finding that to increase tannin content in Mid-Atlantic ciders, cider makers should make judicious use of existing pollinator crab apples, such as Indian Summer and Manchurian, until knowledge of performance of dedicated cider varieties is established for the Mid-Atlantic region
6	Assessment of hydrogen sulfide hazard around manure pits for farms using conventional dairy stall bedding, gypsum bedding, and gypsum bedding with a manure additive treatment
7	Difference in dollars between the profit per cow per year of farms with the lowest breakeven point and the loss per cow per year of farms with the highest breakeven point
8	Total estimated value to participants of livestock production efficiency extension workshops produced from implementation of practices advocated in workshops, assuming that the percentage adoption rates and the average changes in cost or profit reported in retrospective assessments applied to all participants

Outcome #1

1. Outcome Measures

Increase in dollar value of Mid-Atlantic area specialty crops, including nursery and greenhouse crops, for every 1% increase in production by Hispanic/Latino and younger growers

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	66000000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With leveraged funding from the Pennsylvania Department of Agriculture, an extension team created and tested educational programming for Hispanic/Latino and young growers, who represent a promising next generation of specialty crop growers. Goals were to assist these under-served growers in targeting local niche and value-added markets, increasing environmental and socioeconomic sustainability of their enterprises, and developing safe pest control strategies.

What has been done
Team members developed and evaluated the effectiveness of various classroom and hands-on teaching methods, using tree fruit and vegetables as example crops. Teaching strategies for adult learners were evaluated using post-program surveys and interviews. Team members conducted and evaluated bilingual programs in various formats, including in-depth workshops, model demonstration plots, on-line videos, on-farm trainings, and interactive classroom exercises.

Results
Bilingual videos were developed that cover sustainable practices for vegetable and apple production. The top ways Hispanic/Latino growers liked to learn were on-farm demonstrations and learning circles, role plays, special presentations during meetings they already attend, in-depth workshops, on-line courses, problem-solving case studies, and tours of other growers' farms. Suggested ways to improve engagement with Hispanic/Latino growers were to increase use of social media, hold educational events at the farms of Hispanic/Latino growers, hold some networking programs specifically for Hispanic/Latino farmers, and provide interactive formats.

Hispanic/Latino-owned farms increased by 21% from 2002 to 2012. The 2012 PA values of vegetable and fruit production were $112 million and $180 million, respectively. For every 1% increase, there would be a $3 million contribution to the state's economy. Next generation

growers in surrounding states have also participated in bilingual workshops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices

Outcome #2

1. Outcome Measures

Potential cost savings if a new patented test that tells dairy farmers whether a cow is carrying an embryo or failed to conceive and requires re-insemination to become pregnant were used once on just 10% of the dairy cows in PA

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1590000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It takes approximately three inseminations for the average cow to achieve a pregnancy. The average interval between inseminations is dictated by how soon a pregnancy can be detected and is about 40-50 days. Cows need to calve every year to produce milk and be profitable. Dairy farmers like to have cows give birth every 13 months for optimal milk productivity.

What has been done
A new patented test under development tells farmers if a cow is carrying an embryo 18-20 days after she has been inseminated, 10-20 days earlier than is currently possible. The simple blood test detects a protein to determine if a cow has failed to conceive and is "open."

Results
In the 2 months following calving, the cow increases milk production to its peak of 80-120 lb/d and continues producing milk for about 9 months until she is "dried off" to stop milk production and given a 2-month hiatus until her next calving.

To maintain the yearly calving interval, cows need to conceive around 4 months into their lactation. The longer a cow is not pregnant the more it costs dairy farmers, because they are feeding her more and she is producing less milk each day.

If a cow does not become pregnant within 150-175 days, the cost to keep her can become too high and she may be culled for meat.

Detecting an embryo early can save farmers time and between $1 and $3 per day. If the test were used once on just 10% of the dairy cows in PA, the total cost savings would be $1.6 million if we assume an average cost of $2/day over 15 days. With leveraged funding from a Research Applications for Innovation grant from the college, the team is working to bring the test to market.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Percentage reduction in operating cost of one complete cleaning cycle, including the material cost and energy consumption, using blended electrolyzed oxidizing water over commercial one-step cleaning chemicals for cleaning-in-place of milking systems

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	80

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Milk safety is a food safety concern in the U.S., and the cleanliness of on-farm milking systems directly affects raw milk quality. The conventionally accepted four-step procedure for milking system cleaning-in-place (CIP) includes: (1) warm water rinse, (2) alkaline wash, (3) acid wash, and (4) sanitizing rinse prior to the next milking event. Electrolyzed oxidizing (EO) water is an

emerging technology that generates acidic and alkaline EO water by electrodialysis of a dilute sodium chloride solution.

What has been done
EO water can be an alternative for conventional milking system CIP. Recently, a 1-step cleaning process has been adopted on an increasing number of dairy farms that combines the alkaline and acid wash into a less corrosive blended EO water solution to save on chemicals, water, energy, and time. This study evaluated the blended EO water solution for 1-step CIP using a pilot-scale milking system and compared the CIP effectiveness and cost with commercial 1-step CIP chemicals.

Results
Cleaning time, the starting temperature of the blended EO water solution, and the acidic EO water percentage were optimized. Two commercial one-step CIP chemicals were used for comparisons of CIP effectiveness and cost. Results showed that a cleaning time of 17 min, a starting temperature of 59°C, and an acidic EO water percentage of 60% in the blended EO water solution could achieve the required 100% CIP performance and was comparable to the commercial one-step cleaning chemicals. The operating cost of one complete cleaning cycle, including the material cost and energy consumption, using blended EO water was 80% lower than using the commercial one-step cleaning chemicals. Overall, this study demonstrated that blended EO water has potential to be adapted as an alternative for one-step CIP for milking systems and possibly other food processing equipment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Cost in 2010 dollars of implementing the Chesapeake Bay states' watershed implementation plans between 2011 and 2025 to achieve the total maximum daily load and meet applicable federal water quality standards by 2025

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Chesapeake Bay total maximum daily load (TMDL) calls for reducing N, P, and sediment loads from agriculture by 22-37% of 2009 and 2011 levels to meet water quality standards by 2025. The allocation of these reductions varies across jurisdictions and basins. Each state describes how it intends to meet the reductions in a watershed implementation plan (WIP). Concerns have emerged about the costs of achieving the TMDL and who will pay to do so.

What has been done
The researchers conducted a study to estimate costs to agricultural producers of WIPs developed by Chesapeake Bay states to comply with the bay total maximum daily load and potential cost savings that could be realized by a more efficient selection of agricultural best management practices (BMPs) and spatial targeting of BMP implementation. Agriculture is the largest source of nutrients and sediment to the bay.

Results
The cost of implementing the WIPs between 2011 and 2025 is estimated to be about $3.6 billion (in 2010 dollars). The annual cost associated with full implementation of all WIP BMPs from 2025 onward is about $900 million. Significant cost savings can be realized through careful and efficient BMP selection and spatial targeting. If retiring up to 25% of current agricultural land is included as an option, bay-wide cost savings of about 60% could be realized compared to the WIPs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #5

1. Outcome Measures

Finding that to increase tannin content in Mid-Atlantic ciders, cider makers should make judicious use of existing pollinator crab apples, such as Indian Summer and Manchurian, until knowledge of performance of dedicated cider varieties is established for the Mid-Atlantic region

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The burgeoning hard cider market saw sales skyrocket 71% in 2014, and is continuing a steady and sustainable growth trend for 2015 and 2016. The U.S. cider industry is well poised to become a big player in the beverage arena. However, the chemical characteristics relevant to hard cider production of commonly grown processing apples in the Mid-Atlantic region are not widely reported, especially with respect to tannin content.

What has been done
A study examined the chemical characteristics of some important processing apples grown in the Mid-Atlantic region to assess their suitability to production of hard cider. Another objective was to compare these common processing varieties to some dedicated hard-cider varieties and some pollinator crab apples.

Results
Tannin content for dedicated cider varieties not exposed to pulp after juicing averaged 2,894 mg/; dessert varieties averaged 439 mg/L. Average tannin content of the two crab apple varieties tested was 12,496 mg/L, more than 4 times higher than the cider apple average. Cider makers wishing to increase tannin content in Mid-Atlantic ciders make judicious use of existing pollinator crab apples, such as Indian Summer and Manchurian, until knowledge of performance of dedicated cider varieties is established for the Mid-Atlantic region.

Penn State Extension recently released the Hard Cider Guidebook, with leveraged funding from the PA Apple Marketing Program, the State Horticultural Association of Pennsylvania, and the USDA Specialty Crop Block Grant program. It walks new cider makers through the steps to register their business with regulatory agencies. The guide will help grow Pennsylvania's hard cider industry, providing renewed opportunities for process and fresh market apple growers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #6

1. Outcome Measures

Assessment of hydrogen sulfide hazard around manure pits for farms using conventional dairy stall bedding, gypsum bedding, and gypsum bedding with a manure additive treatment

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Gypsum recycled from manufacturing and construction waste is used for dairy bedding. This material absorbs moisture, inhibits bacterial growth, and upon land application, adds Ca to soil and reduces P runoff. But the sulfate in gypsum under anaerobic conditions can be microbially converted to hydrogen sulfide (H2S) gas, which settles in low areas such as manure pits. H2S is released in bursts during manure agitation. The rotten egg odor goes undetected at dangerous levels or after long exposure.

What has been done
Gas concentrations were monitored around outdoor open-air manure storages immediately prior to and for up to two hours after manure agitation began. Three types of farms were monitored based on their bedding management: 1) conventional dairy stall bedding; 2) gypsum bedding, and 3) gypsum bedding with a manure additive treatment. Findings were from 10 farms during 19 events.

Results
The use of gypsum bedding increased H2S gas release during manure agitation to dangerous levels near the storage. Almost no H2S was found near the nongypsum dairy manure storages. Some additive-treated manure and crust-free manure reduced H2S emissions during agitation. Operators with highest H2S exposure were very close to agitation. The first 30-60 minutes of agitation is the most dangerous, even near open-air outdoor manure storages.

Penn State Extension has launched an educational campaign to make users aware of required safety precautions. They advocate using portable gas monitoring instruments to detect hazardous situations. Nonessential people, especially children, should be kept away during agitation. Manure storages should be secured against unauthorized entry and rescue and fall protection

should be provided. Gypsum benefits for cow bedding and agronomic values must be balanced against the potential gas hazard.

4. Associated Knowledge Areas

KA Code	Knowledge Area
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
401	Structures, Facilities, and General Purpose Farm Supplies
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

Difference in dollars between the profit per cow per year of farms with the lowest breakeven point and the loss per cow per year of farms with the highest breakeven point

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1960

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Insights on dairy farm profitability and sustainability can be gleaned via a big-picture assessment. Collecting detailed information on all aspects of the farm allows the examination of trends related to cropping practices, hybrid selection, feed management, and nutrition. It is difficult to pinpoint why cropping costs are out of line or why forage quality is consistently low unless expenses are itemized and can be related back to management.

What has been done
With leveraged funds from USDA's Risk Management Agency, the dairy research and extension team is conducting advanced cash flow calculations for about 60 PA dairy farms representing a range of operations and production systems. With 3 years of data, they determine the breakeven cost of production, including costs of crop and feed management. They analyze the whole farm system to look for common themes among farms with low breakeven points. Corn silage, manure, and milk are sampled to analyze nutrient flows.

Results
The difference in feed costs between farms with high and low breakeven points is about $600/cow/year. Producers with a positive feed and crop balance combined with efficient milk production have the most competitive breakeven costs of production. Farms with lower breakeven points have lower feed costs and minimize off-farm purchases of feed. Controlling forage quality and quantity increases the opportunity for an operation to use precision feeding management, which is an effective best management practice both for the bottom line and for the environment.

Farm income comes primarily from milk sales, so production must remain high quality and at profitable levels for each production system. By chance, the 3 years of the study have seen a wide range of milk prices, so production is analyzed under varying market conditions.

For 2015, farms with the lowest breakeven point earned $892/cow/year in profit, whereas farms with the highest breakeven point lost as much as $1,068/cow/year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
302	Nutrient Utilization in Animals
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #8

1. Outcome Measures

Total estimated value to participants of livestock production efficiency extension workshops produced from implementation of practices advocated in workshops, assuming that the percentage adoption rates and the average changes in cost or profit reported in retrospective assessments applied to all participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	248561

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

With the increasing costs of production, livestock producers must improve efficiency to remain profitable and sustainable. They can do this by making a series of small changes to various aspects of herd management.

What has been done

The livestock research and extension team's educational efforts related to reproduction, feeding and nutrition, health care, marketing, and financial analysis. Some of the programs offered included home-study courses; cattle feeder seminars; shearing schools; webinars; on-farm field days, visits, and assessments; workshops; and certification trainings. Follow-up evaluations were sent to some program participants to assess changes they made to their operation to improve production efficiency (response n=112).

