

2014 Pennsylvania State University Combined Research and Extension Annual Report of Accomplishments and Results

Status: Submitted

Date Submitted: 03/31/2015

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. We have completed the transition from twelve departments to nine, and we have taken bold measures to reduce costs, increase operational efficiencies, and maintain the highest possible level of services for our students and stakeholders. We are confident that these new initiatives will result in increased focus on College-wide thematic areas, key opportunities to innovate, intra-college connections, university partnership opportunities, academic programs, and extension alliances.

In 2014, the College updated its strategic plan around 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 humans, 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. One piece of evidence of this success is that two Penn State doctoral students were named Borlaug Fellows in Global Food Security in 2014.

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 has the good fortune of providing 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. Our work on nutrient management in the Chesapeake Bay is a regional issue of great interest to the federal government. Penn State Extension has brought together diverse stakeholders in a community-based model to improve local waterways, such as the impaired Conewago Creek in the Chesapeake Bay watershed. The project was cited as a model by USDA's Natural Resources Conservation Service. The Penn State Marcellus shale group aims to continue as an internationally sought-after leader in the field. Representatives of more than 50 countries on six continents, the World Bank, the U.S. State Department, and international businesses have sought the group's advice as a leader in objective education on shale gas issues and research. We are building predictive models that allow more targeted nutrient and pest management, examining how best to preserve pollinators in support of the food supply, and studying the impact of invasive species on Pennsylvania and U.S. agriculture. 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.

The College continues to focus our program deliverables, strategically eliminate program areas, 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.
- PA CES captures data on contacts (direct and indirect) and participants. We consider participants to be the number of individuals who attend the educational programs that we offer. Our contact numbers are derived from the number of people each of our extension educators and/or faculty have contacted. Direct

contact numbers are only those from face-to-face meetings; indirect contacts are through e-mail, telephone conversations, Adobe Connect sessions, etc.

- Publication numbers have historically been gleaned from the USDA Accomplishment Reports as submitted to the Current Research Information System (CRIS). With the implementation of REEport, the information submitted cannot be exported for data manipulation. Therefore, the numbers reported in the Publications section include only the research publications indicated as journal articles and extension publications reported by the SETs. With the development of the REEport reporting module, we feel that we'll be able to provide more accurate numbers in future years without redundancy of efforts.

Total Actual Amount of professional FTEs/SYs for this State

| Year: 2014 | Extension | | Research | |
|------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 420.4 | 0.0 | 579.3 | 0.0 |
| Actual | 464.6 | 0.0 | 696.5 | 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 were used to review AES projects. The Hatch, McIntire-Stennis, Animal Health, and State projects were internally reviewed at initiation by at least two qualified faculty.

Many external university panels were used for Multistate Research Project (MRP) activities. Extension and academic faculty were encouraged to participate to meet the jointly agreed objectives. These projects were reviewed multiple times through the five-year duration.

The Northeastern Regional Association (NERA) directors established the Multistate Activity Committee (MAC) with representation from regional research and extension directors. MAC facilitates the development of proposals, organizes peer reviews, conducts evaluations, and makes recommendations to NERA directors on all aspects of the region's research and integrated research/extension/academic programs. To begin a multistate project, a short prospectus is reviewed by MAC to ensure that the research problem is suitable for an MRP. Next a full proposal is developed, and at least five qualified reviewers conduct an online scientific expert peer review based on National Information Management and

Support System criteria.

The suggestions from the review are provided to the technical committee for incorporation into the proposal. The revised proposal is then submitted to the MAC for additional review and recommendation to the NERA membership. NERA then reviews the project and may accept the MAC recommendation. The chair of NERA then forwards the proposal to the Partnership Office of USDA for final review. With the Partnership Office's approval, the project receives its final approval.

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

Combined internal and external university panels were assigned to each of the programmatic issues. These panels were 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 represented all parts of the Commonwealth, and faculty members were chosen to represent relevant research and extension perspectives. Extension Program Leaders provided overall leadership to the SETs, and programs were reviewed by extension administrators. State administrators and academic unit leaders served as liaisons to each team. Each SET developed a program plan, based on logic model components, to guide extension programming and applied research efforts.

Combined internal and external university and external non-university panels were used to create advisory committees for each program team. These panels assisted in identifying issues where expertise could be applied in program efforts. The work plans were 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
- Survey specifically with non-traditional groups
- 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>) provide 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 Internal Focus Groups
- Use Surveys
- 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 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, which was established in 2013.

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
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals

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.

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. 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.

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.

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. A recent tour of the Utz Quality Foods, Inc., factory catalyzed a new research project helping them with food sensory evaluation.

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. For example, the 4-H State Leader Forum was heavily revamped in 2014, with great success, to accommodate participant needs. The forum was shifted from a 3-day event to a single day; registration occurred later in the morning to accommodate commuters; workshop offerings were expanded and eight workshop tracks were offered in collaboration with other 4-H teams. In addition, the awards banquet was streamlined, and the focus of awards was shifted away from years of service to quality of program delivery. Overall registration was almost triple the number of attendees in 2012. Representatives from 85% of PA counties attended. Changes such as these better meet the needs of our audiences.

IV. Expenditure Summary

| 1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS) | | | |
|---|----------------|----------|-------------|
| Extension | | Research | |
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 10582584 | 0 | 7729903 | 0 |

| 2. Totalled Actual dollars from Planned Programs Inputs | | | | |
|---|---------------------|----------------|----------|-------------|
| | Extension | | Research | |
| | Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| Actual Formula | 12340705 | 0 | 8245196 | 0 |
| Actual Matching | 15929362 | 0 | 24334010 | 0 |
| Actual All Other | 19837205 | 0 | 33714777 | 0 |
| Total Actual Expended | 48107272 | 0 | 66293983 | 0 |

| 3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous | | | | |
|--|---------|---|---------|---|
| Carryover | 3938444 | 0 | 4722849 | 0 |

V. Planned Program Table of Content

| S. No. | PROGRAM NAME |
|--------|--|
| 1 | Advanced Agricultural and Food Systems |
| 2 | Biologically Based Materials and Products |
| 3 | Community Resilience and Capacity |
| 4 | Environmental Resilience |
| 5 | Global Engagement |
| 6 | Integrated Health Solutions |
| 7 | Positive Future for Youth, Families, and Communities |
| 8 | Climate Change |
| 9 | Childhood Obesity, Chronic Health Issues, and Healthy Lifestyles |
| 10 | Food Safety |
| 11 | Global Food Security and Hunger |
| 12 | Sustainable Energy |
| 13 | Economic and Community Development |
| 14 | Environmental Management |
| 15 | Food and Fiber Systems |

V(A). Planned Program (Summary)**Program # 1****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 |
|----------------|--|------------------------|------------------------|-----------------------|-----------------------|
| 133 | Pollution Prevention and Mitigation | 2% | | 1% | |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | 2% | | 5% | |
| 202 | Plant Genetic Resources | 2% | | 2% | |
| 204 | Plant Product Quality and Utility (Preharvest) | 2% | | 2% | |
| 205 | Plant Management Systems | 6% | | 7% | |
| 206 | Basic Plant Biology | 2% | | 5% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | 9% | | 18% | |
| 212 | Diseases and Nematodes Affecting Plants | 7% | | 11% | |
| 213 | Weeds Affecting Plants | 4% | | 4% | |
| 216 | Integrated Pest Management Systems | 9% | | 9% | |
| 301 | Reproductive Performance of Animals | 3% | | 7% | |
| 302 | Nutrient Utilization in Animals | 4% | | 4% | |
| 307 | Animal Management Systems | 11% | | 7% | |
| 308 | Improved Animal Products (Before Harvest) | 4% | | 2% | |
| 311 | Animal Diseases | 6% | | 3% | |
| 315 | Animal Welfare/Well-Being and Protection | 9% | | 3% | |
| 402 | Engineering Systems and Equipment | 2% | | 2% | |
| 405 | Drainage and Irrigation Systems and Facilities | 3% | | 1% | |
| 601 | Economics of Agricultural Production and Farm Management | 7% | | 4% | |
| 602 | Business Management, Finance, and Taxation | 6% | | 3% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)**1. Actual amount of FTE/SYs expended this Program**

| Year: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |
| Actual Paid | 25.1 | 0.0 | 22.4 | 0.0 |
| Actual Volunteer | 123.1 | 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 |
| 4077805 | 0 | 2989384 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 4860829 | 0 | 7146762 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 2817910 | 0 | 5764169 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extension program areas employ a comprehensive, 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 in combination with those of producers. Research and extension programs focus on the farm-to-fork continuum, with emphasis on research-based educational programs for the producers and consumers of our agricultural commodities. Our work is responsive to consumers who are demanding that safe, wholesome food is produced in an environmentally and ethically responsible manner. Increasingly, this is translating into growing trends toward 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.

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 take into consideration and address the changing societal awareness and interest in animal welfare. The health and welfare of production animals is a priority for producers and consumers; furthermore, a fundamental understanding of animal health can translate to issues that affect human health care. Agencies at the state and federal levels and the consuming public have a heightened awareness and expectation for environmental issues as important factors in plant and animal production. Producers are informed and educated on best management practices that increase the level of profitability and sustainability of food and fiber systems in an environmentally acceptable manner. The interrelationships among plants, animals, people, and the environment are reflected in regulatory policies that influence decision-making relative to agricultural production.

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, with a focus on a systems approach, in both plant and animal agriculture have been at the heart of Penn State excellence for many years. As new pests emerge, as our portfolio shifts, and as environmental knowledge and rules

change, we are faced with the 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 into other management decisions are all key areas in our AES and CES portfolios.

We are also focused on mechanization in pruning and harvesting to increase efficiency and reduce dependence on transient labor that is not always available in adequate supply.

Another important theme is meeting the needs of traditionally underrepresented audiences, such as female and young farmers, 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 Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org.

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

A member of the soils team worked with the eOrganic community of practice on eXtension to present webinars and develop fact sheets.