Results

90% of respondents indicated they had already made changes. 31% decreased feed costs, for an average savings of $685/farm. This change equates to $60,734 across all participants in those programs. 27% of respondents improved the survival rate of young animals born on the farm, a change equating to $119,146 in increased income across all program participants. Beef producers declared an average increased income of $1,750/farm from knowledge gained during certain winter meetings. This equates to $42,000 in increased income across all meeting participants. Beef producers who changed their handling systems to improve calf value saw a $65/head increase, resulting in $13,650 in additional revenue. Producers assisted with calf marketing saw an average increase of $81/head, for total additional income of $10,981. These and other minor changes bring the approximate total economic impact of the livestock programs for FY 2015 to $248,561. These changes also represent environmental improvements.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management
603	Market Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

Natural Disasters (drought, weather extremes, etc.)
-External factors such as the highly pathogenic avian influenza (HPAI) epidemic created a need for time to produce educational displays, materials, and presentations to help in the education of our poultry industry and others.
Economy
-Lack of a state budget meant that our travel budgets were reduced in face of increased need for travel, meetings, and materials.
-The dairy industry was affected greatly after 2008, and we continue to see farmers and the industry in economic hardship.
Appropriations Changes
-Reductions in state appropriations have shifted a portion of team resources from the development and dissemination of statewide educational programs to applying for extramural funding to enable salary savings and leveraging of limited appropriated dollars.
Public Policy Changes
-The 2014 Agricultural Act (Farm Bill) replaced former milk price support with the Margin Protection Program for dairy producers. This new program was quickly implemented and dairy producers were in need of quick education and support from extension.
Populations changes (immigration, new cultural groupings, etc.)
-Population changes continue to drive the need to make more extension offerings available in other languages.
Other - Extramural Funding
-Extramural funding in the form of an Agriculture and Food Research Initiative Competitive Grant (no. 20156800423131) from the USDA National Institute of Food and Agriculture for "Prevention and Control of Poultry Respiratory Diseases" was timely in supplying monies for creation and production of posters and pamphlets for distribution at fairs.
-Additional funding from the PA Department of Agriculture was secured through a collaboration between Penn State Extension, the PA Cattlemen's Association, the PA Beef Council, and the Center for Beef Excellence. This allowed us to bring an increased presence to underrepresented regions of the state.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Biologically Based Materials and Products

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	9%		7%	
102	Soil, Plant, Water, Nutrient Relationships	9%		7%	
123	Management and Sustainability of Forest Resources	9%		8%	
125	Agroforestry	9%		10%	
205	Plant Management Systems	7%		10%	
402	Engineering Systems and Equipment	15%		8%	
404	Instrumentation and Control Systems	9%		10%	
511	New and Improved Non-Food Products and Processes	9%		10%	
603	Market Economics	8%		10%	
605	Natural Resource and Environmental Economics	8%		10%	
607	Consumer Economics	8%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	11.9	0.0	1.9	0.0
Actual Volunteer	3.9	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1645037	0	277559	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2909613	0	873859	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2094465	0	776703	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research into biologically based materials and products includes the evaluation of winter rye as a bioenergy feedstock, the formation of better quality switchgrass pellets, and a study to determine the effect of harvesting corn stover in continuous corn or corn-soybean rotations on yields, soil nutrients, and the potential for cover crops to mitigate negative impacts of stover harvest.

Other scientists are investigating and developing sustainable technologies to convert biomass resources into chemicals for medicine, energy, materials, and other value-added products. A team has used genetically transformed yeast in a biofilm bioreactor with supports made partially of agricultural by-products to synthesize human lysozyme, which has applications in infant formula, personal care products, and food preservation. Another group is optimizing anthracite briquettes with plant by-products as an ecofriendly fuel for foundries.

Still other researchers conducted an olfactory assessment of various dairy manure land application methods.

Extension work includes using leveraged funding from the U.S. Forest Service to begin developing a state wood energy team that promotes the sustainable use of wood as a statewide, top-tier energy resource; and organizing and hosting on-site field days, demonstration site tours, individual site visits, and other on-site educational opportunities, as well as webinars, newsletters, and other online outreach programs.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Local, Regional, State, and Federal agencies
- Military
- Policy Makers

3. How was eXtension used?

eXtension's Sustainable Farm Energy Community of Practice continued to serve as a vehicle for program material. Outputs from the regional Farm Energy IQ project are hosted on the eXtension site (http://articles.extension.org/pages/72595/northeastfarmenergyiqcurriculum).

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	199956	14226	580501	519

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	5

Patents listed

Patent # 9,003,983; Serial # 13/443,339; Title: Apparatus and Method for No-Till Inter-Row Simultaneous Application of Herbicide and Fertilizer, Soil Preparation, and Seeding of a Cover Crop in a Standing Crop

Patent # 9,095,840; Serial No. 13/733,770; Title: Nitrogen-Containing Activated Carbon Material

Serial No. 62/165,866; Filed 5/22/2015; Title: Multi-Surfactant Systems

Serial No. 14/685,938; Filed 4/14/2015; Title: Apparatus and Method for No-Till Inter-Row Simultaneous Application of Herbicide and Fertilizer, Soil Preparation, and Seeding of a Cover Crop in a Standing Crop

Serial No. 14/810,317; Filed 7/27/2015; Title: Compositions and Methods for Bed Bug Control Using Entomopathogenic Fungi

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	25	35	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	36997

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Creation of state wood energy team

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As recognition of the environmental and global security impacts of concentrated fossil fuel use is more widely acknowledged, facilitating a shift toward carbon-neutral, "homegrown" alternatives is a logical step forward.

What has been done
The Pennsylvania wood energy team is a three-year US Forest Service-funded group that promotes and assists the sustainable use of wood as a statewide, top-tier energy resource, able to compete toe-to-toe with traditional fossil fuels. Penn State Extension is partnering with forest owners (public and private, including the Allegheny National Forest), end users, manufacturers, and forest and energy professionals to further the cause of sustainable wood energy in the state.

Results
The state wood energy team is a major new effort that will benefit Pennsylvanians seeking to sustainably use local forest resources for renewable energy and improved forest management. The team seeks to align statewide interests in wood energy use to help make it a tier-one energy resource. The team is:
-leading educational efforts to highlight the benefits of wood energy
-identifying quality project opportunities and helping them move forward
-providing guidance and leadership in the development of well-grounded public policy that enhances the public's ability to embrace wood energy
-maintaining up-to-date information resources so that champions of wood energy can become and remain local experts on the benefits it can bring to the community
-developing a commodity market price for biomass wood energy.

This project will build the underpinnings of a functional biomass wood energy market in Pennsylvania. The potential impact is easily in the millions of dollars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
603	Market Economics
605	Natural Resource and Environmental Economics
607	Consumer Economics

Outcome #2

1. Outcome Measures

Assessment of sustainability of corn stover harvest strategies in Pennsylvania

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop residues are an important source of biomass feedstock. Corn stover provides environmental benefits--reduced soil erosion, maintenance of soil carbon, and reduced loss of water by evaporation. If corn stover is removed for biomass feedstock, there is concern that some or all of these benefits may be diminished and affect crop yields. However, stover can also interfere with planting, delay planting by keeping soils cool and wet, increase fertilizer needs, and harbor pests and diseases.

What has been done
Penn State researchers conducted a study to determine the effect of harvesting corn stover as a biomass feedstock in continuous corn or corn-soybean rotations on corn grain and stover yields, soil carbon, nitrogen, phosphorus, potassium, and the potential for cover crops to mitigate negative impacts of stover harvest.

Results
Although stover harvest had no significant effect on corn grain yields in continuous corn, it tended to increase yields in years with wet springs and decrease them in dry years. In the corn soybean

rotation, 100% stover removal always resulted in lower grain yields. Harvest index varied from 0.45 to >0.6 over 5 years. The lowest HI values occurred in response to late summer drought and the highest in response to early summer drought. In most cases, 60% soil cover was maintained in fall and spring with 50% corn stover harvest. Without a rye cover crop, surface residue for 100% stover harvest ranged from 20-30%, but it was >40% when rye was established promptly in fall. Soil carbon was similar across stover removal levels, crop rotations, and cover crops, as were soil N, P, and K concentrations, because of fertilizer additions. Based on crop yield, surface cover, and soil nutrient responses, partial stover removal could be sustainable under typical climate and management practices in PA.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #3

1. Outcome Measures

Investigation of impact of switchgrass feedstock characteristics and operational parameters on pellet quality, plugging tendency, and pelletizer energy use for a small-scale pelletizer suitable for on-farm use

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Biofuels pellets made of materials other than wood are difficult to find. A reliable, cost-effective process of manufacturing durable pellets at large scale is still being refined. Pellets must stand up to transportation, rough handling, and long-term storage without breaking apart. Pellets that open before they're burned contribute to clogged equipment, poor combustion efficiency, and dust hazards.

What has been done

The renewable energy team is working to overcome some of these obstacles. The impact of feedstock characteristics (moisture content, additive content) and operational parameters (die temperature, pelletizer speed) on pellet quality, plugging tendency, and pelletizer energy use was investigated for a small-scale pelletizer suitable for on-farm use (about 70 kg/hr rated output). Pellet quality and plugging tendency were assessed using a subjective pellet quality scale.

Results
Results indicate that successful pelleting conditions were most consistently achieved by using a "premix" consisting of ground switchgrass and Distillers Dried Grains in a 3:7 ratio (mass basis) to condition the die, followed by the actual feedstock mixture. The highest quality pellets were obtained from switchgrass with moisture content ranging from 12% to 18% (wet basis). Adding between 1% and 4% vegetable oil improved pellet appearance, but adding starch (1-5%) to the switchgrass feedstock did not yield quality improvements. Reducing the operating speed of the pelletizer resulted in improved pellet quality. Feedstock moisture content was positively correlated to pellet production rate and negatively correlated with pelletizer energy use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
125	Agroforestry
402	Engineering Systems and Equipment

Outcome #4

1. Outcome Measures

Optimization of conditions for producing human lysozyme in biofilm reactor

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lysozyme is a natural antimicrobial that kills Gram positive microorganisms. It is found in tears, saliva, breast milk, and chicken eggs. For babies that are not breast fed, lysozyme produced in chicken eggs is often added to infant formulas, but the chicken variety has low activity compared to human lysozyme. Infants with allergies to egg can't consume this type of formula, leaving them without this important aid to the immune system.

What has been done
Other researchers transferred the gene for human lysozyme production into yeast. The Penn State team used this yeast in a biofilm bioreactor with composite supports made of plastic and various agricultural by-products (e.g., soybean hulls, bovine albumin). They worked to optimize operating conditions, such as temperature, pH, agitation, the supply of lactose for "food" for the microorganisms, and the composition of the supports on which the biofilms grow.

Results
As a result of the optimization experiments, human lysozyme can be produced at a rate almost four times higher than at the start of the work. A commercial company could use the knowledge generated to produce human lysozyme for addition to egg-free infant formulas, or for other high-value uses, such as in wound-healing cream and eye drops, or as a food preservative.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems
511	New and Improved Non-Food Products and Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Other (Extramural Funding)

Brief Explanation

Economy
-Falling fuel prices dulled interest in renewable energy.
Public Policy
-Public policy uncertainty and controversies have stifled private investment in renewables, especially advanced biofuels. Stabilization of the policy framework could release significant pentup demand for biofuel development.
Extramural Funding
-Some of our programs are affected by extramural funding, either by adding resources to promote them or by shaping the content of the product.
-Extramural funding directed much of our efforts, including the Northeast SARE grant-funded Farm Energy IQ program, the AFRI CAP NEWBio project, and the US Forest Service-funded state wood energy team.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through

extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Community Resilience and Capacity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
404	Instrumentation and Control Systems	15%		10%	
602	Business Management, Finance, and Taxation	10%		15%	
604	Marketing and Distribution Practices	15%		10%	
605	Natural Resource and Environmental Economics	15%		10%	
607	Consumer Economics	11%		10%	
608	Community Resource Planning and Development	14%		15%	
902	Administration of Projects and Programs	10%		10%	
903	Communication, Education, and Information Delivery	10%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	2.9	0.0	3.6	0.0
Actual Volunteer	0.8	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
425892	0	606511	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
699990	0	904831	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
394240	0	761093	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research in this planned program ranges from the study of farm markets and the market for organic products, to sustaining Pennsylvania's forests, to prescription drug abuse among rural vs. urban teens. A team has assessed the impacts of wine bottle labeling, profiled the preferences of wine drinkers, and identified factors that make people more likely to participate in wine-tasting tourism. Other teams assessed the economic resilience of counties nationwide in the wake of the Great Recession, analyzed the impacts of Marcellus shale natural gas drilling on hotel revenues, studied the challenges and opportunities that come to local governments with Marcellus drilling, and evaluated the impacts of the natural gas boom on employment patterns.

Extension work related to Community Resilience and Capacity is also diverse. The Marcellus education team is developing new programs to meet continuing needs in mineral management, gas utilization, and global implications of shale energy. The team continues to work with local and international governments and with leaseholders and citizens to address issues arising from natural gas drilling, including royalties management, road and pipeline siting and maintenance, and water quality. The Food for Profit workshops continue to be very popular, and leveraged funding from USDA-SARE recently allowed a retrospective analysis of long-term outcomes stemming from the workshops. The economic and community development extension team runs workshops on successful grant writing for nonprofits and local governments, as well as workshops for people who think they may want to run for elected office. Other Extension programs focus on economic improvement through value-added opportunities, increased efficiency and knowledge (see lumber grading example below), and the inclusion of all costs when figuring pricing (see landscape service example that follows).

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Military
- Non-Governmental Organizations

- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension.

Some extension team members fielded "Ask an Expert" questions, participated in a learning network or innovation hub/tank, and looked up information at extension.org. One member broadcast a webinar listed at learn.extension.org. Additionally, eXtension is referenced as an additional resource for information to support topic areas for workshops. Some teams also used eXtension as a resource of information for clientele.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3926	250	2858	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	1	36	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	8194

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Analysis of likely wine-tasting event participants based on demographics, psychographics, and behavioral characteristics, allowing agritourism operators to enhance marketing efforts and develop profitable on-farm agricultural activities
2	Dollar value of public sector and nonprofit group grants obtained after attendance at a Penn State Extension Making the Most of Your Grant Writing Efforts workshop
3	Increase in dollar value of kiln-dried lumber from PA mills from knowledge gained about lumber grading from a Penn State extension short course that produced a 20% increase in grading accuracy
4	Minimum amount (in $) by which 22 Pennsylvania businesses that sent a participant(s) to the Penn State Extension landscape contractor estimating and bidding course from 2007 to 2015 had collectively increased their net returns in the first 9 months following the course

Outcome #1

1. Outcome Measures

Analysis of likely wine-tasting event participants based on demographics, psychographics, and behavioral characteristics, allowing agritourism operators to enhance marketing efforts and develop profitable on-farm agricultural activities

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Small family farms in the U.S. recognize the need to broaden offerings to remain or become economically sustainable. They must be creative and diversify farm activities through value-added products and/or services, and identify new markets. Deciding what agritourism activities could attract visitors can be a daunting task. With the proliferation of wineries in the Mid-Atlantic, researchers were interested in investigating consumer attitudes and behaviors pertaining to wine tourism. Tasting room visits were up by an average of 8 percent in 2012 compared to that in 2011.

What has been done
A study was completed to determine the likelihood of Mid-Atlantic region consumers' willingness to partake in a wine-tasting event based on their responses to an Internet survey. Potential participants were screened and asked to participate if they resided in Delaware, New Jersey, or Pennsylvania; were aged 21 years or older; were the primary food shopper for the household; and had previously attended an agritourism and/or direct marketing event or activity.

Results
A statistical model was developed based on responses from 972 consumers who completed the Internet survey to predict participation in wine-tasting activities. Consumers who are more likely to attend an on-farm wine-tasting event include those who learn about agritourism events through newspapers, think that the variety and price of produce is better at direct markets than supermarkets, are older than 50, have a graduate degree, and are self-employed. These results will help agritourism operators enhance marketing efforts and develop profitable on-farm agricultural activities by identifying consumer segments likely to participate in wine tourism activities. This study allows marketers to target likely buyers based on corresponding

demographic, psychographic, and behavioral characteristics. According to a 2004 survey, agritourists in Pennsylvania spent approximately $120 per visit. Pennsylvania ranked third in the country in farm direct to consumer sales in 2012, at $86 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
607	Consumer Economics
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Dollar value of public sector and nonprofit group grants obtained after attendance at a Penn State Extension Making the Most of Your Grant Writing Efforts workshop

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	2918200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Economic conditions have affected Pennsylvania communities and organizations in numerous ways. Many declining line items in state and federal budgets have resulted in dwindling resources for local governments and community organizations. As a result, these entities often need to increase their capacity to search for and receive private and public grants.

What has been done
The Penn State Extension economic and community development team offers the Making the Most of Your Grant Writing Efforts workshop. This program breaks the grant writing process down into workable strategies. It includes areas such as making the most of your search efforts and the components of an effective proposal. In the 2015 program year the program was conducted 19 times for 523 participants. A long-term follow-up evaluation (six months to two years) was also conducted in 2015.

Results
Of 93 survey respondents, 84% believed the program increased their organization's ability to

meet its grant writing needs. The program contributed to the success of participants receiving $2.9 million in grant funds. Respondents reported that the funding received lessened the burden of fundraising on the organization and was used for expenses such as educational programing; transportation; construction of facilities; needed software; preparation of display materials; and publication of educational materials. The funds allowed an agency to employ 2 people part-time and another agency to begin museum design and construction. Grant funds paid for infrastructure projects in the community, such as wheelchair-accessible sidewalks, and allowed a community to keep the doors of their shelter open.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
902	Administration of Projects and Programs
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Increase in dollar value of kiln-dried lumber from PA mills from knowledge gained about lumber grading from a Penn State extension short course that produced a 20% increase in grading accuracy

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	8693952

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pennsylvania is the leading producer of hardwood lumber in the country. In 2006 production was over 1.1 billion board feet of lumber and the industry employed 128,000 people. The recent economic downturn hit the industry especially hard; lumber production dropped to around 500 million board feet in 2010 and employment fell to 62,000 people. Many skilled employees were lost. With the economy turning around production is on the rise and workers with lumber skills are in demand.

What has been done

Extension offers several workshops designed to give wood products workers the skills they need to improve efficiency and quality. A 3-day kiln drying of hardwood lumber course trained 20 personnel on how to dry hardwood lumber for efficiency and quality. Penn State Extension also worked directly with several companies in Pennsylvania to improve their drying quality by developing drying schedules to correct problems they were having. A 4-day hardwood lumber grading course was also held with 13 participants.

Results

Seventy-three percent of participants of the lumber grading workshop indicated that they would be able to improve the quality of lumber grading at their facility as a result of attending. Based on a pre- and post-workshop grading test, participants improved grading accuracy by 20%. Based on numbers provided by the participants, the facilities they work at represent 70 million board feet of lumber graded annually. The value of the lumber is approximately $71 million based on average kiln-dried lumber prices for 1-inch-thick, #1 common lumber of 7 common species in Pennsylvania. The 20% increase in grade accuracy amounts to $8,693,952 for the companies based on the pre- and post-tests. Given that Pennsylvania mills produced about 1.2 billion board feet of lumber in 2012, if we extrapolate statewide, Pennsylvania mills could increase their revenues by $149 million if every mill sent a grader to this workshop and they experienced similar increases in accuracy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
404	Instrumentation and Control Systems
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Minimum amount (in $) by which 22 Pennsylvania businesses that sent a participant(s) to the Penn State Extension landscape contractor estimating and bidding course from 2007 to 2015 had collectively increased their net returns in the first 9 months following the course

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1551000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The green industry is made up of businesses of varying sizes, but collectively they provide many local jobs. Although there is a lot of opportunity, landscape companies often fail in their first few years because proprietors lack the business skills needed to be profitable and competitive. Even established companies can benefit from re-examining their estimating methods.

What has been done
In 2015, a 2-day course was held in 2 locations for landscape estimators to explore the true costs of their business. The course, taught by the owner of a successful landscaping company, covered how to determine business overhead and incorporate overhead figures into billable cost by working through a bid on a small hardscape installation. A total of 39 people participated. Twenty-two returned a written survey at the end of the course. Eleven returned a follow-up survey 9 months after the class.

Results
Participants indicated on a 5-step scale how important they thought it was to figure true costs into their estimates. Their perception of how important this was increased by 60% before vs. after the course. Again on a 5-step scale, participants were asked to indicate their level of confidence that their estimates are as accurate as possible. Their average confidence level increased by 78% before vs. after the course. Before the course 23% included all overhead in their estimates, 14% added a realistic profit margin to estimates, and 18% included their direct costs in estimates. At the end of the course, 100% of the professionals said they planned to use these good estimating practices in the future. Participants in this course from 2007 to 2015 representing 22 Pennsylvania businesses replied in a 9-month follow-up survey that they had collectively increased their net returns by at least $1,551,000 in the first 9 months following the course.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

Natural Disasters (drought, weather extremes, etc.)

-Adverse weather factors continued to influence clientele participation. The extremely cold winter of 2015 led to numerous cancelations.

Economy

-Economic conditions have affected Pennsylvania communities and organizations. Declining line items in state and federal budgets have resulted in dwindling resources. These entities have a need to increase their capacity for searching for and receiving grants.
-The state funding situation has limited our ability to obtain new resources from the state. However, windfall gains from shale gas drilling have affected some of our programs positively.
-Increasing costs forced increases in the price of some programs.
-The economic impacts of the introduction of shale energy have been historic. This is true domestically, with over half of dry natural gas production in the U.S. now being sourced from shale, as well as geopolitically, as less energy is imported into the U.S., allowing more flexibility in foreign policy. PA is now the leader nationally in shale gas production and #2 in total natural gas production.
-Many landscape contractors are booked far in advance thanks to an improving economy. Now one of the challenges is getting enough plant materials to fulfill their contracts, as there has been consolidation in the nursery industry.
-Some people are seeking alternative income opportunities, which is an advantage for many of our programs.

Public Policy Changes

-Oversight of food and farm businesses at all levels of government affects our program efforts, and we must stay current.
-Public policy changes have increased interest in green infrastructure.

Government Regulations

-Government regulations have been evolving in PA and other states with shale development. There is a need to explain the technical, community, and economic impacts related to the changes. The Marcellus team assists elected officials in understanding the technologies and the corresponding implications to environmental health.
-Changes in government regulations in the natural gas industry require education on related impacts.
-Changes to pesticide laws by EPA and PDA that are starting next year are driving more people to take their pesticide license exams before the changes are implemented. These changes are likely to drive more people to preparation courses and pesticide update sessions.

Competing Programmatic Challenges

-Most staff members are stretched very thin due to multiple needs from various producer or industry groups. The small staff is working to prioritize issues.

Population Changes

-The number of native Spanish speakers is on the rise. Our programs must adapt to be relevant to that audience.

Other - Extramural Funding

-We have been reasonably successful in generating extramural funding to support many aspects of our work. This has led to increases in our food business programming.
-Extramural funding of the Marcellus team expanded and fostered additional programming with our clientele (e.g., royalty/mineral management programs, global shale awareness training, and pipeline right-of-way programs).

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Environmental Resilience

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	5%		5%	
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
111	Conservation and Efficient Use of Water	5%		5%	
112	Watershed Protection and Management	5%		5%	
123	Management and Sustainability of Forest Resources	5%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
135	Aquatic and Terrestrial Wildlife	5%		5%	
136	Conservation of Biological Diversity	5%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		5%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	5%		5%	
215	Biological Control of Pests Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	5%		5%	
306	Environmental Stress in Animals	5%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%		5%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
405	Drainage and Irrigation Systems and Facilities	5%		5%	
511	New and Improved Non-Food Products and Processes	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
723	Hazards to Human Health and Safety	5%		5%	
903	Communication, Education, and Information Delivery	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	10.6	0.0	11.8	0.0
Actual Volunteer	2.5	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1494061	0	1697226	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2476138	0	5934197	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1993890	0	10048339	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Environmental quality is affected by a broad spectrum of activities, including agricultural practices; natural gas drilling; forest resources, wildlife, and fisheries management; land use decisions; population dynamics; and recreation--all likely to be influenced by climate change. Research and extension programs focus on the protection, enhancement, and restoration of environmental resources to develop sustainable management approaches for the use and preservation of these resources. In the agricultural sector, producers manage soil resources, balance nutrients, and protect air and water quality, while maintaining production efficiencies and meeting environmental regulations. Recent research evaluated the effects of surface water withdrawals for Marcellus shale natural gas development on fish and macroinvertebrates in the Susquehanna River basin.

Pennsylvania has significant forest resources, 70% of which are under private ownership. The economics of land use and balancing timber production with recreation, wildlife management, environmental degradation, and land development pressure are critical issues facing PA forest landowners. Local and state governments and nongovernmental organizations in partnerships with AES and CES work together to develop and implement policies based on science for the effective management of natural resources and protection of the environment. A recent study assessed the effects of climate, fire, and disturbance on eastern forests. A new USDA NIFA-funded grant led by Penn State focuses on forest legacy planning in a 21-state area.