Members of the vegetable, small fruit, and mushroom team developed six 30minute pesticide recertification courses accessible via eXtension for which clients can pay a fee to complete.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|--------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 78266 | 515433 | 70440 | 25194 |

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

Patent Applications Submitted

Year: 2014

Actual: 3

Patents listed

Serial No. 2,759,246; Filed 4/23/2009; Title: Rapid Generation of Vitamin D2 from Mushrooms and Fungi Using Pulsed UV-Light

Serial No. 2,452,183; Filed 12/28/2003; Title: Methods and Compositions for Highly Efficient Transformation of Filamentous Fungi

Serial No. 13/640,131; Filed 10/9/2012; Title: Strategies for the Transgenic Manipulation of Filamentous Fungi

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 48 | 164 | 212 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|------|--------|
| 2014 | 146402 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 6 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Amount of cost savings (in \$) if feed and labor costs for just 10% of heifers in PA were managed at maximum efficiency. |
| 2 | Number of insecticide active ingredients receiving Section 18 Emergency Registration from EPA for use on fruit in PA during the 2014 season, to protect against heavy losses in specialty crops. |
| 3 | Exploration of spatial distribution of injury at harvest caused by brown marmorated stink bug in commercial Mid-Atlantic apple orchards. |
| 4 | Savings (in \$) in commercial greenhouse crop salvaged after green industry extension team helped identify herbicide-polluted irrigation water as the culprit. |
| 5 | Increase (in \$) in Pennsylvania's alfalfa crop value per year if 60% of farmers growing alfalfa grow one of the top five yielding varieties from Penn State blind trials. |
| 6 | Finding that spraying the leaves of the Theobroma cacao tree (from which we obtain cocoa) with a low-concentration glycerol solution triggers the plant's defense response and enhances its natural disease resistance in the laboratory. |
| 7 | New hybrid rye line that is yielding more than two times the currently common variety in PA & NY trials and is of interest for the expanding brewing and distilling market. |
| 8 | Development of a set of rules for pruning apple trees and grape vines to produce results more effectively and efficiently. |
| 9 | Approximate potential value of growth in income if all PA dairy producers earned just \$30 more per culled animal by focusing on reducing tissue blemishes |

Outcome #1

1. Outcome Measures

Amount of cost savings (in \$) if feed and labor costs for just 10% of heifers in PA were managed at maximum efficiency.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|---------|
| 2014 | 3200000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dairy heifers are the future revenue-generating units on a dairy operation. However, during their pre-productive period, they represent a significant cost toward the production of milk. The total cost of raising dairy heifers is the second largest contributor to the annual operating expense of dairy farms in Pennsylvania. Efficiency in feeding, breeding, and milk production will allow PA dairy farms to improve their competitive position and remain sustainable in the future.

What has been done

Data were collected from 44 dairy operations in Pennsylvania on management practices, feeding, and costs for labor, health, bedding, and reproduction for replacement heifers from birth to first calving. Costs/heifer were broken into 4 periods: birth to weaning, weaning to 6 mo of age, 6 mo of age to breeding age, and heifers from breeding to calving. Milk production records were obtained from Dairy Herd Improvement. The average number of milking cows/farm was 198 (range: 38-1,708).

Results

All costs given here are averages. Total cost/heifer was \$1,808 from birth to freshening. Cost per animal for the 4 time periods was: birth to weaning, \$217; weaning to 6 mo, \$247; 6 mo to breeding, \$607; and breeding to calving, \$736. Feed was the largest component of cost, accounting for nearly 73% of the total. Data envelopment analysis determined that 9 farms were the most efficient of those studied. These farms best combined feed and labor investments, spending, on average, \$1,137 and \$140/heifer for feed and labor, respectively. These heifers calved at 23.7 mo and produced 88% of the milk produced by older cows. In contrast, the 35 inefficient farms spent an average of \$227 more on feed and \$78 more on labor per heifer for animals that calved 1.6 mo later and produced only 82% of the milk made by their mature herd mates. If 10% of the 105,000 heifers in PA were managed at optimal efficiency, dairy farms would

save \$3.2 million. This work appeared in Journal of Dairy Science.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 301 | Reproductive Performance of Animals |
| 302 | Nutrient Utilization in Animals |
| 601 | Economics of Agricultural Production and Farm Management |

Outcome #2

1. Outcome Measures

Number of insecticide active ingredients receiving Section 18 Emergency Registration from EPA for use on fruit in PA during the 2014 season, to protect against heavy losses in specialty crops.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 2 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are more than 600 'specialty' crops, with a total value in the U.S. of about \$49.6 billion. This represents 34% of the value of all crops. The economic importance of these crops varies widely. In 10 states, including PA, sales of specialty crops exceed \$1 billion/year. In the Northeast, sales of specialty crops represent more than half of total crop sales in all states, and exceed 75% in most. Insect damage to specialty crops can have devastating impacts on local and regional economies.

What has been done

This project facilitates registrations of pest management products for specialty food crops and for minor uses on major crops. It is estimated that one-third of plants grown are lost to pest damage. This amount would be even higher without the availability of modern pest management technology.

Results

Multiple new pest management products were evaluated during efficacy trials conducted on pome and stone fruit crops. Based on field trials and using residual data support provided by the IR4 headquarters and expressed, continuous need for the products, two insecticide active ingredients--dinotefuran and bifenthrin--again received Section 18 Emergency Registration from EPA for use on fruit in PA during the 2014 season. The project director provided pest management recommendations to fruit growers during more than 30 commercial grower meetings across PA. Patterns for rational use of newly registered products and dinotefuran and bifenthrin were discussed during multiple on-site grower visits.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 211 | Insects, Mites, and Other Arthropods Affecting Plants |

Outcome #3

1. Outcome Measures

Exploration of spatial distribution of injury at harvest caused by brown marmorated stink bug in commercial Mid-Atlantic apple orchards.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The invasive brown marmorated stink bug (BMSB) (*Halyomorpha halys*) has caused serious economic injury to many crops in the Mid-Atlantic region, including to tree fruit. Losses to apple in 2010 were estimated at \$37 million in that region alone. As a result, pesticide use increased fourfold between 2010 and 2011, and growers are recently seeing more secondary pest outbreaks. Increased pesticide use is detrimental to the environment and to growers' bottom lines.

What has been done

Researchers studied the spatial distribution of BMSB injury at harvest in commercial Mid-Atlantic apple orchards in 2011 and 2012. Within each orchard block, a border zone (next to woods), an interior zone (near orchard center), and an intermediate zone were designated. Just before harvest, fruit were sampled from 3 positions within the canopies of trees in each zone. Following

3-5 weeks in cold storage, external and internal injuries, and severity of internal injury from BMSB were assessed.

Results

Apples from the upper canopy of border zone trees were most likely to show external and internal injury. The lowest rate of injury occurred in the lower canopy within the interior zone. Results confirm patterns seen previously, in which BMSB move into orchards to feed from host plants in wooded areas. Results also confirm previous research findings that BMSB tend to gather at the tops of trees. In a Maryland orchard untreated for BMSB because the apples were bound exclusively for processing, injury rates were 75%. Results indicate that sampling fruit accessible from the ground may not provide accurate estimates of BMSB injury or the need for treatment to prevent injury. Scouting, and possibly spraying, for BMSB should focus on border areas. Maintaining a more open canopy may also improve the efficacy of pesticides. The research, which highlights the need for a return to more sustainable orchard pest management practices, was written up in the Journal of Economic Entomology.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 211 | Insects, Mites, and Other Arthropods Affecting Plants |
| 216 | Integrated Pest Management Systems |

Outcome #4

1. Outcome Measures

Savings (in \$) in commercial greenhouse crop salvaged after green industry extension team helped identify herbicide-polluted irrigation water as the culprit.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 12000000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Besides teaching green industry professionals how to identify and safely manage plant pests, pathogens, and abiotic disorders, the green industry team helps commercial greenhouses and others solve production problems.

What has been done

A Lancaster County greenhouse saved a \$12-million herbaceous perennial plug crop when an extension educator helped them discover herbicide-polluted irrigation water. Several years ago the growers began to notice cupping and curling of dicot foliage, terminal shoot loss in some cases, and stunting.

Results

The green industry extension team helped identify the culprit: the herbicide picloram at 3-4 parts per billion in irrigation water. The client subsequently changed water sources and installed a water purification system to resolve the problem. The herbicide may have been used as a right-of-way treatment on the rail line behind the facility.

This grower produces up to 360,000 trays of product per year. Roughly 2/3 of the crop was dicot and 1/3 was monocot. Monocots are not generally affected by picloram. At an average flat price of \$50, the total site production value would be approximately \$18 million, and 2/3 of this is \$12 million.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 405 | Drainage and Irrigation Systems and Facilities |

Outcome #5

1. Outcome Measures

Increase (in \$) in Pennsylvania's alfalfa crop value per year if 60% of farmers growing alfalfa grow one of the top five yielding varieties from Penn State blind trials.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 126480000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growing high-yielding, high quality crops can make a difference in long-term farm sustainability.

What has been done

Penn State Extension runs yearly variety trials for perennial forage crops. The goal is to provide unbiased, comprehensive, accurate, and assessable forage variety testing results to industry and producers. The team specializes in alfalfa and cool season grasses. Funding also comes from a fee charged to seed companies to enter a variety in the trial.

Results

Between 1996 and 2002, average dry matter yield for alfalfa was 5.7 tons per acre. Between 2005 and 2011, the average yield was 7.3 tons per acre, an increase of 1.6 tons per acre in just 10 to 15 years. This difference was present in all years of the stand life. Fertility and pest control were constant during the period, so yield improvement was likely from improved genetics.

So how valuable can non-bias alfalfa trial evaluation be to farmers' In Pennsylvania over the past 16 years, the yield of the top five varieties has averaged 1.7 tons more per acre than the yield of the bottom five varieties. To a producer making variety selections (assuming a hay value of \$200 per ton), this difference would amount to an increase of nearly \$340 per acre per year from selecting a top variety using variety trial data.

About 620,000 acres of alfalfa are grown in PA yearly, so if 60% of those farmers use the variety trial data, the total added earnings per year could be over \$126 million per year.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 202 | Plant Genetic Resources |
| 601 | Economics of Agricultural Production and Farm Management |

Outcome #6

1. Outcome Measures

Finding that spraying the leaves of the Theobroma cacao tree (from which we obtain cocoa) with a low-concentration glycerol solution triggers the plant's defense response and enhances its natural disease resistance in the laboratory.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cocoa farmers this year will lose an estimated 30 to 40 percent of their crop to pests and disease, and with chocolate prices having risen globally by roughly two-thirds in the past decade, concern is growing about sustainability in cocoa production. Of particular concern are the environmental impact and human health risks of toxic agrichemicals--organochloride insecticides and heavy-metal-based fungicides--used in cocoa production to fight pests and disease.