A key demand for research and extension programming is nutrient management, including economic trade-offs and considerations at farm to regional scales. Our portfolio addresses tillage practices along with innovations in manure application, regional waste-to-energy technologies, and effects on water quality. PAOneStop is a geospatial web-based interface that helps PA farmers reduce their farms' environmental impacts on Chesapeake Bay and other waterways; new features are continually made

available.

Implementation of integrated pest management programs is important to developing sustainable management approaches for environmental protection. A Penn State research team recently found that fall armyworm caterpillars feeding on corn leaves induce the plant to turn off its defenses against insect predators, allowing the caterpillars to eat more and grow faster. Our world-class bee research group found that inactive ingredients in pesticides seem to do more damage to bees than the active ingredients. Another team determined that neonicotinoids move through the soil food chain. Yet another cross-disciplinary group designed a new trap for exotic emerald ash borers using 3-D-printed female beetles. Other invasive/exotic insects we are working on include hemlock woolly adelgid, spotted lanternfly, Asian longhorned beetle, and brown marmorated stink bug.

Extension programs, such as woodland owner and watershed education programs and pollinator-friendly gardens certification, address community and urban natural resource management.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Local, Regional, State, and Federal agencies
- Military
- Non-Governmental Organizations
- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension.

Some members of most teams serve as topic experts and answer questions submitted to eXtension's Ask an Expert system. Team members also use eXtension resources for further information for themselves and/or clientele.

A member of the equine environmental stewardship team serves on the federal eXtension Horse Quest Community of PracticeNational Equine Resource Team. In addition, members of the PSU equine team are members of the eXtension HorseQuest Community of Practice. One team member, through the Equine Environmental Impact MultiState Experiment Station Project, was part of the planning committee for the Waste to Worth eXtension conference.

One team member worked with the Penn State Pesticide Education Program to bring some recertification courses online.

One team member was selected to be a part of eXtension's i-Three Issue Corps with a project for climate, forest, and woodlands.

Forty-four of the counties in Pennsylvania use Master Gardeners to answer homeowner gardening questions. In an effort to better serve all PA residents, especially in those counties without a garden hotline, the eXtension "Ask a Master Gardener" widget was added to the Home Lawn and Garden website, as well as several county sites. As more people use the Internet for information, the widget provides easy access for homeowners to have their gardening questions quickly and accurately answered. In the first year, over 600 gardening questions were answered by a team of Master Gardeners.

The pest monitoring and management team participated in eXtension webinars (eOrganic Community of Practice) that explained the results from our organic rotational notill project but also did our own webinars through Penn State that were focused on IPM and resistance management.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	167620	12847	501846	498

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	3

Patents listed

Serial No. 14/810,317; Filed 7/27/2015; Title: Compositions and Methods for Bed Bug Control Using Entomopathogenic Fungi

Serial No. PCT/US2014/070532; Filed 12/16/2014; Title: Manipulation of Light Spectral Quality to Reduce Parasitism by Cusuta and Other Plant Parasites

Serial No. 14/571,850; Filed: 12/16/2014; Title: Manipulation of Light Spectral Quality to Reduce Parasitism by Cusuta and Other Plant Parasites

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	28	138	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	27430

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Call for future risk assessment for pollinators on organosilicone surfactants and N-methyl-2-pyrrolidone (NMP)
2	Assembly of multifaceted team to help fight new invasive spotted lanternfly, which threatens several major agricultural crops in Pennsylvania
3	Number of fields in Pennsylvania mapped in PAOneStop to address environmentally safe manure transportation and soil erosion and sedimentation planning
4	Finding that neonicotinoid insecticide travels through a soil food chain, disrupting biological control of nontarget pests and deceasing soybean yield
5	Finding that impacts of stream water withdrawals for shale gas development within the Susquehanna River basin are limited at the present state of flow alteration
6	Demonstration of the potential for traps baited with both male-produced pheromones and plant volatiles to assist in the rapid detection and delineation of A. glabripennis infestations
7	Finding that cyanobacterial biomass applied to soil surfaces increased fivefold to tenfold within 40 days and could regrow after being on dried-out soils for two months and longer, possibly offering an alternative to some chemical fertilizers

Outcome #1

1. Outcome Measures

Call for future risk assessment for pollinators on organosilicone surfactants and N-methyl-2-pyrrolidone (NMP)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Colony collapse disorder (CCD) and the general decline of pollinators continues worldwide. Honey bee (Apis mellifera L.) overwintering colony losses in the U.S. have averaged one-third since 2006, and are climbing. Pathogens, parasites, malnutrition, and pesticide exposure seem to play a role in CCD. Modern pesticide formulations and seed treatments, particularly when multiple active ingredients are blended, require proprietary adjuvants and inert ingredients to achieve high efficacy.

What has been done
Analysis of beehive samples has found over 130 different pesticides and metabolites, but no individual pesticide or amount correlates with recent bee declines. Results show that honey bees are sensitive to organosilicone surfactants, nonylphenol polyethoxylates, and the solvent N-methyl-2-pyrrolidone (NMP), widespread co-formulants used in agrochemicals and frequent pollutants within the beehive. Effects of exposure include learning impairment for adult bees and chronic toxicity to larva.

Results
Billions of pounds of formulation ingredients are released yearly. These synthetic chemicals are generally recognized as safe, have no mandated tolerances, and residues remain largely unmonitored. Only about 70% of the pesticide active ingredients searched for were found in beehive samples, but all the formulation ingredients targeted were found.

Evaluation of the role of these chemicals in pollinator decline is only beginning. Lack of disclosure of formulation ingredients and lack of adequate analysis methods hinder the assessment of total chemical load and agrochemical exposures on bees. Most studies to document pesticide effects on honey bees are performed without the formulation or other spray adjuvant components used to

apply the toxicant. Formulations are generally more toxic than active ingredients, particularly fungicides, by up to 26,000-fold, based on published literature. Some candidates for future risk assessment for pollinators include organosilicone surfactants and NMP.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
306	Environmental Stress in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

Outcome #2

1. Outcome Measures

Assembly of multifaceted team to help fight new invasive spotted lanternfly, which threatens several major agricultural crops in Pennsylvania

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The spotted lanternfly is native to China, India, Japan, and Vietnam. It was detected for the first time in the United States in eastern Berks County, Pennsylvania, in 2014. This pest poses a significant threat to the state's more than $20.5 million grape crop, nearly $134 million apple crop, and more than $24 million stone fruit crops, as well as the hardwood industry in Pennsylvania, which accounts for $12 billion in sales.

What has been done

Researchers and educators across the college quickly came together with the Pennsylvania Department of Agriculture and others to begin fighting this invasion. Team members held informational meetings for agricultural producers, the public, and government officials to educate participants on the biology, distribution, and effective management of the spotted lanternfly in Pennsylvania.

Results
Penn State entomologists determined from the presence of old egg masses that the insect had already been in Berks County for at least a year. Team members in the affected region are monitoring the active range of this pest. This insect is now found in portions of four Pennsylvania counties. They are looking to Korean research to see what happened when the insect invaded that country. Extension educators are helping to educate the public about the insect and the quarantine in the affected areas. As a result of the trainings and continued monitoring, additional detections of the spotted lanternfly were made in eastern Pennsylvania. More informed stakeholders in the green industry, forestry, and the public could result in new detections and the identification of applied research needs on the spotted lanternfly.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Number of fields in Pennsylvania mapped in PAOneStop to address environmentally safe manure transportation and soil erosion and sedimentation planning

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	91000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Pennsylvania farmers must comply with a range of federal and state environmental regulations, from creating detailed maps of fields to formulating manure management and soil erosion and sedimentation plans. Farmers can rely on a free online system created by Penn State Extension, PAOneStop, which is supported by the state's agricultural and environmental protection departments and the State Conservation Commission.

What has been done
More than 4,000 farmers and other agriculture community members have used the system to map more than 13,000 farms and 91,000 fields across the state. The interface was created to help Pennsylvania farmers reduce the environmental impact their farms were having on Chesapeake Bay and other waterways.

Results
Because agriculture is a major source of pollutants such as P, N, sediment, fertilizers, and pesticides entering waterways, farmers can play a critical role in minimizing soil loss and protecting water quality.

PAOneStop supports the environment through initiatives like the federal Clean Streams Act, and makes it easier and less expensive for farmers to meet these complex regulations. The secure system enables farmers to generate the high-quality farm and field maps they must submit to state regulators as components of nutrient balance sheets, nutrient management plans, manure management plans, and soil erosion and sedimentation plans. PaOneStop also allows farmers to calculate soil loss from fields under various management scenarios to reduce soil loss to acceptable levels.

Before the advent of PAOneStop, farmers could hand-draw these maps or hire a consultant, which could cost hundreds of dollars per map--adding up to millions of dollars for the state's roughly 56,000 farmers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Finding that neonicotinoid insecticide travels through a soil food chain, disrupting biological control of nontarget pests and deceasing soybean yield

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Neonicotinoids are the most widely used insecticides worldwide, but their fate in the environment remains unclear, as does their potential to influence nontarget species and the roles they play in agroecosystems. Mounting evidence suggests that they can undermine populations of nontarget animals in natural and agricultural ecosystems.

What has been done
A laboratory and field study investigated the influence of the neonicotinoid thiamethoxam, applied as a coating to soybean seeds, on interactions among soybeans, nontarget slugs, and their insect predators.

Results
In the laboratory, the pest slug Deroceras reticulatum was unaffected by thiamethoxam, but transmitted the toxin to predaceous beetles (Chlaenius tricolor), impairing or killing more than 60%. In the field, thiamethoxam-based seed treatments depressed activity-density of arthropod predators, thereby relaxing predation of slugs and reducing soybean densities by 19% and yield by 5%. Neonicotinoid residue analyses revealed that insecticide concentrations declined through the food chain, but levels in field-collected slugs (up to 500 ng/g) were still high enough to harm insect predators. The findings reveal a previously unconsidered ecological pathway through which neonicotinoid use can unintentionally reduce biological control and crop yield. Trophic transfer of neonicotinoids challenges the notion that seed-applied toxins precisely target herbivorous pests and highlights the need to consider predatory arthropods and soil communities in neonicotinoid risk assessment and stewardship.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
216	Integrated Pest Management Systems
723	Hazards to Human Health and Safety

Outcome #5

1. Outcome Measures

Finding that impacts of stream water withdrawals for shale gas development within the Susquehanna River basin are limited at the present state of flow alteration

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water withdrawals in the Susquehanna River basin are increasing with shale gas extraction activities. The Susquehanna River Basin Commission (SRBC) regulates water withdrawals and consumptive uses, and requires approval for any water withdrawn for unconventional shale gas development. SRBC regulates shale gas withdrawals with restrictions intended to protect aquatic ecosystems. There is a paucity of regionally specific data available to determine the efficacy of these withdrawal regulations.

What has been done
This study measured the ability of watersheds to accommodate a relatively new industry that requires large volumes of fresh water. To determine if flow alteration resulting from shale gas industry surface water withdrawals affects fish and macroinvertebrate assemblages in lotic habitats, data were collected upstream and downstream of 12 withdrawal and 3 reference sites in headwater, cold water, and large warm water streams. Average daily withdrawals ranged from 0.05 to 1.4 million liters.

Results
Analysis of withdrawal data indicated that approved withdrawals far exceeded actual withdrawals across all stream types. The largest withdrawals relative to stream size were from headwater streams, where on average 6.8% of average daily flow was withdrawn daily. Overall, evidence suggests impacts of shale gas withdrawals within the Susquehanna River basin are limited at the present state of flow alteration. Potential reasons include protective measures such as pass-by flow restrictions, which require withdrawals to cease when flows drop below a predetermined low flow threshold, maximum instantaneous and daily withdrawal limits, and recent initiation of withdrawals (1-3 years of operation).

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

Outcome #6

1. Outcome Measures

Demonstration of the potential for traps baited with both male-produced pheromones and plant volatiles to assist in the rapid detection and delineation of A. glabripennis infestations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Native to China and Korea, the Asian longhorned beetle (ALB) (Anoplophora glabripenni) is a polyphagous wood-boring pest for which a trapping system would greatly benefit eradication and management programs. ALB could destroy 30% of the urban hardwood trees in the U.S. This level of destruction could result in an economic loss of $669 billion. Pheromone-baited traps offer a species-specific tool to detect economically devastating pests such as ALB at low population densities.

What has been done
Over two field seasons, a total of 160 flight intercept panel traps were deployed in Harbin, China, and trapped a total of 65 beetles. In 2012, traps using lures with a 1:1 ratio of 2 male-produced pheromone components designed to release at a rate of 1 or 4 milligrams per day per component in conjunction with 3 plant volatiles caught significantly more ALB females than other pheromone release rates, other pheromone ratios, plant volatiles only, and no lure controls.

Results
In 2012 male ALB were caught primarily in traps baited with plant volatiles only. In 2013, 10X higher release rates of these plant volatiles were tested, and linalool oxide was evaluated as a fourth plant volatile in combination with a 1:1 ratio of the male-produced pheromone components emitted at a rate of 2 milligrams per day per component. Significantly more females were trapped using the pheromone with the 10-fold higher three or four plant volatile release rates compared with the plant volatiles only, low four plant volatiles and pheromone, and control. Our findings show that the male-produced pheromone in combination with plant volatiles can be used to detect

ALB. Results also indicate that emitters should be monitored during the field season, as release rates fluctuate with environmental conditions and can be strongly influenced by formulation additives. This work was done with leveraged funding from the U.S. Forest Service and other entities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Finding that cyanobacterial biomass applied to soil surfaces increased fivefold to tenfold within 40 days and could regrow after being on dried-out soils for two months and longer, possibly offering an alternative to some chemical fertilizers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cyanobacteria grow naturally on soil surfaces and can "fix" or add C and N from the air. After crop harvest, cyanobacteria can also reduce nutrient loss in runoff by stabilizing soils and immobilizing excess N. A one-time application of cyanobacteria to agricultural fields results in annual regrowth that could supply up to 25 pounds of renewable N/ac/yr. Cyanobacteria cannot supply all N needed by most crops, but they can help reduce costs of manufactured N fertilizer while improving the soil.

What has been done
Supported by a Research Applications for Innovation Grant from the College of Agricultural Sciences, the team has developed a high-performance mixture of local cyanobacteria with the goal of licensing the bioproduct to an agricultural company. The objective of this project is to develop cyanobacterial cultures as commercial soil amendments and renewable N sources for

landscaping, agriculture, and land reclamation.

Results
In the first year of the project, the team demonstrated that cyanobacterial biomass applied to soil surfaces increased fivefold to tenfold within 40 days and could regrow after being on dried-out soils for two months and longer.

Cyanobacteria and their associated mosses and algae can take up excess N, keep it from being lost through runoff or leaching, and release it more slowly during the growing season. These biofilms also serve to make the soil surface more cohesive and resistant to erosion, and they will not fix N from the air if there already is N in the soil.

Cyanobacteria are a potential tool to increase N-use efficiency in the Chesapeake Bay basin and globally. As much as 50% of N applied to crops may be lost to aquifers and waterways. Decreasing these losses with biological organisms that don't require energy inputs or purchases would be beneficial.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
511	New and Improved Non-Food Products and Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Extramural Funding)

Brief Explanation

Natural Disasters
-Weather conditions may drive clients' requests for programs and advice.
-Weather conditions may necessitate changes in field research plans and workshops.
Economy
-The economy influences clientele's interest in and ability to implement tactics suggested.
-Limited budgets for travel do not allow educators to meet all requests for programs. Budget limitations also hinder the development and delivery of programs.
-High costs of fuel and reseeding when weather conditions necessitate can hamper field

research.
-Increasing costs have necessitated increases in some registration fees.
-Winterkill of turf caused major economic problems on golf courses and required significant consulting time.

Appropriations Changes

-The decrease in public support for both research and extension, as measured by real dollars, has necessitated a shift by research and extension teams to more extramural funding.
-Due to the changes in appropriations, all consumer horticulture educator positions funded through the university have been eliminated. This has left a gaping hole in extension, and now Master Gardeners are called on to answer most homeowner gardening questions. An advanced level of training for Master Gardeners allows them to be better equipped to answer homeowner questions.

Government Regulations

-Revised regulations and local legislatures enacting additional regulations can drive the need for new or revised programs.
-Helping farmers comply with federal and state nutrient management regulations continues to be an important driver for this extension program.
-Working with both the environmental and ag communities to develop programs that result in sustainable economic agricultural production and protect the environment has been a priority.
-State and federal funding in support of nutrient management programs has supported significant parts of this extension program.
-A critical activity has been educational support for the implementation of the Chesapeake Bay TMDL by USEPA and technical support to government agencies and NGOs for this effort.

Competing Public Priorities

-Competing public priorities force us to continually align our program priorities with budget realities.
-Youth programs compete against their various other activities.

Competing Programmatic Challenges

-With the continued loss of county-based FTEs in some programs, it is difficult to provide a comprehensive statewide program.
-Demand from external partners for subject matter expertise consumes educator resources.
-Public policy changes have increased interest in green infrastructure.
-Availability of equipment, structure restrictions, lack of knowledgeable machine operators can hinder research.

Extramural Funding

-Extramural funding has allowed some teams to conduct practical applied research projects that include integrated extension/educational components.
-Extramural funding can pull educators in different directions, for example, research that supports no-till can be in competition with organic management research.
-Time spent preparing, conducting, and reporting on extramurally funded projects takes away from traditional extension duties.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More

statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Global Engagement

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
202	Plant Genetic Resources	5%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	5%		5%	
206	Basic Plant Biology	5%		5%	
404	Instrumentation and Control Systems	5%		5%	
502	New and Improved Food Products	5%		5%	
602	Business Management, Finance, and Taxation	5%		5%	
603	Market Economics	5%		5%	
604	Marketing and Distribution Practices	5%		5%	
605	Natural Resource and Environmental Economics	5%		5%	
606	International Trade and Development Economics	5%		5%	
607	Consumer Economics	5%		5%	
608	Community Resource Planning and Development	5%		5%	
609	Economic Theory and Methods	5%		5%	
611	Foreign Policy and Programs	5%		5%	
701	Nutrient Composition of Food	5%		5%	
723	Hazards to Human Health and Safety	5%		5%	
724	Healthy Lifestyle	5%		5%	
802	Human Development and Family Well-Being	5%		5%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	1.4	0.0	0.3	0.0
Actual Volunteer	0.5	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
194497	0	41874	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
310284	0	554497	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
147635	0	615604	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activity in global engagement includes the empowerment of women in agriculture, consulting with indigenous tribes about issues related to natural gas drilling, and exploring the association between health and literacy and numeracy among recent U.S. immigrants and U.S. residents.

Additional efforts are aimed at meta-analysis of food demand elasticities in China, evaluating potential conflict between greenhouse gas abatement and food security, and efforts to increase drought hardiness in crops aided by patented laser ablation tomography.

Other researchers are studying antioxidants in edible mushrooms of Ethiopia, and in ongoing work with cacao, researchers discovered a gene that controls the melting point of cocoa butter.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Human Service Providers
- Military

- Non-Governmental Organizations
- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2013	174	20728	181

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	0	13	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	3595

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Analysis of food demand elasticities for China
2	Species of edible mushrooms collected from Ethiopia identified to have antioxidant properties
3	Patented laser ablation tomography technology, which allows the efficient analysis of root structure important in efforts to develop more drought-tolerant crops
4	Number of continents on which the Penn State Marcellus team has engaged with aboriginal groups to explore ways to enhance the benefits to their communities adjacent to shale energy development
5	Finding that literacy and numeracy were both positively related to self-reported health for immigrants and U.S.-born adults, indicating that literacy is an independent and significant social determinant of health

Outcome #1

1. Outcome Measures

Analysis of food demand elasticities for China

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Economic models of ag markets depend on elasticities of demand. Accurate evaluations of demand response allow us to estimate how a supply shock will affect commodity prices and consumption. Long-term projections used in analyses of climate change or the future global food situation depend on income elasticities that govern how ag markets will evolve with economic growth. Such projections also depend on price elasticities that determine how prices and quantities interact as yield changes.

What has been done
China's rapid rate of economic growth has attracted significant attention from economists. Penn State researchers led a team that conducted a meta-analysis of food and agricultural demand elasticities for China, and used the results to derive estimates of income, own-price, and cross-price elasticities of demand that can be used in models of food and agricultural markets.

Results
Consistent with expectations, the researchers found that income elasticities of demand for many food products decline as per capita income increases. The declines are relatively large for alcohol and tobacco, and smaller for livestock products. Contrary to expectations, own-price elasticities for some products become more price-elastic as per capita income increases. Economic development may bring improvements in food supply chains that provide more food choices to consumers, leading to greater substitution possibilities and more price-elastic demands. Estimates suggest that China's meat and dairy demands, and therefore, livestock feed demands, will continue to grow strongly. Policy makers should continue to monitor the evolution of demand for these products to ensure food security, particularly given the sheer size of the population and relatively tight domestic food supply situation in China.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
606	International Trade and Development Economics
607	Consumer Economics
609	Economic Theory and Methods
611	Foreign Policy and Programs

Outcome #2

1. Outcome Measures

Species of edible mushrooms collected from Ethiopia identified to have antioxidant properties

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mushrooms contain various secondary metabolites, including phenolic compounds, polyketides, terpenes, and steroids, known to act as excellent antioxidants. Mushrooms were also recently discovered to be the primary source of ergothioneine, a naturally occurring thiol-containing amino acid known for its antioxidant properties. The World Bank estimates that 40 percent of Ethiopia's population is undernourished, so identifying nutritious, indigenous sources of antioxidants could be helpful.

What has been done
A team from Addis Ababa University and Penn State analyzed two cultivated (Pleurotus ostreatus and Lentinula edodes) and five wild (Laetiporus sulphureus, Agaricus campestris, Termitomyces clypeatus, T. microcarpus, and T. letestui) edible mushroom species for their antioxidant activities, total phenolics, total flavonoids, phenolic profile, and ergothioneine content. This study was the first to investigate these properties in cultivated and wild edible mushrooms of Ethiopia.

Results
The research revealed that A. campestris had highest antioxidant activity in all assays. To correlate well with activities, A. campestris also exhibited greater total phenolics and total flavonoids content. Gallic acid was the major contributor to the total phenolic content for all the

mushrooms. All mushrooms contained various amounts of ergothioneine, but P. ostreatus contained substantially higher amounts. Local people eating these mushrooms might benefit by protecting themselves against oxidative damage, which can cause an array of diseases associated with inflammation and aging.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
701	Nutrient Composition of Food
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Patented laser ablation tomography technology, which allows the efficient analysis of root structure important in efforts to develop more drought-tolerant crops

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Among the likely effects of climate change, perhaps the one with the most potential to devastate human and natural communities is prolonged drought over vast areas, lasting years or decades. Drought in developing countries can spawn or worsen civil strife and lead to the forced migration of millions of people. About 850 million people today are chronically hungry, and chronic malnutrition is a leading cause of childhood mortality in the developing world.

What has been done
Penn State scientists are exploring how to improve crops' ability to grow in dry, low-nutrient soils, to fight the chronic food shortages that plague much of the world. Their research identified several traits in maize and common bean that allow plants to grow better under drought and in soils with low P and N. After finding the genetic basis of these traits, the team is helping plant breeders develop desired strains of both crops and testing them in Africa, Asia, Latin America, and the U.S.

Results

To assess root structure and identify lines better able to grow under stress, the team developed laser ablation tomography (LAT). This patented technology allows them to circumvent a laborious and time-consuming method used to get a detailed look at the internal anatomy of plant tissue. The old method involved using a fine blade to take a very thin cross-section from a root and examining it under a microscope. This was not sufficient to handle the huge numbers of samples the lab generated each year. The new method, developed in collaboration with other researchers at Penn State, uses a laser to ablate, or vaporize, thin sections from the root. A camera takes a picture of the fresh surface after each pass of the laser. The digital images are then manipulated with computer software to create a 3D image of the root that allows the scientists to assess its traits. The information gained is used to improve stress-tolerance in maize and common bean.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
404	Instrumentation and Control Systems

Outcome #4

1. Outcome Measures

Number of continents on which the Penn State Marcellus team has engaged with aboriginal groups to explore ways to enhance the benefits to their communities adjacent to shale energy development

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Members of the Marcellus team have been working with indigenous groups around the world on issues related to shale gas development and its socioeconomic implications. The indigenous communities approached the team to explore ways they could undertake workforce training and localized small business development to enhance the benefits to their communities adjacent to

shale energy development.

Work with indigenous groups is just one aspect of a multipronged approach that the Marcellus team takes.

What has been done
Online and in-person sessions were organized with the indigenous groups to explain the development process, illustrate the likely emerging workforce needs, discuss the needed institutional capacity to build local technical expertise, and more closely examine the need for entrepreneurial endeavors to connect local suppliers of goods and services to large, out-of-town energy companies.

Results
The Marcellus team has worked with indigenous groups in South Africa, Australia, Argentina, several Canadian provinces, and the Northeast U.S. The team has found opportunities and funding to immerse the educators in these new cultures so they could better appreciate the challenges uniquely faced in previously unfamiliar locations. Working in new settings with diverse languages, religions, ethnicities, cultural heritage, race, and socioeconomic capacities afforded the team unique insights upon their return to the U.S. and in their work with traditional and emerging nontraditional audiences in Pennsylvania. The Marcellus team will build on these efforts while evaluating the economic outcomes.