What has been done

Penn State scientists have found--in a safe, biodegradable compound--a potential alternative to the hazardous antifungal agents currently being used to combat one of the most damaging cacao diseases, Phytophthora pod rot (also known as black pod), responsible for an estimated 20 to 30 percent loss in yield annually. Spraying the leaves of the Theobroma cacao tree with a low-concentration glycerol solution triggers the plant's defense response and enhances its natural disease resistance.

Results

Cocoa farmers are currently using fungicides and other chemicals that are very effective but are also highly toxic compounds, very persistent in the soil, and relatively expensive. Glycerol, on the other hand, is extremely non-toxic; it's super safe, super cheap, biodegradable, and it triggers the plants' defenses very efficiently - it only takes small amounts to trigger the whole plant defense system. Glycerol, a simple sugar-alcohol compound called a polyol, is a colorless, odorless, viscous liquid commonly used in soaps and other cosmetic products and is produced in different ways, including as a byproduct of biodiesel production. Production of biodiesel is expected to increase, so glycerol should become even less expensive. The lab is now field-testing the treatment.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 133 | Pollution Prevention and Mitigation |
| 212 | Diseases and Nematodes Affecting Plants |

Outcome #7

1. Outcome Measures

New hybrid rye line that is yielding more than two times the currently common variety in PA & NY trials and is of interest for the expanding brewing and distilling market.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rye grain yields are often disappointing. This has discouraged use of the crop for grain and even seed production. Most of the current production is older varieties like Aroostook.

What has been done

Two years ago, Penn State agronomists began evaluating a hybrid rye line, Brasetto, from German breeder KWS, versus Aroostook. The crops were managed similarly to wheat in the trials, with planting in October and harvesting at or around the same time as the wheat. The hybrid rye yielded about 90 bushels/acre, and Aroostook averaged 40 bushels/acre. Similar results were obtained by Cornell.

Results

There are limited markets for rye grain, but having this hybrid as an option could be useful in developing new markets, such as the growing distilling industry with its need for high quality rye grain to make vodka or whiskey. A few growers in PA and NY are gearing up to meet this demand, which emerged in PA in 2012, when the new 'Limited Distillery' license was created.

In Europe rye is widely used in hog and beef rations, so this might be an additional potential future market.

The KWS hybrid rye has been licensed to Seedway. It will be commercially available for 2015. The hybrid is a premium-priced seed marketed to be planted and not saved, so a lower seeding rate is key to managing seed cost.

An advantage to introducing a newly feasible crop is that as farms have more diverse crop rotations, ecosystem services tend to increase.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 202 | Plant Genetic Resources |
| 601 | Economics of Agricultural Production and Farm Management |

Outcome #8

1. Outcome Measures

Development of a set of rules for pruning apple trees and grape vines to produce results more effectively and efficiently.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

To maintain viability in the highly competitive global market, the U.S. specialty crop industry must reduce the need for a large seasonal workforce by mechanizing and automating. Growers need to reduce the expense of and uncertainty about the availability of seasonal labor. This is especially true for labor-intensive crops such as deciduous fruits, for which pruning is among the most labor-intensive practices. The 'art' of pruning can be phased out in favor of scientifically sound principles.

What has been done

The aim is to make apple and grape production more cost competitive and to reduce risk from insufficient labor. The team is accomplishing this by integrating engineering and horticulture to develop technologies that automate pruning. The researchers developed a set of rules for pruning that has been evaluated and compares favorably with human-pruned trees and vines.

Results

The team is using the pruning rules to develop automated decision systems and to train people to prune more effectively and efficiently. Data from field experiments to develop and refine the pruning rules appear to encapsulate optimal pruning.

The rules are valuable as an educational tool to help growers make pruning cuts that result in favorable outcomes. Following pruning workshops, orchard employees participated in a trial to assess ease of following the pruning rules. They quickly adopted the rules, and the trees they pruned were indistinguishable from trees pruned by horticulturalists in the automated pruning project.

The cost of autonomous pruning by a machine currently being tested for wine grapes in California is \$251/ac--lower than the estimated labor costs from 7 of 9 recent cost studies from various states. A similar machine for apples could have the potential to economically replace pruning labor in high-density orchards.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 204 | Plant Product Quality and Utility (Preharvest) |

| | |
|-----|--|
| 205 | Plant Management Systems |
| 402 | Engineering Systems and Equipment |
| 601 | Economics of Agricultural Production and Farm Management |

Outcome #9

1. Outcome Measures

Approximate potential value of growth in income if all PA dairy producers earned just \$30 more per culled animal by focusing on reducing tissue blemishes

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 6000000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A recent study of dairy herds indicated that 90% of cows culled were sold for beef. Producers often view these animals as being of little value to their bottom line. The study found that producers had little knowledge of the quality performance of animals sold for beef, the average hot carcass weight, or the average body condition of cull animals. Each cull animal is deducted an average of \$60 due to preventable tissue blemishes.

What has been done

The Penn State Extension Veterinary Team, in conjunction with the PA Beef Council, conducted 17 beef quality assurance programs in FY 2013-14, impacting more than 2,000 producers across the state. Participants learned facts and statistics about the beef industry and how meat is affected by poor handling and improper injection techniques. Residue avoidance, judicious antibiotic use, and impending changes to Food & Drug Administration regulations on antibiotic use in animals were also emphasized.

Results

Dairy producers found the information presented to be easily and directly applicable to their operations. One dairy producer who attended the program captured, on average, \$90 more per cull animal. She stated that this "was the easiest way she added \$5,000 to her checkbook for the year!" If each dairy producer in PA captured only one-third of this amount (\$30) per culled animal, the industry would realize almost \$5 million in income, most of which would be profit.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 307 | Animal Management Systems |
| 308 | Improved Animal Products (Before Harvest) |
| 601 | Economics of Agricultural Production and Farm Management |

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

- There have been weather extremes with too wet or too dry conditions that had major implications for somatic cell count and feed quality and quantity. This can have huge impacts on a producer's income, due to decreased milk production and milk premium earned, and increased feed costs.
- Adverse weather factors continued to influence clientele participation.
- Wet growing conditions for much of the season fostered numerous, severe plant disease outbreaks that required diagnosis and clientele education to manage those diseases safely and efficiently.

Economy

- The economic climate continues to have a significant impact on the ability of clientele to attend meetings and conferences.
- The economy influenced the ability of clientele to implement tactics suggested.

Appropriations Changes

- Appropriation changes affected both the research and extension functions of the College of Agricultural Sciences and resulted in fewer faculty and staff across all areas of the college. The ability to travel to interact with clientele, attend meetings to improve skills, and hire personnel to help conduct programs have all been affected.

Public Policy Changes

- Oversight of food and farm businesses at all levels of government affects our program efforts, and we must stay current.

Government Regulations

- Nutrient management legislation now demands that cover crops are used after corn silage if the farmer wishes to apply manure in the winter. The Resource Enhancement and Protection legislation continues to assist farmers to get 50% tax credits for purchased no-till equipment and other BMPs. This requirement has increased interest in the integrated crop production practices program.
- The Food Safety Modernization Act is having an enormous impact on the food supply chain. The need for programs is expected to rise.
- Pennsylvania's new limited distillery license is increasing interest in new specialty grain crops.

Competing Public Priorities

- Competing public priorities force us to continually align our program priorities with budget realities.
- Although the awareness and knowledge is increased, the implementation of best management practices may have been impaired by the economy and public policy priorities.
- Competing public priorities continue to be an issue as program funding declines.

Competing Programmatic Challenges

- The Pennsylvania Department of Agriculture is changing pesticide exams to closed book, which will increase the need for training to help employees prepare.

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

- 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.
- Extramural funding continues to decline. An increasing amount of time is spent on developing proposals for extramural funding.

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) are scheduled to be implemented in fall 2015 to 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 # 2****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 | 0% | | 2% | |
| 102 | Soil, Plant, Water, Nutrient Relationships | 5% | | 3% | |
| 112 | Watershed Protection and Management | 4% | | 3% | |
| 123 | Management and Sustainability of Forest Resources | 6% | | 12% | |
| 131 | Alternative Uses of Land | 2% | | 4% | |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | 3% | | 7% | |
| 205 | Plant Management Systems | 7% | | 4% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | 6% | | 3% | |
| 213 | Weeds Affecting Plants | 6% | | 3% | |
| 216 | Integrated Pest Management Systems | 9% | | 4% | |
| 302 | Nutrient Utilization in Animals | 4% | | 2% | |
| 307 | Animal Management Systems | 8% | | 4% | |
| 315 | Animal Welfare/Well-Being and Protection | 6% | | 3% | |
| 402 | Engineering Systems and Equipment | 3% | | 9% | |
| 404 | Instrumentation and Control Systems | 3% | | 5% | |
| 511 | New and Improved Non-Food Products and Processes | 4% | | 13% | |
| 512 | Quality Maintenance in Storing and Marketing Non-Food Products | 2% | | 5% | |
| 601 | Economics of Agricultural Production and Farm Management | 9% | | 4% | |
| 602 | Business Management, Finance, and Taxation | 7% | | 5% | |
| 608 | Community Resource Planning and Development | 6% | | 5% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)**1. Actual amount of FTE/SYs expended this Program**

| Year: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |
| Actual Paid | 12.6 | 0.0 | 1.9 | 0.0 |
| Actual Volunteer | 25.6 | 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 |
| 1951697 | 0 | 319698 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 2721933 | 0 | 684487 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 2084890 | 0 | 1130200 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research into biologically based materials and products includes work toward the formation of a more durable biofeedstock through better understanding of the microscale mechanics of pelletizing materials common to the Northeast. Researchers also examined the effect of time of harvest of switchgrass on amount of energy consumed in baling, and analyzed 200 site-years of field data to determine the average sustainable removal rates for bioenergy corn stover across the country, as well as associated rates of N, P, and K removal. Other scientists are investigating and developing sustainable technologies to convert biomass resources into chemicals, energy, materials, and other value-added products.

This planned program also includes research into nascent technologies that are farther from commercial-ready, such as semicontinuous bacterial cellulose production in a rotating disk biofilm bioreactor. Over the long term, research such as this may help us transition from sequestered-carbon energy sources such as oil, natural gas, and coal, to more renewable energy systems.

Extension work included support for the first commercial energy willow harvest ever in PA; making specialized willow planting and harvesting equipment available for use by farmers; facilitating a switchgrass energy purchase agreement for a Pennsylvania farmer to supply the first known commercial "bale burner" in the region; facilitating the sale of \$120,000 of alternative energy credits for PA renewable energy producers; 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?

The bioenergy extension team worked with the Farm Energy COP to deliver materials, especially for regional efforts. They used eXtension materials for referrals and resource material, and provided peer review of eXtension materials.

Penn State Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 34282 | 759106 | 9718 | 3214 |

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

Patent Applications Submitted

Year: 2014
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|-----------|----------|-------|
| Actual | 31 | 19 | 50 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 38191 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 0 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Work toward better understanding of the microscale mechanics of pelletizing biofeedstock materials common to the Northeast, with the goal of forming a durable pellet. |
| 2 | Finding that fall-harvested switchgrass consumes less energy to compress into bales than does spring-harvested switchgrass due to changes in properties of switchgrass over winter. |
| 3 | Supported the first commercial energy willow harvest ever in Pennsylvania. |
| 4 | Quantified average sustainable bioenergy corn stover removal rates for 36 sites across the country using 200 site-years of field research data. |

Outcome #1

1. Outcome Measures

Work toward better understanding of the microscale mechanics of pelletizing biofeedstock materials common to the Northeast, with the goal of forming a durable pellet.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Agriculture is the second largest producer and user of products in particulate form. The U.S. particulate industry is valued at over \$1 trillion and growing. Plants that handle and process solids generally operate at average efficiency of 64% vs. 90% for liquid/gas plants. For the bioenergy sector to compete effectively with other fuel sources, every stage of biomass processing must be at efficiencies comparable to currently dominant fossil fuels.

What has been done

Three Northeast bioenergy crops--corn stover, switchgrass, and willow--were ground to two sizes (3.175 mm and 6.35 mm) and were conditioned at two levels of moisture content (17.5% and 20%). Various tests of pellet durability were run on the three materials.

Results

Pellet durability for the three materials was more than 80%. The pelletization process compressed the loose material nearly 12- to 14-fold for corn stover, 7- to 9-fold for switchgrass, and 5- to 7-fold for willow. The achieved relative pellet densities were 96-98% for corn stover, 67-88% for switchgrass, and 91-98% for willow. Diametral tensile strength of pellets was 4-5.8 MPa for corn stover, 0.9-3.8 MPa for switchgrass, and 0.8-5.7 MPa for willow. Axial compressive strength was 8-11.5 MPa for corn stover, 0.8-5.7 MPa for switchgrass, and 1.5-8.5 MPa for willow. These results improve our understanding of how to make a durable pellet using these three bioenergy materials, and point to issues needing further research and development.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-----------------------------------|
| 402 | Engineering Systems and Equipment |

511 New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

Finding that fall-harvested switchgrass consumes less energy to compress into bales than does spring-harvested switchgrass due to changes in properties of switchgrass over winter.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The greatest challenges in biomass logistics are transportation and storage costs. Current transportation costs are as high as \$0.18-\$0.40 per km/Mg for truck, rail, pipeline, and barge transport. Storage costs are usually greater than \$15/Mg. These costs become substantial when massive quantities of biomass must be transported and stored. Maximizing the transportation and storage efficiencies through densification is critical.

What has been done

Switchgrass may be harvested in fall or early spring, depending on weather conditions and other issues. To reduce storage space demand and increase transportation efficiency, harvested switchgrass should be densified. Research was conducted to examine energy consumption of compressing switchgrass collected from different harvesting seasons. Lab compression tests quantified the energy requirements needed for switchgrass compression. The work appeared in American Journal of Plant Sciences.

Results

Switchgrass moisture content had no effect on energy required to compress switchgrass when only dry matter bulk density was accounted for. Wetter switchgrass could be compressed to higher wet bulk density for any given pressure. When baling switchgrass, moisture content did not influence dry matter bulk density of bales. Bales with higher moisture content have higher wet bulk density.

Time of year of switchgrass harvest greatly affects biomass characteristics. Compression testing showed that decreased leaf matter caused the spring-harvested switchgrass to be much harder to

compress than fall-harvested. Switchgrass fields harvested in fall yield more dry matter, and the material can be formed into denser, large square bales, indicating higher quality over long-term storage.

Specific energy requirements calculated from the lab compression tests showed that the energy consumed by large square balers and bale compressors will be much less if harvest and baling is done in fall than in spring.

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 |

Outcome #3

1. Outcome Measures

Supported the first commercial energy willow harvest ever in Pennsylvania.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Renewable energy resources, especially biomass sources, are gaining a foothold in Pennsylvania, and the bioenergy extension team is supporting these efforts on several fronts.

What has been done

The team is supporting biomass crop farmers with equipment, knowledge, and connections to renewable energy producers. For example, they organized a field tour and provided technical support for the first ever commercial energy willow harvest in PA. Interested people came from all over the Mid-Atlantic to see how the harvest was done and to learn more about how a school uses biomass energy for heating.

Results

Several years ago, Hughesville High School in East Lycoming School District planted 40 acres of shrub willow hybrid for use as fuel for the heating system. Now about one-third of this area can be harvested each year. Biomass provides approximately one-third of the school's annual heating needs. About \$30,000 per year is saved by heating with biomass. Many other schools and organizations have inquired about growing and heating with shrub willow, and Penn State Extension often links interested parties and organizes tours.

The team also facilitated:

-the sale of \$120,000 of alternative energy credits for PA renewable energy producers. Energy corporations nationwide purchased credits to meet their commitments for renewable energy generation.

-a switchgrass energy purchase agreement for a Pennsylvania farmer to supply the first known commercial "bale burner" in the region, in New Jersey.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-----------------------------------|
| 131 | Alternative Uses of Land |
| 205 | Plant Management Systems |
| 402 | Engineering Systems and Equipment |

Outcome #4

1. Outcome Measures

Quantified average sustainable bioenergy corn stover removal rates for 36 sites across the country using 200 site-years of field research data.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The need for information regarding potential effects of harvesting crop biomass as feedstock to meet mandated Renewable Fuel Standard (RFS) requirements for advanced biofuels is

increasing exponentially as the 15 billion gallon ceiling for grain-based fuels in 2022 deadline approach. Corn (*Zea mays*, L.) stover was identified as an important feedstock for cellulosic bioenergy production because of the extensive area upon which the crop is already grown.

What has been done

A regional partnership collected replicated field data quantifying grain and stover (aboveground plant parts remaining after harvesting the grain) yields, as well as the amount of nitrogen (N), phosphorus (P), and potassium (K) removed when harvesting a moderate or high amount of the stover at 36 locations across the U.S. The team summarized more than 200 site-years of field research conducted across the country to determine quantities and locations where stover could be sustainably harvested.

Results

New and existing research studies provide extensive field validation data sets to confirm the sustainable amount of corn stover available for advanced biofuel production. Average corn grain yields ranged from 5.0 to 12.0 Mg ha⁻¹ (80 to 192 bushels per acre) and were highest in the center of the Corn Belt. Stover removal rates averaged 3.9 and 7.2 metric tons per hectare (1.7 and 3.2 tons per acre). Harvesting stover increased N, P, and K removal by 24, 2.7, and 31 kilograms per hectare (22, 2.4, and 28 pounds per acre) at the moderate harvest rate or 47, 5.5, and 62 kilograms per hectare (42, 4.9, and 55 pounds per acre) at the high harvest rate. This information will be useful to scientists, conservationists, farmers, and industries planning to use corn stover for producing bioenergy or other bioproducts. This data should be used to verify simulation modeling and available corn stover feedstock projections, but not for site-specific stover harvest decisions.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 101 | Appraisal of Soil Resources |
| 102 | Soil, Plant, Water, Nutrient Relationships |
| 131 | Alternative Uses of Land |
| 205 | Plant Management Systems |

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

Economy

- Strong markets for food and feed crops, coupled with a sluggish economy and falling fuel prices, dulled interest in renewable energy.

Appropriations

- Losses of county-level funding for renewable energy programming reduced the team's ability to deliver programming.

Public Policy

- Wavering public policy regarding biofuels increased risk for renewable energy producers.

Government Regulations

- Public Utility Commission rule changes regarding renewable power increased risk for renewable energy producers.

Competing Public Priorities

- Extension educators were drawn away from energy extension work by demands for programming in other areas.

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) are scheduled to be implemented in fall 2015 to 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 # 3****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 |
|----------------|--|------------------------|------------------------|-----------------------|-----------------------|
| 131 | Alternative Uses of Land | 0% | | 3% | |
| 133 | Pollution Prevention and Mitigation | 8% | | 0% | |
| 301 | Reproductive Performance of Animals | 2% | | 2% | |
| 302 | Nutrient Utilization in Animals | 2% | | 1% | |
| 303 | Genetic Improvement of Animals | 2% | | 1% | |
| 307 | Animal Management Systems | 2% | | 1% | |
| 601 | Economics of Agricultural Production and Farm Management | 18% | | 8% | |
| 602 | Business Management, Finance, and Taxation | 29% | | 3% | |
| 603 | Market Economics | 0% | | 8% | |
| 604 | Marketing and Distribution Practices | 8% | | 6% | |
| 605 | Natural Resource and Environmental Economics | 0% | | 3% | |
| 607 | Consumer Economics | 0% | | 5% | |
| 608 | Community Resource Planning and Development | 29% | | 20% | |
| 609 | Economic Theory and Methods | 0% | | 3% | |
| 703 | Nutrition Education and Behavior | 0% | | 3% | |
| 724 | Healthy Lifestyle | 0% | | 1% | |
| 802 | Human Development and Family Well-Being | 0% | | 1% | |
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities | 0% | | 19% | |
| 805 | Community Institutions and Social Services | 0% | | 7% | |
| 806 | Youth Development | 0% | | 5% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |
| Actual Paid | 3.1 | 0.0 | 3.6 | 0.0 |
| Actual Volunteer | 0.1 | 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 |
| 489942 | 0 | 556262 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 593434 | 0 | 780918 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 459158 | 0 | 417266 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research in this planned program includes study of economic factors affecting poor mental health; economic improvement through value-added opportunities and new business development, sometimes in biologically based materials and products; and addressing issues affecting the food system. Researchers also investigated the organic price premium in relation to size of market; social and economic change related to Marcellus shale development, as well as changing perceptions about this development; sustaining Pennsylvania's forests; and prescription drug abuse in rural vs. urban areas.

Extension work related to Community Resiliency and Capacity includes the Farm\$en\$e course, which helps farmers learn to better manage the financial side of their business, and community strategic planning, which can position municipalities to qualify for additional grant money to implement their plans. Other extension work helps livestock producers maximize profit by minimizing costs and focusing on improving animal health. The Marcellus Education Team is developing new programs to meet continuing needs in mineral management, gas utilization, and global implications of shale energy.