International programs for government delegations have become a strong programmatic thrust for the team, which last year partnered with 12 countries on 6 continents in discussions of lessons learned in the U.S. and PA. Every country visiting represents a potential multibillion-dollar investment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
606	International Trade and Development Economics
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Finding that literacy and numeracy were both positively related to self-reported health for immigrants and U.S.-born adults, indicating that literacy is an independent and significant social determinant of health

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Educational attainment is strongly related to health. But the health benefits of formal education do not accrue equally across racial/ethnic groups in the United States. Although previous analyses suggested that literacy and numeracy proficiency are associated with U.S. adults' self-reported health, the previous research did not explore how the relationship between health and proficiency in literacy and numeracy varies by immigrant status.

What has been done
Penn State researchers used data from the Program for the International Assessment of Adult Competencies to analyze the relationship between self-reported health (SRH) and literacy and numeracy proficiency for immigrants compared to U.S.-born respondents and for Hispanic versus Asian immigrants.

Results
Immigrants had significantly lower literacy and numeracy scores, yet reported better health than U.S.-born respondents. Statistical analyses showed that literacy and numeracy were both positively related to SRH for immigrants and U.S.-born adults, and should be viewed as part of the growing evidence that literacy is an independent and significant social determinant of health. U.S.-born and immigrant adults accrued similarly positive health benefits from stronger literacy and numeracy skills. Although Hispanic immigrants were more disadvantaged than Asian immigrants on almost all socioeconomic characteristics and had significantly lower literacy and numeracy scores and worse SRH than Asian immigrants, both Hispanic and Asian immigrants experienced similar positive health returns from literacy and numeracy. These findings underscore the potential health benefits of providing adult basic education, particularly for immigrants with the least schooling and fewest socioeconomic resources.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Extramural Funding)

Brief Explanation

Natural Disasters
-Natural disasters allow the rapid spread of diseases and can damage equipment, such as drinking water treatment systems, that is essential for public health.
Economy
-The global economy influences political instability, and lack of opportunity can incite radical groups, disempower women and minorities, and discourage peace-building activities.
Government Regulations
-U.S. and foreign government regulations can influence the feasibility and necessity of various work.
Changes in Appropriations, Public Policy Changes, Competing Public Priorities, and Competing Programmatic Challenges
-Changes in appropriations, public policy changes, competing public priorities, and competing programmatic challenges can influence the amount of foreign aid available.
-The economic impacts of the introduction of shale energy have been historic. This is true domestically, with over half of dry natural gas production in the U.S. now being sourced from shale, as well as geopolitically, as less energy is imported into the U.S., allowing more flexibility in foreign policy.
Extramural Funding
-Some of our programs are affected by extramural funding, either by adding resources to promote them or by shaping the content of the product.
-Extramural funding has allowed some teams to conduct practical applied research projects that include integrated extension/educational components.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments

(Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Integrated Health Solutions

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	8%		8%	
133	Pollution Prevention and Mitigation	5%		5%	
301	Reproductive Performance of Animals	5%		5%	
303	Genetic Improvement of Animals	5%		5%	
304	Animal Genome	5%		5%	
305	Animal Physiological Processes	5%		5%	
307	Animal Management Systems	5%		5%	
311	Animal Diseases	5%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%		5%	
315	Animal Welfare/Well-Being and Protection	5%		5%	
503	Quality Maintenance in Storing and Marketing Food Products	5%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	5%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	8%		8%	
721	Insects and Other Pests Affecting Humans	5%		5%	
722	Zoonotic Diseases and Parasites Affecting Humans	10%		10%	
723	Hazards to Human Health and Safety	14%		14%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890

Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	8.7	0.0	14.1	0.0
Actual Volunteer	0.4	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1407826	0	2073166	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2521844	0	8705099	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3956396	0	15800499	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Food processing is one of the largest industries in Pennsylvania, and much of the research in this planned program contributes to improved and safer food processing. Research includes study of the effectiveness of high pressure processing on reduction of O157:H7 E. coli in hamburger, the potential to use an extract from avocado seeds as a natural colorant, and gender differences in preference for spicy foods.

Research into one health, toxicology, and immunology in the college includes racial differences in use of health care for diabetes management, interaction of harmless E. coli in our intestines with pathogenic E. coli, suppression of colon tumorigenesis by anthocyanin in purple potatoes, genetic variability in Holstein cattle, efforts to educate about and fight a potential outbreak of highly pathogenic avian influenza, the life cycle of the malaria mosquito, and accumulation of pharmaceuticals and personal care products in and on crops spray irrigated with treated wastewater.

The requirements of the Food Safety Modernization Act are driving much of our extension programming in this planned program. Trainings in Hazard Analysis Critical Control Point (HAACP) and Good Agricultural Practices (GAP) continue. The ServSafe curriculum is frequently presented to meet regulatory requirements for commercial food service operations. We offer specialized food safety trainings for specific industries, such as the wine industry.

Extension work in consumer food safety includes frequent offerings of Cooking for Crowds, for volunteer organizations that prepare and serve food to the public; and workshops by Master Food Preserver volunteers, who teach home food preservation.

We are offering more extension food safety trainings in Spanish to meet the growing need, and we are translating more materials into additional languages as well.

The safe drinking water research and extension team analyzed water samples from private wells in northern Pennsylvania before nearby development of wells for Marcellus shale natural gas extraction. The study provided free water testing and help in interpreting the results and planning action steps as needed.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Human Service Providers
- Military
- Non-Governmental Organizations
- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension. Members of most teams answered questions submitted to eXtension's Ask an Expert system.

One extension food safety team member has answered more than 300 questions asked via eXtension's Ask an Expert system and is ranked in the top 20 for responding to food safety questions. Some team members use eXtension as a resource for information and/or articles to use in programs they conduct.

One team member was selected to be a part of eXtension's i-Three Issue Corps with a project for women in agriculture ergonomics.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	22771	3769	15981	1250

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	15

Patents listed
Patent # 2010284428; Serial No. 2010284428; Title: Compositions, Methods, and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Patent # ZL 201280031659.2Serial No. 201280031659.2; Title: Compositions, Methods and Kits for Treating Leukemia

Patent # 9,119,862; Serial No. 14/335,020; Title: Compositions, Methods and Kits for Treating Cancer

Serial No. 14/804,933; Filed 7/21/2015; Title: Selected Automated Blossom Thinning

Serial No.PCT/US2015/0413; Filed 7/21/2015; Title: Selected Automated Blossom Thinning

Serial No. 14/810,317; Filed 7/27/2015; Title: Compositions and Methods for Bed Bug Control Using Entomopathogenic Fungi

Serial No. 62/186,026; Filed 6/29/2015; Title: Foaming and Emulsifying Properties of High Pressure Jet Processing Pasteurized Skim Milk

Serial No. 14/850,688; Filed 9/10/2015; Title: Compositions, Methods, and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Serial No. 2015-151167; Filed 7/30/2015; Title: Compositions, Methods, and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Serial No. 2015138677; Filed 9/20/2015; Title: Compositions, Methods and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Serial No. 62/065,931; Filed 10/20/2014; Title: Methods for Treatment of Leukemia

Serial No. 14,735,231; Filed 6/20/2015; Title: Compositions, Methods and Kits for Treating Cancer

Serial No. 62/175,639; Filed 6/15/2015; Title: Methods for Treatment of Leukemia

Serial No. 14/669,663; Filed 3/26/2015; Title: Modulation of CCR10 Signals for Treatment of Skin and Intestinal Inflammatory Diseases and Infection

Serial No. 62/193,876; Filed 7/17/2015; Title: A Size Tunable Enrichment Platform for Capturing Nano Particles in a Fluid

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	7	145	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	78929

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Finding that personal care products can be taken up into wheat plants and adhere to plant surfaces when wastewater treatment plant effluent is spray-irrigated
2	Percentage of participants in Penn State Extension workshops on interpreting results of private drinking water supply testing who had taken action (n=160) on their water supplies within a few months of attending a workshop
3	Finding that some strains of harmless E. coli in our intestines can interact with pathogenic E. coli in ways that will either increase or decrease how much toxin the pathogen produces
4	Finding that malaria mosquitoes feed on common caterpillars, suggesting a new mechanism for horizontal transmission of pathogens and other microorganisms between hosts
5	Finding that Holstein lineages trace back to two bulls from the early 1880s
6	Assembly of multifaceted, multipartner team to fight highly pathogenic avian influenza and educate all relevant audiences
7	Number of fruit and vegetable growers trained in Good Agricultural Practices (GAPs)

Outcome #1

1. Outcome Measures

Finding that personal care products can be taken up into wheat plants and adhere to plant surfaces when wastewater treatment plant effluent is spray-irrigated

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With rising demands on water supplies necessitating water reuse, as well as a desire to reduce exposure of fish to wastewater constituents, wastewater treatment plant (WWTP) effluent is often used to irrigate agricultural lands. Emerging contaminants, such as pharmaceuticals and personal care products (PPCPs), are frequently found in effluent due to limited removal during WWTP processes. Concern has arisen about the environmental fate of PPCPs, especially regarding plant uptake.

What has been done
Penn State researchers conducted a study to analyze uptake of sulfamethoxazole, trimethoprim, ofloxacin, and carbamazepine in wheat plants spray-irrigated with WWTP effluent. Wheat was collected before and during harvest, and plants were divided into grain and straw. Subsamples were rinsed with methanol to remove compounds adhering to surfaces. All plant tissues underwent liquid-solid extraction, solid-phase extraction cleanup, and liquid chromatography-tandem mass spectrometry analysis.

Results
Residues of each compound were present on most plant surfaces. Ofloxacin was found throughout the plant, with higher concentrations in the straw (10.2 +/- 7.05 ng/g) and lower concentrations in the grain (2.28 +/- 0.89 ng/g). Trimethoprim was found only on grain or straw surfaces, whereas carbamazepine and sulfamethoxazole were concentrated within the grain (1.88 ± 2.11 and 0.64 +/- 0.37 ng/g, respectively). These findings demonstrate that PPCPs can be taken up into wheat plants and adhere to plant surfaces when WWTP effluent is spray-irrigated. The presence of PPCPs within and on the surfaces of plants used as food sources raises the question of potential (but apparently very low) health risks for humans and animals consuming grain. To ingest the lowest typical dose of sulfamethoxazole, a person might have to consume 100-200 pounds of this grain.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Percentage of participants in Penn State Extension workshops on interpreting results of private drinking water supply testing who had taken action (n=160) on their water supplies within a few months of attending a workshop

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	80

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In PA, at least 30% of residents in most counties where gas drilling is occurring rely on shallow groundwater sources. Research before gas drilling began found that about 40% of these private supplies fail to meet federal drinking water standards. Because of the gas drilling boom, thousands of homeowners have received predrilling drinking water tests. Homeowners often have difficulty understanding test reports, resulting in low awareness of pre-existing problems.

What has been done
Penn State Extension and partners, with leveraged funding from Colcom Foundation, attempted to improve understanding of predrilling water tests. Homeowners in 8 north-central PA counties were provided free water tests. Testing for 21 parameters was completed on 743 homes with a private water supply. Homeowners received test results and an invitation to a Penn State Extension workshop on interpreting water tests. Homeowners who attended received an online follow-up survey (54% response).

Results

Educational workshops with companion publications and websites were used by 79% of all households tested. More than half of the private supplies tested failed at least 1 health-based standard (e.g., coliform bacteria, E. coli, turbidity, or Ba). Many other water supplies failed standards for aesthetic pollutants (e.g., Mn, Fe, pH, total dissolved solids, chloride, or sulfate). Eight percent (n=60) of water supplies contained very hard water, and 14% (n=101) contained measurable concentrations of methane gas before shale gas drilling occurred. Follow-up evaluations found that nearly all homeowners understood the test reports and 80% had taken actions on their water supplies since the workshop, including disinfection, 22% (n=45); improved water supply construction, 17% (n=36); installed water treatment, 10% (n=21); designated wellhead protection area, 9% (n=19); and other responses. The program represents an emerging educational opportunity for extension in shale gas drilling regions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Finding that some strains of harmless E. coli in our intestines can interact with pathogenic E. coli in ways that will either increase or decrease how much toxin the pathogen produces

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Scientists wonder why some people get so sick and even die after being infected by the foodborne pathogen E. coli O157:H7, while others experience much milder symptoms and recover relatively quickly.

What has been done

Researchers co-cultured the pathogenic E. coli O157:H7 serotype with a nonpathogenic strain of the bacteria and inoculated mice. These mice got much sicker than mice infected with the pathogenic strain alone. The finding appears to be especially relevant because people normally have multiple strains of E. coli in their intestines.