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 Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org.

Some extension team members answered questions through the automated eXtension system, fielded "Ask an Expert" questions, participated in a Community of Practice, and looked up information on eXtension. One member broadcast a webinar on this platform.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 3983 | 70232 | 2245 | 0 |

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|-----------|----------|-------|
| Actual | 1 | 19 | 20 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 8622 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 0 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Finding that poverty is a statistically more important factor in explaining poor mental health than is income inequality. |
| 2 | Amount (in \$) of USDA Farm Service Agency loans obtained by farmers who completed Penn State Extension's "Farm\$en\$e" course. |
| 3 | Amount (in \$) of grants obtained by the borough of Mount Union, PA, as a result of implementing a 5-year strategic plan, which Penn State Extension was instrumental in facilitating. |
| 4 | Potential value (in \$) of livestock production efficiency changes advocated by Livestock Extension team if just 5% of all sheep and goat farms in Pennsylvania implemented the recommended changes and saw the average changes in costs reported in retrospective assessments. |

Outcome #1

1. Outcome Measures

Finding that poverty is a statistically more important factor in explaining poor mental health than is income inequality.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Poor mental health is a concern in the U.S. and worldwide. Not much is known about how community health and resilience affects the mental health of county residents.

What has been done

Researchers examined the effects of socioeconomic and environmental variables on the number of days of poor mental health reported across U.S. counties. They used census and telephone survey data from 2002 to 2008 as well as data from USDA's Economic Research Service.

Results

The results suggest that educational attainment, employment opportunities including self-employment, and social capital have important benefits to community mental health. Other socio-demographic variables also tended to have predicted effects, as did the amount of sunshine in January, which was the control for seasonal affective disorder. The general conclusion of the study was that living in a nonmetro county and adjacent to a metro core is associated with greater happiness. Mental health declined considerably with natural disasters and was affected by regional climate variability. For policymakers concerned about reducing the average number of poor mental health days across the nation, the results suggest that reducing poverty is a more powerful strategy than reducing income inequality. The paper was published in the journal Social Indicators Research.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 724 | Healthy Lifestyle |
| 802 | Human Development and Family Well-Being |

Outcome #2

1. Outcome Measures

Amount (in \$) of USDA Farm Service Agency loans obtained by farmers who completed Penn State Extension's "Farm\$en\$e" course.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|---------|
| 2014 | 2500000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farmers may be experts at managing their crops and livestock, but they often need help with the business side of the operation to increase profitability and sustainability. Penn State Extension provides a well-rounded set of management education courses for agricultural operators, including farm financial management.

What has been done

In the Farm\$en\$e course, farmers learn to organize and use financial records and develop and analyze financial statements. They come to understand the concepts of stability, liquidity, solvency, and profitability, leading to better decision-making for farm management and stronger relationships with external partners, such as farm lenders. This allows agricultural businesses in PA to remain viable as they continue to develop their knowledge and skills associated with managing a business.

Results

Thirty farmers completed the Farm\$en\$e course. As a result, these farmers acquired \$2.5 million in loans from USDA Farm Service Agency, 45% of which were for start-up businesses ranging from small-scale goat or beef cow-calf production, corn, greenhouse vegetables, and small-herd dairies. Each one completed an impact plan to solve a production problem, which will improve liquidity, profitability, and efficiency. One dairyman was so motivated by this class that he now uses cash-flow projections that he compares monthly with actual cash flows and analyzes the difference, making adjustments to correct any negative trend. He has since established a dairy profit team and obtained an FSA-guaranteed loan with a local private bank.

Having a detailed understanding of their financial situation and options for lending, if needed, helps agricultural operations persist through weather- and market-related difficulties and take

advantage of new opportunities as they arise.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 601 | Economics of Agricultural Production and Farm Management |
| 602 | Business Management, Finance, and Taxation |

Outcome #3

1. Outcome Measures

Amount (in \$) of grants obtained by the borough of Mount Union, PA, as a result of implementing a 5-year strategic plan, which Penn State Extension was instrumental in facilitating.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 612000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In early 2013, the Mount Union Borough Council (Huntingdon County, PA) decided to develop a strategic plan that would identify key goals to improve the community. The borough engaged a member of the Extension Economic and Community Development team to conduct the strategic planning process.

What has been done

Borough Council was committed to making this a community-wide process. Three public meetings were held, and more than 40 community members attended one or more meetings. Borough Council met with high school students and their advisors, and discussed the plan extensively at several council meetings. County agencies were also well represented in the process.

Results

The ECD team facilitated development of a 5-year strategic plan for Mount Union. This strategic plan is intended as a road map. It is a brief, action-oriented statement of the borough's long-range goals, the objectives it will use to achieve those goals, and a plan of action describing who, what, when, and how the objectives will be achieved. The goals are to:

- rejuvenate rail infrastructure and activities in Mount Union
- increase river tourism

- increase jobs and the tax base in Mount Union
- revitalize and beautify Mount Union's homes and buildings
- build community pride.

By spring 2014, the borough had in place a strategic planning implementation committee, and citizens were beginning to put the plan into action. The community recently obtained \$612,000 in grants to support implementation of the plan, hired a code enforcement officer, and is constructing a boat launch ramp as part of the first phase of a linear park along the Juniata River.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 608 | Community Resource Planning and Development |

Outcome #4

1. Outcome Measures

Potential value (in \$) of livestock production efficiency changes advocated by Livestock Extension team if just 5% of all sheep and goat farms in Pennsylvania implemented the recommended changes and saw the average changes in costs reported in retrospective assessments.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 566784 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

With the increasing costs of production, producers must improve efficiency to remain profitable. The use of sustainable practices and best management practices in production is important if livestock operations are to remain viable in the future.

What has been done

The Livestock Extension team addressed these issues during sheep and goat field days related to pasture production. Decreased feed costs come from doing a better job with rotational grazing so that less money is spent on supplemental feeds (hay and grain). With these practices, many producers are able to graze for a longer part the year. Efficiency can come from better pasture management, stockpiling feeds for late fall and early winter grazing, grazing crop residues, and better ration balancing.

Results

Completed retrospective evaluations (n=28) for this program showed improved production efficiency as a result of attending. Twenty-seven percent of respondents indicated a decrease in feed costs by an average of \$1,476 per farm. If just 5% of the sheep and/or goat farms in Pennsylvania (total of 7,678) achieved similar results, the impact would equal \$566,784. Achievable economic impacts such as these can help improve long-term farm sustainability, which increases the stability of rural economies.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-------------------------------------|
| 301 | Reproductive Performance of Animals |
| 302 | Nutrient Utilization in Animals |
| 303 | Genetic Improvement of Animals |
| 307 | Animal Management Systems |

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

- Adverse weather factors continued to influence clientele participation.

Economy

- The economic climate continues to have a significant impact on the ability of clientele to attend meetings and conferences.
- A rapidly shifting and historic sourcing of energy globally has affected educational programming needs in local Pennsylvania communities and around the world. Windfall gains from shale gas drilling have impacted some of our programs in a positive way.
- The economic activity around shale gas has increased wealth in many communities. In turn, this has led to opportunities to address issues of land use and economic development.
- The state funding situation is not strong. This has limited our ability to obtain new resources from the state.
- 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.

Government Regulations

- There is a growing awareness with a widening array of stakeholders as to the importance of Marcellus shale development to many aspects of their communities, businesses, educational institutions, and organizations. Communities are becoming more engaged in decision making and the consideration of ordinances. Considerable discussion is taking place on the local level as municipal officials discuss their options for some local regulation.
- Changes in government regulations in the natural gas industry require education on related impacts.

Competing Public Priorities

- Competing public priorities force us to continually align our program priorities with budget realities.
- Public priorities cause concern over the use of ag land. Odors travel across farm boundaries and can affect quality of life for nearby neighbors.

Competing Programmatic Challenges

- Most staff members are stretched very thin due to multiple needs from phone calls, emails, programming, and various producer or industry groups. The small staff is working to prioritize issues and address the most pressing ones.

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.
- The perception of extramural funding from natural gas companies continues as a sensitive issue for the Marcellus Education Team and is leading the team to successfully seek new revenue streams to fund programmatic efforts and the associated staff. It has also led to outreach on new topics.

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) are scheduled to be implemented in fall 2015 to 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 # 4****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 | 2% | | 6% | |
| 102 | Soil, Plant, Water, Nutrient Relationships | 13% | | 10% | |
| 112 | Watershed Protection and Management | 7% | | 10% | |
| 121 | Management of Range Resources | 8% | | 2% | |
| 123 | Management and Sustainability of Forest Resources | 8% | | 11% | |
| 132 | Weather and Climate | 0% | | 3% | |
| 133 | Pollution Prevention and Mitigation | 7% | | 9% | |
| 134 | Outdoor Recreation | 8% | | 2% | |
| 135 | Aquatic and Terrestrial Wildlife | 5% | | 13% | |
| 136 | Conservation of Biological Diversity | 0% | | 3% | |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | 0% | | 4% | |
| 212 | Diseases and Nematodes Affecting Plants | 4% | | 8% | |
| 213 | Weeds Affecting Plants | 7% | | 5% | |
| 301 | Reproductive Performance of Animals | 4% | | 2% | |
| 302 | Nutrient Utilization in Animals | 9% | | 3% | |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals | 4% | | 2% | |
| 605 | Natural Resource and Environmental Economics | 2% | | 4% | |
| 610 | Domestic Policy Analysis | 4% | | 1% | |
| 611 | Foreign Policy and Programs | 4% | | 1% | |
| 723 | Hazards to Human Health and Safety | 4% | | 1% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)**1. Actual amount of FTE/SYs expended this Program**

| Year: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |
| Actual Paid | 9.8 | 0.0 | 13.5 | 0.0 |
| Actual Volunteer | 24.0 | 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 |
| 1718808 | 0 | 1990487 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 2342277 | 0 | 5889432 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 1898103 | 0 | 10601935 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Environmental quality is affected by a broad spectrum of activities on the terrestrial and aquatic landscapes, including agricultural practices, natural gas drilling, forest resource management, wildlife and fisheries management, land use decisions, population dynamics, and recreation--all of which will likely 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 fragile resources. The management of our natural resources can have direct and substantial influences on environmental outcomes. In the agricultural sector, producers manage soil resources, balance nutrients, and protect air and water quality, while maintaining production efficiencies as environmental regulations are being more stringently enforced.

Pennsylvania has significant forest resources, 70% of which are under private ownership; the balance is under state, federal, or industry control. The economics of land use and balancing timber production with recreation, wildlife management, environmental degradation, and land development pressure are critical issues facing forest landowners in the state. 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 key demand for research and extension programming is nutrient management, including economic trade-offs and considerations at farm, watershed, and regional scales. Addressing tillage practices in sequence with innovations in manure application, regional waste-to-energy technologies, and effects on water quality are included in our programming portfolio. Implementation of integrated pest management programs is an important component necessary to develop sustainable management approaches for environmental protection. A wide range of natural resource management activities focuses on forest management for timber production, recreation, fish and wildlife management, economics of natural resource management practices, and land use decision-making. Extension programs also 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 Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org. Some members of most teams serve as topic experts and answer questions from participants of the Ask the Expert program.

The team members of the Penn State Equine Extension Stewardship Program are listed on the Ask the Expert eXtension program. One member serves on the Federal eXtension web-based program, USDA Extension, Horse Quest National Equine Resource Team. In addition, members of the PSU equine team are on USDA Experiment Station Project No. 1141, which works very closely with the Equine Horsequest eXtension project. One team member, through the Equine Environmental Impact MultiState Experiment Station Project, is part of the planning committee of the Waste to Worth eXtension Program to be held in April 2015.

A member of the soils extension team worked with the eOrganic community of practice on eXtension to present webinars and develop fact sheets.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Actual | 26957 | 508704 | 5759 | 2467 |

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|------------------|-----------------|--------------|
| Actual | 28 | 157 | 185 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 27833 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 0 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Estimated value (in \$M) of avoided loss in recreational use values of coral reefs in Hawaii from 2000 to 2100 if a greenhouse gas mitigation policy scenario involving full international participation in reducing emissions is adopted, versus a business as usual emissions scenario. |
| 2 | Determination that land application of wastewater is more effective for removal of some estrogenic chemicals than is direct stream discharge. |
| 3 | Candidate genes for blight resistance in Chinese chestnut tree identified to aid restoration of American chestnut. |
| 4 | Global dose-response curves developed for the herbicides dicamba and 2,4-D on cotton and soybean using data from more than 70 years of simulated drift experiments. |
| 5 | Number of major habitat types at greatest risk from development of shale oil and gas resources in the United States. |
| 6 | Finding that unconventional shale gas development may cause measurable changes in soil function. |
| 7 | Potential annual cost savings (in \$) if 10% of attendees of PSU equine owners' educational programs adopted proper ration balancing. |

Outcome #1

1. Outcome Measures

Estimated value (in \$M) of avoided loss in recreational use values of coral reefs in Hawaii from 2000 to 2100 if a greenhouse gas mitigation policy scenario involving full international participation in reducing emissions is adopted, versus a business as usual emissions scenario.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 10600 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The ecosystem services provided by coral reefs are highly vulnerable to increasing atmospheric and ocean carbon dioxide concentrations. The net annual value of the services provided by coral reefs globally has been estimated at approximately \$33.6 billion per year, with tourism and recreation accounting for \$10.8 billion (all values adjusted to US 2007\$).

What has been done

The researchers applied the COMBO coral reef simulation model to shallow-water reefs in Hawaii, Florida, and Puerto Rico. They compared estimates of future coral cover from 2000 to 2100 for a 'business as usual' greenhouse gas (GHG) emissions scenario with a GHG mitigation policy scenario involving full international participation in reducing GHG. They calculated the economic value of changes in coral cover, including recreational values for snorkeling and diving and existence values for reefs.

Results

Results suggest that a reduced emissions scenario would provide a large benefit to shallow water reefs in Hawaii by delaying or avoiding potential future bleaching events. For Hawaii, reducing emissions is projected to result in an estimated "avoided loss" from 2000 to 2100 of approximately \$10.6 billion in recreational use values compared to a BAU scenario. However, in Puerto Rico and South Florida, sea-surface temperatures are already close to bleaching thresholds and coral cover is projected to drop well below 5% cover under both scenarios by 2050, and below 1% cover under both scenarios by 2100. The work appeared in the journal PLOS One.

The results indicate the grave changes that can be expected with climate change. Without strong tourism spending, the economies of these places and places like them would be devastated and they would require more federal assistance.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 132 | Weather and Climate |
| 134 | Outdoor Recreation |
| 136 | Conservation of Biological Diversity |
| 605 | Natural Resource and Environmental Economics |
| 610 | Domestic Policy Analysis |
| 611 | Foreign Policy and Programs |

Outcome #2

1. Outcome Measures

Determination that land application of wastewater is more effective for removal of some estrogenic chemicals than is direct stream discharge.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Birth control medication may be discarded in the sewer system. Treated wastewater is sometimes applied as irrigation water to forest and/or cropland. The movement of endocrine-disrupting chemicals (EDC) through the soils of these systems is not well understood, nor is their effect on human and animal health. Estrogenic compounds have been found in U.S. surface waters, and they are known to feminize male fish and destroy fish populations.

What has been done

Do EDCs in wastewater used for irrigation accumulate in soil above the water table, effectively keeping them out of groundwater and reducing fish exposure to these chemicals? At Penn State's "Living Filter" site, researchers measured levels of 3 estrogenic compounds - 2 naturally produced hormones and 1 synthetic component of birth control pills - in the soils of wastewater-irrigated forestland, cropland, and a non-irrigated control site. The work appeared in the Journal of Environmental Quality.

Results

Soil from wastewater-irrigated sites contained higher concentrations of the 2 natural hormones than did control site soil. Concentrations of the synthetic chemical were generally near detection limits at all sites. But accumulation of EDCs in soil depended on land use. Forested soils accumulated more EDCs than did agricultural soils. In forest soils, which have about 3 times as much organic carbon as agricultural soils, EDCs bind to the organic carbon and don't move as rapidly through the soil. Land application of wastewater is more effective for removal of these estrogenic chemicals than is direct stream discharge. But effluent management practices may need to be adjusted to account for soil accumulation of some of these chemicals. The scientists are now measuring EDC concentrations in wells near the Living Filter to see if soil accumulation prevents EDCs from entering groundwater. In the future, experts expect to see more wastewater used for irrigation and groundwater recharge.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 112 | Watershed Protection and Management |
| 133 | Pollution Prevention and Mitigation |
| 301 | Reproductive Performance of Animals |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals |
| 723 | Hazards to Human Health and Safety |

Outcome #3

1. Outcome Measures

Candidate genes for blight resistance in Chinese chestnut tree identified to aid restoration of American chestnut.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 12 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The American chestnut, a tree that in its time was highly versatile and prevalent, is struggling from its long battle with chestnut blight. The fungus came to America through imports from Asia. The earliest case was cited in 1904, and by the 1950s, nearly every tree was infected. Today, roots in the forest still sprout new shoots, which succumb to infection. This work addresses restoring

American chestnut through transfer of blight resistance genes from Chinese chestnut by back-cross breeding.

What has been done

The researchers have assembled over 90% of the Chinese chestnut genome, including three regions (loci) in the genome responsible for blight resistance. Having a sequenced genome helps to further research and breeding for blight resistance. They have identified and are testing about a dozen candidate genes for their roles in blight resistance. All twelve, or more, may be involved.

Results

The researchers are already using the genome sequence to follow variation across the genome to advance the breeding and selection process while they also determine which specific genes are most important to blight resistance. A website for the genome has been established, with public access. The journal Tree Genetics and Genomes carried the paper.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 123 | Management and Sustainability of Forest Resources |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 212 | Diseases and Nematodes Affecting Plants |

Outcome #4

1. Outcome Measures

Global dose-response curves developed for the herbicides dicamba and 2,4-D on cotton and soybean using data from more than 70 years of simulated drift experiments.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 4 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Commercial introduction of soybean, corn, and cotton genetically engineered to resist the herbicides dicamba and 2,4-D will increase the flexibility of these herbicides, but may cause problems related to herbicide drift with susceptible soybean and cotton.

What has been done

The researchers conducted a meta-analysis using data from more than 70 years of simulated drift experiments in which soybean and cotton were treated with low doses of these herbicides and yields were measured. The researchers produced global dose-response curves for each crop and herbicide.

Results

Soybean is more susceptible to dicamba in the flowering stage and relatively tolerant to 2, 4-D throughout its growth. The results are nearly opposite for cotton, with greatest vulnerability to dicamba in the vegetative and preflowering squaring stages. Both crops show variability in their response to these herbicides. Soil moisture and air temperature at time of exposure are critical. Visual injury symptoms, especially during vegetative stages, do not predict final yield loss. The global dose-response curves generated through this work can guide herbicide applications and approximate the mean and range of crop yield loss expected as a result of drift or nontarget exposure to dicamba or 2, 4-D. The article was chosen as paper of the year in the journal Weed Science.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|------------------------|
| 213 | Weeds Affecting Plants |

Outcome #5

1. Outcome Measures

Number of major habitat types at greatest risk from development of shale oil and gas resources in the United States.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 3 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The widespread use of hydraulic fracturing and horizontal drilling has opened up new shale oil and gas plays across the U.S. in recent years. Full build-out of these resources is not expected for years. Other countries as well are similarly beginning to develop these resources. The stages

of resource exploration, development, and production affect nearby ecosystems. Some impacts are likely to be similar to those from conventional energy extraction, but some are relatively uncharted.

What has been done

In the Lower 48 states, 20 shale plays are under extensive development and production. The research team reviewed the literature on the ecological effects of conventional oil and gas extraction on habitat and wildlife. They also noted differences related to hydraulic fracturing and horizontal drilling, such as accidental release of wastewater, that could be detrimental to wildlife and habitats.

Results

The researchers concluded that species and habitats most at risk are ones where there is a great deal of overlap between the shale resource and a species' range or a habitat type, and for which there is also limited range, low population size, special habitat requirements, and/or high sensitivity to disturbance. Examples of these at-risk habitat types and species include core forest and core forest specialists; sagebrush habitat and specialists; and vernal ponds, species that require vernal ponds, and stream biota. The team suggests concentrating research and monitoring on spatial analyses, species-based modeling, vulnerability assessments, ecoregional assessments, and threshold and toxicity evaluations to help with development of guidelines and policies to reduce negative effects of shale energy exploration and development and to protect sensitive species and ecosystems.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 121 | Management of Range Resources |
| 123 | Management and Sustainability of Forest Resources |
| 135 | Aquatic and Terrestrial Wildlife |
| 136 | Conservation of Biological Diversity |

Outcome #6

1. Outcome Measures

Finding that unconventional shale gas development may cause measurable changes in soil function.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Development of historical conventional gas and recent unconventional shale-gas infrastructure in Appalachia has led to extensive landscape disturbance. For each of more than 1,500 well pads constructed in Pennsylvania thus far, about two hectares of soil per pad are typically removed, stockpiled, and eventually reclaimed. Researchers hypothesized that unconventional gas development would cause measurable changes in soil function.