Results
This research suggests that some strains of harmless E. coli in our intestines can interact with pathogenic E. coli in ways that will either increase or decrease how much toxin the pathogen produces. This may dictate how sick a person gets with an E. coli infection, or even if an infection proves to be fatal. The study may be a significant step toward doctors being able to predict how an E. coli-infected patient will fare by evaluating a stool sample and analyzing the presence or absence of various strains of nonpathogenic E. coli. With further work, we might be able to determine if the patient is going to clear the organisms and have mild symptoms, or if they are likely to have something that is more serious.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Finding that malaria mosquitoes feed on common caterpillars, suggesting a new mechanism for horizontal transmission of pathogens and other microorganisms between hosts

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Adult female mosquitoes need blood to develop their eggs. Both sexes use nectar and honeydew as carbohydrate resources for flight and survival, and to enhance reproduction. However, there are also a few reports in the literature of mosquitoes feeding on haemolymph of soft-bodied insects such as caterpillars. The frequency and significance of this behavior is not well

understood, but is thought to be a vestige of ancestral feeding behavior or an opportunistic behavior that has evolved over time.

What has been done
The research team used y-tube olfactometer assays to investigate the extent to which the malaria mosquito, Anopheles stephensi, is attracted to, and can successfully feed on, larvae of two common moth species, Manduca sexta and Heliothis subflexa.

Results
They found that female A. stephensi readily flew upwind to and landed on the caterpillars of both moth species. The nature of the volatile cues used in host location remains unclear, but respirometer studies suggest a possible role of carbon dioxide. Laboratory cage assays further showed that the female mosquitoes were able to actively feed on moth larvae and gain sufficient nutritional benefit to influence survival. The extent to which such an opportunistic behavior occurs in the field has yet to be explored, but our results suggest that this haemolymph feeding behavior could play a role in malaria mosquito life history and could provide a new mechanism for horizontal transmission of pathogens and other microorganisms between hosts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
721	Insects and Other Pests Affecting Humans

Outcome #5

1. Outcome Measures

Finding that Holstein lineages trace back to two bulls from the early 1880s

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Holsteins are the most numerous dairy cattle breed in the world and have undergone intensive selection for improving milk production and conformation, which leads to the reduction of the effective population size and a reduced genetic diversity.

What has been done
The objective of this study was to investigate effective population size of the Holstein Y chromosome and the effects of the limited Y-chromosome lineages on male reproduction. Paternal pedigrees were analyzed of 62,897 Holstein bulls born between 1950 and 2013 in North America and 220,872 bulls registered in Interbull.

Results
The results indicated that the number of Y-chromosome lineages in Holsteins has undergone a dramatic decrease from 1950 to 2013 as a consequence of artificial selection and the application of artificial insemination (AI) technology. All current Holstein AI bulls in North America are the descendants of only two ancestors born in 1880. These two ancestral Y lineages are continued through three dominant pedigrees from the 1960s, namely Pawnee Farm Arlinda Chief, Round Oak Rag Apple Elevation, and Penstate Ivanhoe Star, with contributions of 48.78%, 51.06%, and 0.16% to the population in the 2010s, respectively. This study suggests minimal genetic diversity on the Y chromosome in Holsteins, and provides a basis for investigating the impact of the extremely limited number of Y lineages on male reproduction. Because dairy producers are primarily concerned with the genetic potential of cows, it is not clear that the limited male lineages present any real challenges for Holstein breeders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
307	Animal Management Systems

Outcome #6

1. Outcome Measures

Assembly of multifaceted, multipartner team to fight highly pathogenic avian influenza and educate all relevant audiences

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The highly pathogenic avian influenza (HPAI) that started in the U.S. in December 2014 has affected over 48 million birds in 15 western and midwestern states. This disease causes 75-90% mortality and eventually the depopulation of all birds on site. Pennsylvania's $1.4-billion egg industry is the fourth largest in the country. If we have a really severe avian flu outbreak, it's estimated that there could be losses of more than 50,000 jobs and billions of dollars.

What has been done
Penn State's poultry team is a critical part of the PA HPAI task force, along with USDA, PA Department of Agriculture, and others. Team members developed and delivered educational materials and presentations for a wide range of audiences. They would also help with depopulation, disposal, composting, and vaccination in the event of an outbreak. Team members at Penn State's Animal Diagnostic Laboratory are on the front line of detection and reporting on avian influenza of all types.

Results
The result has been widespread education to residents of PA and the region on developing farm plans to deal with biosecurity and depopulation, disposal, and disinfection of their farms. The team widely spread general knowledge of the disease, its etiology, what to do to prevent it, and how to properly report on the disease. Greater skills have been developed, preparedness has improved, resources have been accumulated, and abilities to detect the disease and communicate with our diagnostic labs and diagnosticians have increased. The greatest outcome has been the production of farm plans and the coordination among industry, backyard producers, government, and academia in addressing the problem and preparing for an outbreak of HPAI in the state.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #7

1. Outcome Measures

Number of fruit and vegetable growers trained in Good Agricultural Practices (GAPs)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	330

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Microbial contamination of farm produce is a source of foodborne disease outbreaks that can result in hospitalizations and deaths. In 1998, FDA proposed agricultural production practices to reduce the risk of microbial contamination of fresh produce. These Good Agricultural Practices (GAPs) address farm workers' health and hygiene; agricultural water quality; the use of domesticated animals; potential contamination by wild animals; sanitation standards; and traceability/recall.

What has been done
Since 2009, Penn State Extension has trained approximately 2000 produce growers on GAPS. In 2015, Extension conducted 10 on-farm food safety workshops statewide to train 330 fruit and vegetable growers on GAPs. These workshops were evaluated using pre- and post-tests to assess the impact of the training on participating growers.

Results
After-workshop evaluations revealed statistically significant increases in growers' GAP knowledge and identified areas where content delivery must be improved. Practitioners acknowledge the need to conduct delayed follow-up evaluations to gather information on participants' actual steps taken in response to attendance.

Penn State has been a leader in developing research-based food-safety standards for the mushroom industry, known as mushroom GAPS, or MGAPs. Now about 90 percent of the fresh mushrooms consumed in the United States have been grown on a farm that passed an MGAP third-party inspection. As a result of MGAPs, mushroom growers are more prepared than other produce groups to comply with the FDA produce-safety regulation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

Natural Disasters
-Weather extremes (floods and droughts) create numerous questions about effects on private drinking water supplies and management to address these concerns.
Economy
-Economic factors drive clients to participate in free or reduced fee water testing programs and also affect what water testing packages are selected by clients.
-The food industry is a major economic driver for the state. Issues that impact a company or an industry will have a ripple effect throughout the state, from the sales to jobs.
Government Regulations
-Introduction of water well construction legislation resulted in significant time expenditure.
-Passage of the Food Safety Modernization Act (FSMA) has stimulated interest in offering farm food safety trainings. But FDA has mandated that only one curriculum, developed by the Produce Safety Alliance (PSA), can satisfy the training requirement. Therefore, we have not been regularly offering our "Keeping Produce Safe Using Good Agricultural Practices" workshop. PSA has not released the new curriculum and has not established a protocol for approving instructors, so we cannot yet teach the curriculum.
-FSMA has changed attitudes in the college and the state legislature as evidenced by funding available for a new GAP extension educator in 2016.
-The Food Safety Modernization Act is having an enormous impact on the food supply chain. Foodborne illness cases and food recalls continue to grab news headlines, which has a dramatic impact on the entire food chain. Food producers and processors need improved practices under increased scrutiny from the public, law makers, and regulators.
-PA has adopted the FDA Food Code, resulting in some changes to regulations governing food service operations. The ServSafe curriculum covers these new regulations. Although FSMA does not affect retail operations as much as other segments of the food system, we can provide information to participants in the program. In large metropolitan areas, more participants have English as a second language, and although the curriculum and test are available in other languages, not all are represented and often the issue of literacy in any language is an issue. Often these individuals must take the exam multiple times before passing.
Public Policy Changes
-Oversight of food and farm businesses at all levels of government affects our program efforts, and we must stay current.
Competing Public Priorities
-Competing public priorities force us to continually align our program priorities with

budget realities.
-Retirements may make it more difficult all of our current programs.

Population Changes

-Population changes continue to drive the need to make more extension offerings available in other languages.

Other - Extramural Funding

-Some of our programs are affected by extramural funding, either by adding resources to promote them or by shaping the content of the product.
-Extramural funding has allowed some teams to conduct practical applied research projects that include integrated extension/educational components.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

V(A). Planned Program (Summary)

Program # 15

1. Name of the Planned Program

Positive Future for Youth, Families, and Communities

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
401	Structures, Facilities, and General Purpose Farm Supplies	5%		5%	
402	Engineering Systems and Equipment	5%		5%	
610	Domestic Policy Analysis	5%		5%	
701	Nutrient Composition of Food	5%		5%	
702	Requirements and Function of Nutrients and Other Food Components	5%		5%	
703	Nutrition Education and Behavior	8%		8%	
723	Hazards to Human Health and Safety	13%		13%	
724	Healthy Lifestyle	10%		9%	
802	Human Development and Family Well-Being	13%		14%	
805	Community Institutions and Social Services	10%		9%	
806	Youth Development	13%		14%	
903	Communication, Education, and Information Delivery	8%		8%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	20.7	0.0	0.7	0.0
Actual Volunteer	0.6	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
2216125	0	95544	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
3739885	0	183298	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
9246757	0	359082	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Food and lifestyle choices are often inextricably linked to health issues that are costing our nation in terms of dollars, productivity, and quality of life. Research and extension programs that focus on these complex, interrelated issues are ongoing activities in this planned program area.

Research includes analysis of the Las Vegas foreclosure crisis on quality of life, effectiveness of regulations limiting juveniles' access to tobacco on youth smoking rates, and metabolites as new markers for childhood obesity in Mexican American children.

The problem of obesity and other chronic diseases must be addressed through a combination of approaches. Families are a crucial link in teaching healthy behaviors, including good nutrition and physical activity as the cornerstone of prevention. Extension programs use innovative interdisciplinary approaches to discover, translate, and apply how nutrition and physical activity can prevent disease and promote good health and well-being. Programs use the socioecological model as a framework to address multiple factors that influence an individual's ability to change.

Youth organizations, such as 4-H, offer programs that help young people increase their knowledge and offer opportunities to improve healthy eating and physical activity habits, develop leadership and decision-making skills, and perform community service. A benefit for 4-H volunteers is the development of leadership, time management, and organization skills that can be helpful in volunteers' personal and professional life, as well as the personal fulfillment attained through giving back.

Other extension activities include a focus on farm safety, grandfamilies, and diabetes education. Extension programs improve preschool childcare via extensive online professional development training through the Better Kid Care program and by increasing ability of preschool educators to approach at-risk families by focusing on their strengths and applying the attributes of healthy families, as taught through the Bringing the Protective Factors Framework to Life in Your Work curriculum.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups

- Education
- General Public
- Government Personnel
- Human Service Providers
- Non-Governmental Organizations
- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension.

At least some members of most extension teams answer Ask an Expert questions and use eXtension resources as reference materials to address client questions and acquire personal knowledge when appropriate. Some programs include a link to the appropriate eXtension community articles on their site.

In 2015 we had two team members serve on the writing team of the For Youth, For Life Community of Practice. The PA 4H science group uses eXtension as a peripheral reference resource. This ensures the scientific information included in curriculum components is accurate and up to date. eXtension has also been a source of potential curriculum ideas for program development.

Some 4H science extension educators are engaged in communities of practice within eXtension.

Penn State is the lead institution for the Farm & Ranch in eXtension for Safety and Health (FReSH) Community of Practice (CoP). The CoP consists of over 100 members who are actively involved in developing and reviewing content for the site. The FReSH site is the official ag safety and health website for the Agricultural Safety and Health Council of America (ASHCA), which is linked to industry. eXtension is used for information dissemination, webinars (learn.extension.org), mobile app promotion, and online courses (campus.extension.org/Moodle). Grant funding was obtained this fiscal year that will continue to enhance and expand the FReSH CoP. Our role with eXtension enabled the Ag Safety and Health Program to generate close to $2 million in an 8-year period to fund program development and expansion. During this reporting period, there were over 56,000 visits to the FReSH site compared to 25,000 the previous year. USDA-NIFA emphasized the use of eXtension in the grant application for the Safety in Agriculture for Youth (SAY) project. Because Penn State has a primary role in FReSH, it enabled us to write a successful grant application that integrated Penn State Ag Safety and Health, multiple landgrants, and a forprofit organization that used eXtension as the primary mechanism for hosting and promoting SAY project information.

eXtension was used as a resource for educational articles and links for newsletters for the Everybody Walks Across PA program.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	28814	5632	3163	1874

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	7	22	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2015	109739

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Finding that the 1992 Synar Amendment, which led all 50 states to enact prohibitions on tobacco sales to minors, has had some degree of success in limiting youth smoking
2	Approximate total dollar value of volunteer time (102,961 hours) invested by 5,902 volunteers in leadership and/or delivery of 4-H programs during the reporting year
3	Total number of hours of professional development training provided in program year 2014-2015 by Better Kid Care program
4	Number of tractors retrofitted with a rollover protective structure through a program of the rural health and safety extension team
5	Percentage of diabetic participants in Dining with Diabetes extension program who experienced a decline from baseline in their long-term blood sugar measurements at followup
6	Percentage of participants in Extension-offered workshop on Bringing the Protective Factors Framework to Life in Your Work who expressed increased knowledge of specific actions and strategies to increase factors protective against child abuse in their work with preschool children and families

Outcome #1

1. Outcome Measures

Finding that the 1992 Synar Amendment, which led all 50 states to enact prohibitions on tobacco sales to minors, has had some degree of success in limiting youth smoking

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Scholars who examine the efficacy of juvenile tobacco sales restrictions, especially the 1992 Synar Amendment, which led all fifty U.S. states to enact prohibitions on tobacco sales to minors, are notably divided as to impact on youth smoking. Some researchers claim that such policies have failed and ought to be abandoned, while others insist that enforcement has indeed led to reduced tobacco use.