What has been done

To test this hypothesis, they examined dynamic soil property (DSP) change on three types of reclaimed gas infrastructure: 75-year-old conventional gas pads, 25-year-old conventional gas pads, and recently developed unconventional gas pads. Disturbed and undisturbed soils within a site were analyzed for bulk density, soil organic carbon (SOC) pools, soil nitrogen (N) pools, and available phosphorus pools.

Results

Results showed that conventional sites do not currently exhibit significant differences in DSPs between disturbed and undisturbed soils, but unconventional sites show significantly higher (potentially root-limiting) bulk density and lower SOC and N pools on disturbed soils. The team attributed the significant DSP change on unconventional sites to soil compaction during reclamation surface grading and increased soil organic matter decomposition, N mineralization, and soil mixing during stockpiling. The 75- and 25-year-old conventional sites probably exhibit less DSP change now because more time has passed during which these soils could recover.

Reclaimed soils on unconventional sites under the conditions in this study are unlikely to be as productive as adjacent undisturbed soils. Techniques developed for mine soil reclamation may be applicable to unconventional gas sites, but further analysis of their effectiveness and economic benefits specific to natural gas development is needed.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 101 | Appraisal of Soil Resources |
| 102 | Soil, Plant, Water, Nutrient Relationships |
| 123 | Management and Sustainability of Forest Resources |

Outcome #7

1. Outcome Measures

Potential annual cost savings (in \$) if 10% of attendees of PSU equine owners' educational programs adopted proper ration balancing.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1400000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Routine overfeeding of dietary protein and phosphorus results in significant nutrient losses in manure. Previous journal articles showed that protein and phosphorus levels in equine rations averaged 62% and 92%, respectively, above National Research Council (2007) recommendations. This inefficiency costs owners in unnecessary feed costs and society in nutrient pollution to waterways.

What has been done

The researchers evaluated rations on 23 equine farms. They reformulated rations using NRC recommendations.

Results

The continued use of NRC-recommended ration balancing would reduce nutrient loads to the state's watersheds. Reducing feed (8-10 lbs of grain/concentrates @ \$15/50 lb. bag, to 4-5 lbs and increased forage) would save farms an average of \$219/equine/year. If just 10% of attendees of PSU equine owners' educational programs adopted proper ration balancing, the yearly savings in feed costs could be \$1.4 million. Annual nutrient loading would be reduced by 19.5 tons N and 5.6 tons P.

The equine industry is the second largest animal agricultural industry in PA and directly accounts for over \$10 billion of economic activity. Equine owners devote 1.14 million acres of land in the state to equine purposes, with associated assets totaling nearly \$8.27 billion. The equine industry provides about 20,000 jobs to the Commonwealth.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-------------------------------------|
| 112 | Watershed Protection and Management |
| 302 | Nutrient Utilization in Animals |

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.
- Weather conditions may necessitate changes in field research plans.

Economy

- The economy influences the ability of clientele to implement tactics suggested.
- Limited budgets for travel do not allow educators to meet all requests for educational programs.

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.

Government Regulations

- Government regulations can provide funding to train technical service providers in the Mid-Atlantic region or can drive the demand for programs.

Competing Public Priorities

- Competing public priorities force us to continually align our program priorities with budget realities.
- Youth program offerings 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.

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) are scheduled to be implemented in fall 2015 to 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 # 5****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 |
|----------------|--|------------------------|------------------------|-----------------------|-----------------------|
| 112 | Watershed Protection and Management | 5% | | 3% | |
| 131 | Alternative Uses of Land | 5% | | 3% | |
| 132 | Weather and Climate | 5% | | 2% | |
| 133 | Pollution Prevention and Mitigation | 5% | | 3% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | 5% | | 2% | |
| 216 | Integrated Pest Management Systems | 5% | | 3% | |
| 402 | Engineering Systems and Equipment | 5% | | 3% | |
| 403 | Waste Disposal, Recycling, and Reuse | 5% | | 3% | |
| 602 | Business Management, Finance, and Taxation | 12% | | 6% | |
| 605 | Natural Resource and Environmental Economics | 5% | | 3% | |
| 606 | International Trade and Development Economics | 3% | | 9% | |
| 608 | Community Resource Planning and Development | 12% | | 10% | |
| 610 | Domestic Policy Analysis | 5% | | 2% | |
| 721 | Insects and Other Pests Affecting Humans | 3% | | 6% | |
| 722 | Zoonotic Diseases and Parasites Affecting Humans | 5% | | 3% | |
| 723 | Hazards to Human Health and Safety | 2% | | 6% | |
| 724 | Healthy Lifestyle | 5% | | 2% | |
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities | 2% | | 6% | |
| 805 | Community Institutions and Social Services | 3% | | 9% | |
| 903 | Communication, Education, and Information Delivery | 3% | | 16% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |
| Actual Paid | 1.6 | 0.0 | 0.5 | 0.0 |
| Actual Volunteer | 0.1 | 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 |
| 224757 | 0 | 64919 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 266105 | 0 | 944926 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 155145 | 0 | 628934 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

The College of Agricultural Sciences is committed to fostering advances toward solving some of the world's most pressing problems. To do so, our faculty extensively collaborate with colleagues and partners from around the world. We foster a welcoming climate for international students, scholars, and visitors in which the free flow of information and ideas leads to solutions for the challenges we face as a global population.

Efforts in sustainable intensification of global agriculture are aimed at building the self-reliance of farmers in developing countries. Researchers are engaged in promoting international cooperation in insect chemical ecology; predicting the demand growth for animal products in Brazil, Russia, India, Indonesia, and China, the world's most rapidly developing countries; and investigating approaches for disease control in cacao to help growers globally to have a more sustainable and environmentally friendly crop.

Understanding the transmission cycles of diseases combined with the effects of environmental degradation or change sparked investigations into how population growth combined with ecosystem change have increased human schistosomiasis around Lake Malawi in Africa and the use of fine-scale climate model projections to predict malaria at local levels in East Africa under expected climate change.

Penn State research and extension activities are advancing the role of women in agriculture and increasing opportunities for civic engagement by international youth, underserved populations, and women. Global programs with social impacts use sports and recreation to build peace and youth leadership. We are also working to increase opportunities for civic engagement with underserved populations and women.

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 Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Actual | 1817 | 29135 | 853 | 144 |

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

Patent Applications Submitted

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|-----------|----------|-------|
| Actual | 0 | 3 | 3 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 3749 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 0 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Finding that a new strain of Schistosoma haematobium has developed in Lake Malawi following the decline of snail-eating fishes in the lake's shallows. |
| 2 | Number of countries that sought out the Penn State Marcellus Education Team as an objective educational leader in shale gas issues and research. |
| 3 | International symposium held and formal international declaration made in support of the effects sport and recreation can have on youth leadership, peace building, empowering women, and social inclusion. |
| 4 | Use of fine-scale climate model projections to predict malaria at local levels in East Africa under expected climate change. |
| 5 | International short course in insect chemical ecology offered. |

Outcome #1

1. Outcome Measures

Finding that a new strain of *Schistosoma haematobium* has developed in Lake Malawi following the decline of snail-eating fishes in the lake's shallows.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Schistosomiasis, a debilitating disease caused by parasitic flatworms, affects about 250 million people. The flatworms burrow into people's skin in freshwater, then mate within the intestines. Eggs are carried in human excrement back to the lake, where they hatch and live in a snail host. Urogenital schistosomiasis was formerly transmitted in Lake Malawi, Africa, only in swamps and backwaters. But infection rates along the lakeshore have increased, sometimes reaching 94% of schoolchildren.

What has been done

The researchers studied interactions among snail-eating cichlid fishes; the density of the intermediate host of the parasite, a small, freshwater snail (*Bullinus nyassanus*); and the prevalence of human infection with *S. haematobium* in Lake Malawi.

Results

The researchers found that the increased human infection rate was correlated with a decline in a snail-eating fish caused by overfishing and other ecological changes. The human population on the shoreline has doubled in the last 30 years, bringing increased sediment and nutrients into the shallow waters of the lake. The researchers believe that a strain of *S. haematobium* transported to the lake by tourists from another part of Africa interbred with the native Lake Malawi strain of *S. haematobium* to produce a strain of the parasite that can colonize both the original host snail and its close relative. This relative lives in the shallows and open waters of the lake, rather than in the swamps and backwaters, resulting in the higher human infection rates. This evolving situation affects transmission of urogenital schistosomiasis in local and tourist populations along the lakeshore. The work was published in the journal *EcoHealth*.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
722 Zoonotic Diseases and Parasites Affecting Humans

Outcome #2

1. Outcome Measures

Number of countries that sought out the Penn State Marcellus Education Team as an objective educational leader in shale gas issues and research.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 50 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Marcellus Education Team teaches landowners, community and government leaders, and businesses about financial, environmental, economic, and legal issues and impacts of Marcellus shale and natural gas drilling. They are recognized as national and international leaders able to provide an unbiased introduction to the opportunities and issues surrounding shale gas development.

What has been done

Last year the team delivered about 200 programs in 21 counties in Pennsylvania, 10 states, and 10 countries and reached more than 28,000 participants.

Results

The team has met with representatives of countries such as Brazil, Ukraine, Lithuania, South Africa, and Algeria, and worked with the U.S. State Department, the U.S. Department of Interior, and the Pennsylvania Department of Community and Economic Development, to discuss the economic and societal implications and social license of developing a shale gas resource. They have also met with representatives of the World Bank and international businesses. The team has partnered with state representatives to provide pipeline outreach to constituents.

Because of their collaborative efforts, more than \$110,000 in new natural gas programming support was committed in the past year.