What has been done
This was the first study to combine national data from the U.S. Substance Abuse and Mental Health Services Administration, the Tobacco Institute, and the Centers for Disease Control's Youth Risk Behavior Surveillance System for 1996 to 2007 on Synar violation rates from all states and years available since the amendment's implementation to assess the connection to national rates of cigarette sales and youth smoking behavior.

Results
This study shows that the efficacy of juvenile tobacco sales prohibitions can be empirically tested. States test retailer violation rates of laws prohibiting juvenile tobacco sales. Violation rates are related to overall cigarette sales and to youth smoking. Controlling for state-level demographic variables, results indicate that retailer violation rates are significantly associated with greater youth smoking prevalence and higher overall cigarette sales. Although critiques of Synar policies are substantive and should be addressed, laws prohibiting the sale of tobacco to juveniles appear to have had some degree of success.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis

723	Hazards to Human Health and Safety
724	Healthy Lifestyle
805	Community Institutions and Social Services
806	Youth Development

Outcome #2

1. Outcome Measures

Approximate total dollar value of volunteer time (102,961 hours) invested by 5,902 volunteers in leadership and/or delivery of 4-H programs during the reporting year

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	2330007

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since the establishment of the Extension system, volunteers have helped Extension professionals expand the reach of their services. As the breadth of programs continues to grow, volunteers remain integral to program implementation and success. This is especially true for 4-H Youth Development programs. Volunteers help the 4-H program realize its goals on a daily basis. A diverse and well supported corps of volunteers is a basic element of high quality 4-H programs.

What has been done
For 4-H youth development professionals to effectively use volunteers, our practice must have a strong research base, and paid staff must have access to the training and tools needed to recruit, select, orient, train, use, recognize, and evaluate volunteers who serve in all aspects of the 4-H program. Extension staff assessed 4-H volunteers' participation in various levels of training and the trainings' effects on the 4-H program and on volunteers' personal and professional life.

Results
Assessments show that 80% of 4-H volunteers (n=200) participated in at least one district, state, or national training in the last program year, and 6.5% of volunteers participated in three or more such trainings. When asked how the training affected their 4-H program, 69% of respondents (n=88) said they shared new ideas with other club leaders, 34% (n=44) had implemented a new life or project skill, and 44% (n=56) had improved efficiency of meetings. As a result of their 4-H volunteer experience, 56% (n=510) reported improved leadership skills, 53% (n=483) reported improved organizational skills, and 33% reported improved time management skills. When asked

to rate the effect of their 4-H volunteer experience on their personal life (n=932), 67% reported significant or moderate improvement. 44% said the same for the effect on their professional life.

The value of 4-H volunteer time committed was $2.3 million, at $22.63/hour, according to Independent Sector.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Total number of hours of professional development training provided in program year 2014-2015 by Better Kid Care program

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	401806

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
About 11 million preschool children receive child care in the U.S. In Pennsylvania, there are more than 700,000 children birth to age 4. The Better Kid Care (BKC) program helps parents, caregivers, and early learning professionals develop the knowledge and skills needed to fulfill their roles in the healthy development of children. Providing online learning is filling a critical gap for child care providers with easy anytime, anywhere access to professional development.

What has been done
Penn State Extension provides research-based education to meet these needs through web-based and in-person professional development. BKC On Demand is now approved to meet state-mandated training standards in 40 states. National and state child care programs recommend BKC as a quality resource for professional development. During program year 2014-2015,

148,613 online modules were completed, providing 401,806 hours of training. During in-person workshops, 4,164 participants provided evaluation.

Results
More than 200 online modules are available, and evaluation data are extensive. For example, there was a significant difference between control and intervention groups in knowledge about storage of hazardous chemicals in a child care facility ($p<0.05$) and overall pest treatment knowledge ($p<0.01$). Evaluation reports indicate that participant knowledge gained and intent to apply learning to practice had mean scores greater than 3.3 (1=low to 4=high) for each module.

The number of children who benefit from the caregiver training is significant. 57% of the 4,164 participants who attended in-person workshops care for and educate more than 13 children daily.

In a 3-month follow-up, 59% of all respondents (n=60) indicated that they have used an idea learned from BKC (e.g., started using more open-ended questions, incorporated more science materials). 46% indicated that they changed a practice (e.g., got down on child's level, took more time to connect with parents).

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety
802	Human Development and Family Well-Being
806	Youth Development

Outcome #4

1. Outcome Measures

Number of tractors retrofitted with a rollover protective structure through a program of the rural health and safety extension team

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farming is among the most dangerous occupations in the United States, with a fatality rate 800 percent higher than that for the average American worker. Tractors are the leading cause of farm deaths, and the most frequent cause of tractor-related deaths is side and rear overturns.

Of the 37 farm fatalities in Pennsylvania in 2013, 15 were tractor-related, and 10 of those involved a rollover. Our rolling terrain contributes to farmers in the Northeast experiencing the highest rates of overturn death.

What has been done
A program designed to reduce tractor-related farm injuries and deaths by helping farmers pay for the installation of rollover protective structures, or ROPS, recently reached a milestone in Pennsylvania. The ROPS Retrofit Program rebates 70 percent of the cost of purchasing and installing rollover protection, up to a maximum of $865. The program has been supported by Farm Family Life Insurance Co., Land O' Lakes Inc., AgChoice Farm Credit, MidAtlantic Farm Credit, and other donors.

Results
In 2015, the ROPS Retrofit Program for Pennsylvania Farmers funded the installation of the 100th ROPS since the initiative began in 2011. Rollover protective structures, when combined with seatbelt use, can almost entirely prevent deaths and serious injuries from tractor overturns.

Eighty percent of rollover deaths happen to experienced farmers, and 7 out of 10 farms that suffer a tractor overturn fatality will go out of business within a year. One in seven farmers involved in a tractor overturn is permanently disabled. The ROPS Retrofit Program helps ensure farmers' health, farm sustainability, and the rural economy and landscape.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
723	Hazards to Human Health and Safety

Outcome #5

1. Outcome Measures

Percentage of diabetic participants in Dining with Diabetes extension program who experienced a decline from baseline in their long-term blood sugar measurements at followup

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	66

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Diabetes is the 7th leading cause of death in PA. About 1.3 million Pennsylvanians (12.1%) have diabetes, including about 325,000 who are unaware of it and greatly increase their health risk. Also, 3.5 million (35.8%) Pennsylvanians have prediabetes. Diabetes costs an estimated $13.4 billion/year in Pennsylvania, and people with diabetes have medical expenses 2.3 times higher than those without it. Only 50-60% of adults with diabetes have attended a diabetes self-management class.

What has been done
To help address this issue, seventy Dining with Diabetes community-based programs were offered in 32 rural, suburban, and urban counties. Extension educators taught a series of four classes, each 2.5 hours in length, plus a follow-up class. They reached 693 participants through 95 classes.

Results
Community-based diabetes education programs reduce the risk of diabetes by 58%, improving biomarker scores and reducing health care costs. Over the three-month Dining with Diabetes program, 50% of participants experienced a drop in long-term blood sugar (A1C) and 59% of participants had lowered blood pressure. Sixty-six percent of participants with diabetes who had baseline and follow-up A1C measurements experienced a decline in their A1C test result at follow-up. Fifty-two percent of participants increased the number of days per week on which they exercised for 20 minutes or more. Fifty-six percent of participants increased the number of days per week on which they ate a variety of fruits and vegetables. Sixty-seven percent increased the number of nights per week on which they slept 6.5-8.5 hours. All of these improved measurements and behaviors reduce the risk for long-term complications of diabetes, and reduce the risk of developing diabetes for those with pre-diabetes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
802	Human Development and Family Well-Being
805	Community Institutions and Social Services
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Percentage of participants in Extension-offered workshop on Bringing the Protective Factors Framework to Life in Your Work who expressed increased knowledge of specific actions and strategies to increase factors protective against child abuse in their work with preschool children and families

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	87

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The family strengths team adopted Bringing the Protective Factors Framework to Life (BPFF) to address child abuse prevention. The National Alliance of Children's Trust Funds developed this curriculum based on extensive research by the Center for the Study of Social Policy to examine commonalities of strong families. BPFF highlights the attributes of healthy, nonabusive families.

What has been done
The seven Extension educators who are certified instructors delivered programs across the state in 2014-15, primarily to those who work with preschoolers. Some were stand-alone sessions with a brief overview, while others were full series. There were conference days as well in which a team of educators worked together to provide workshops. A 6-month follow-up survey was sent to a group of participants (n=8) who completed the 7-part series in 2015.

Results
All respondents (100%) expressed a significant increase in their ability to take a strength-based approach with families, to assess families' strengths as well as needs, and to communicate the relationship between protective factors and child abuse prevention. All respondents could give examples of how they have applied information and concepts from the training to their work with families.

The Adverse Childhood Experience Study (ACES) showed that nearly 48% of U.S. children have experienced at least one of these conditions: abuse/neglect, domestic violence, parental divorce, or mental illness in the family. The more ACEs in a person's early life, the higher the risk for tobacco use, drug or alcohol abuse, and suicide. Other researchers have found a correlation between ACE scores and cancer, heart disease, depression, and obesity in adulthood. The

impacts of ACEs present huge costs for society and families. Protective factors can mitigate the impacts of ACEs and reduce/prevent them.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety
724	Healthy Lifestyle
802	Human Development and Family Well-Being
805	Community Institutions and Social Services
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

Brief Explanation

Natural Disasters
-The cold and threatening winter forced a number of classes be postponed or cancelled.
Economy
-Funding is limited to conduct agricultural safety and health trainings.
-Some clientele could not participate in statewide programming because of costs.
-Our inability to recruit high quality staff to deliver 4-H science programs decreases the reach of our programmatic efforts.
-Cutbacks in funding for extension have resulted in the loss of educator positions.
Changes in Appropriations
-Reduced appropriations continue to result in fewer educators to conduct inperson programming for the Better Kid Care team. Other programmatic challenges include contract processing, statewide learning management system changes that reduced the number of approved instructors, and a new, more costly statewide registration process.
Public policy changes
-Instructors of the Bringing the Protective Factors Framework to Life in Your Work curriculum are expected to deliver the programs at no cost to participants, but without financial support from supporting/administering organizations. The curriculum has travel and supplies costs. The extension instructor is usually a wage payroll staffer who needs to recover costs. This year, those costs were covered with salary savings from an educator's grant. However, sustaining this program will mean recovering costs.

Government Regulations

- The state regulations regarding background checks for volunteers working with youth and the University policy regarding child abuse training have required staff to focus efforts on these administrative tasks and have added requirements for individuals to serve in volunteer leadership roles.

Competing Public Priorities

-Some YMCAs, community centers, and senior centers offer a free program similar to the Strong Women program, though they lack the nutrition education piece.

Programmatic Challenges

-The availability of volunteers can be a limiting factor.

-Engaging participants in the Bringing the Protective Factors Framework to Life in Your Work professional development series has been difficult because the entire course takes 14 hours. Therefore, stand-alone sessions rather than the entire series were the most frequent delivery format.

-Many educators are juggling several major programs while supervising paraprofessionals. Most educators have multicounty responsibilities covering a large geographic area, therefore promoting/expanding programs is difficult.

-Increased demand for classes requires additional time for the coordinator to administer, supervise, and make site visits.

-Loss of staff through retirements and other attrition has left many counties without the oversight of family and consumer sciences educators to administer programs.

Population Changes

-The number of native Spanish speakers is on the rise. Our programs must adapt to be relevant to that audience.

Other - Extramural Funding

-Some of our programs are affected by extramural funding, either by adding resources to promote them or by shaping the content of the product.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.