The team also helped develop a new smartphone gas royalty and well decline curve app that

provides information to lessors about wise lease management, all based on actual Pennsylvania shale gas well data. More than 1,400 sessions have been opened from more than 20 countries.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 112 | Watershed Protection and Management |
| 131 | Alternative Uses of Land |
| 133 | Pollution Prevention and Mitigation |
| 402 | Engineering Systems and Equipment |
| 403 | Waste Disposal, Recycling, and Reuse |
| 602 | Business Management, Finance, and Taxation |
| 605 | Natural Resource and Environmental Economics |
| 606 | International Trade and Development Economics |
| 608 | Community Resource Planning and Development |
| 610 | Domestic Policy Analysis |
| 723 | Hazards to Human Health and Safety |
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities |

Outcome #3

1. Outcome Measures

International symposium held and formal international declaration made in support of the effects sport and recreation can have on youth leadership, peace building, empowering women, and social inclusion.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Half of the world's population is aged 25 or less, and about 85% of all youth live in less developed

countries. Nearly half the world's population resides in rural areas, and 38% of the world's population depends on agriculture for livelihood. These statistics particularly apply in Africa and the Global South. There is a pressing need--for international security, stability, and regional capacity building--for innovative strategies to engage youth.

What has been done

This project seeks to create worldwide opportunities for youth to improve their lives and communities. It focuses on youth personal development, building capacity in their communities, and activism in social justice and equality. This project works on a range of international collaborations in evidence-based research and innovative educational programs. In August 2014 the UNESCO Croke Park Symposium on Youth Civic Engagement and Leadership through Sport and Recreation was held in Ireland.

Results

The symposium, leveraged by appropriated funds, explored the positive effects sport and recreation can have on youth and their communities. The symposium resulted in significant policy initiatives and a major formal declaration on using sports and recreation as mechanisms for youth development worldwide. The Croke Park Declaration was presented to the UN, UNESCO, and UNICEF as a platform for them to build global programming and policy.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 724 | Healthy Lifestyle |
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities |
| 805 | Community Institutions and Social Services |

Outcome #4

1. Outcome Measures

Use of fine-scale climate model projections to predict malaria at local levels in East Africa under expected climate change.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Malaria mosquitoes are cold-blooded--their body temperature matches the temperature of their direct surroundings. The ability of mosquitoes to transmit malaria is strongly influenced by environmental temperature. People are interested in how expected climate change will affect global malaria trends, but they are most interested in what may happen in their own town or village. The use of new fine-scale climate model projections helps to answer that question.

What has been done

Scientists examined how future climate warming might affect the potential for mosquitoes to transmit malaria. The researchers compared malaria transmission at four sites in Kenya that differed in altitude and prevailing environmental temperature. The team applied a statistical technique to conventional, coarse-scale climate models to better predict malaria transmission potential at local levels.

Results

This is one of the first studies to attempt to explore how climate change might affect conditions at the local level. Malaria predictions using global climate model simulation results don't necessarily indicate what may happen at a specific location. What is likely to happen in one location can be very different from another location just 50 miles down the road. To really understand the impact of climate change on malaria dynamics, a higher-resolution approach is needed. Fine-scale climate model projections suggest the possibility that population centers in cool, highland regions of East Africa could be more vulnerable to malaria than previously thought, while population centers in hot, lowland areas could be less vulnerable. Fine-scale predictions of malaria risk will be better tailored to the needs of local communities and can improve local adaptation and mitigation strategies. The research was published in the journal *Climatic Change*.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 132 | Weather and Climate |
| 721 | Insects and Other Pests Affecting Humans |

Outcome #5

1. Outcome Measures

International short course in insect chemical ecology offered.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Gathering as an international group allows young scientists to make professional connections they can use for the rest of their careers. They practice presenting their research and their professional selves. Entomologists can learn about similar plant-pest interactions in other parts of the world, and may even find the beginnings of a solution to a local problem in a predatory insect that could be safely introduced for biological control.

What has been done

As part of a research project on chemical ecology of interactions among plants, insects, and microorganisms, a 2-week international short course in insect chemical ecology was offered. This highly successful course rotates yearly amongst the Swedish Agricultural University, the Max Planck Institute for Chemical Ecology, and Penn State.

Results

Participants were 42 students from 14 countries: Brazil, Botswana, China, Nigeria, Kenya, Sweden, Belgium, Italy, France, Germany, India, French Guiana, Japan, Canada, and the U.S. The 22 guest lecturers were all recognized international experts in their subdiscipline. Each student presented a poster and a short lecture on his or her research. Subject matter covered included sensory biology and evolution; insects and pathogens; applied uses of pheromones and other semiochemicals; semiochemical discovery, isolation, identification, and synthesis; plant-insect interactions; pollination ecology; and the evolution of odor-mediated behavior. During a field trip, the group learned about the latest research underway at the Penn State Fruit Research and Extension Center in Biglerville.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 211 | Insects, Mites, and Other Arthropods Affecting Plants |
| 216 | Integrated Pest Management Systems |
| 903 | Communication, Education, and Information Delivery |

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.

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) are scheduled to be implemented in fall 2015 to 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 # 6

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 | 3% | | 3% | |
| 133 | Pollution Prevention and Mitigation | 3% | | 3% | |
| 216 | Integrated Pest Management Systems | 5% | | 2% | |
| 301 | Reproductive Performance of Animals | 0% | | 6% | |
| 305 | Animal Physiological Processes | 0% | | 6% | |
| 311 | Animal Diseases | 9% | | 19% | |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals | 0% | | 2% | |
| 315 | Animal Welfare/Well-Being and Protection | 4% | | 3% | |
| 501 | New and Improved Food Processing Technologies | 0% | | 5% | |
| 502 | New and Improved Food Products | 0% | | 6% | |
| 503 | Quality Maintenance in Storing and Marketing Food Products | 3% | | 0% | |
| 504 | Home and Commercial Food Service | 3% | | 0% | |
| 702 | Requirements and Function of Nutrients and Other Food Components | 1% | | 10% | |
| 703 | Nutrition Education and Behavior | 13% | | 4% | |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources | 15% | | 2% | |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins | 15% | | 14% | |
| 722 | Zoonotic Diseases and Parasites Affecting Humans | 18% | | 4% | |
| 723 | Hazards to Human Health and Safety | 0% | | 5% | |
| 724 | Healthy Lifestyle | 2% | | 4% | |
| 802 | Human Development and Family Well-Being | 6% | | 2% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |

| | | | | |
|-------------------------|-----|-----|------|-----|
| Actual Paid | 6.6 | 0.0 | 14.6 | 0.0 |
| Actual Volunteer | 1.5 | 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 |
| 1411999 | 0 | 2240959 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 2111907 | 0 | 8708188 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 3888608 | 0 | 14688310 | 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 investigations of mycotoxins and bacteria and other problematic compounds in foods and tracking bacteria that cause foodborne illnesses in food manufacturing processes and environments.

Research into one health, toxicology, and immunology in the college includes sequencing the genomes of microorganisms that cause disease in humans and livestock, exploring gut health, analyzing the microbiome to explore the efficacy of drugs, and finding ways to produce foods of higher nutritional quality. Additional work in integrated health solutions includes studies of carcinogenesis and cancer treatment, especially through dietary supplements.

The veterinary team is exploring mastitis, milk quality, dairy hoof health, and antimicrobial use and resistance, and also some links among these topics. They are investigating the potential to increase farm profits by paying closer attention to meat quality and reducing blemishes before harvest. They have recently begun to work directly with private veterinary practices and industry consultants.

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) are much in demand. 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 some materials into additional languages as well.

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 Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org. Members of some teams answered questions in the "Ask an Expert" sections.

One Extension Food Safety Team member has answered more than 300 questions on eXtension and is ranked in the top 20 for responding to food safety questions. Team members are the top-rated for answering food safety questions. Some team members use eXtension as a resource for information and/or articles to use in programs they conduct.

A Veterinary Team member served as an area leader in eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 29041 | 594768 | 27880 | 23196 |

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

Patent Applications Submitted

Year: 2014
 Actual: 1

Patents listed

Serial No. 13/538,297; Filed 6/29/2012; Title: Compositions, Methods and Kits for Treating Leukemia

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|------------------|-----------------|--------------|
| Actual | 7 | 282 | 289 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 82126 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 2 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Investigation of the influence of mycotoxins on Shiga toxin-producing Escherichia coli (STEC) in cattle. |
| 2 | Determination that pulsed ultraviolet (UV) light can inactivate microorganisms Penicillium roqueforti and Listeria monocytogenes on the surface of hard cheeses. |
| 3 | Strains of B. pertussis (whooping cough) derived from recent hospital cases in which the genome was sequenced. |
| 4 | Determination that all Listeria spp. isolates found in a small-scale mushroom production facility have rarely been reported in foodborne disease outbreaks. |
| 5 | Exploration of efficacy of UV processing to reduce levels of the mycotoxin patulin in apple beverages. |
| 6 | Annual value (in \$) of averted infections with waterborne cryptosporidiosis assuming that educational programs of Safe Drinking Water extension team prevent just 5% of expected yearly cryptosporidium infections in Pennsylvania. |
| 7 | Potential value (in \$) of prevented food service company losses if just 5% of expected foodborne illnesses are avoided due to increased employee knowledge after participating in the retail ServSafe program. |

Outcome #1

1. Outcome Measures

Investigation of the influence of mycotoxins on Shiga toxin-producing Escherichia coli (STEC) in cattle.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Mycotoxins produced by fungi can contaminate livestock feed and negatively affect livestock. Workers responsible for animal and human health need information about the toxicity and modes of action of mycotoxins, which are associated with infection of mature cattle by Shiga toxin-producing Escherichia coli (STEC). STEC bacteria are commensal in these animals, which suggests that mycotoxins enable a mechanism that makes this bacterium pathogenic, causing vomiting and bloody diarrhea.

What has been done

During natural disease outbreaks, the researchers assessed the mycotoxin content in vomit and bloody diarrhea (mucosa) in dairy calves. They compared the virulence genes of the STECs, assessed the effect of mycotoxins in the mucosa on STEC toxin expression, and tested the efficacy of a commercially available prebiotic/probiotic drug treatment--Celmanax/Dairyman's Choice--in alleviating the disease.

Results

The study showed that the same STEC disease complex affects calves and mature cattle. The OI-122 encoded nleB gene existed in all STEC genotypes that produced serious disease, indicating that virulence of the disease may arise from the protein encoded by this gene. Low levels of aflatoxin (1-3 ppb) and fumonisin (50-350 ppb) were found in mucosa. The mycotoxins elevated toxin activity. Use of Celmanax/Dairyman's Choice in the calves eliminated STEC shedding, the interaction of STEC and mycotoxins, and associated morbidity and mortality. The work appeared in the journal Toxins.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|----------------|
|---------|----------------|

- 311 Animal Diseases
- 314 Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

Outcome #2

1. Outcome Measures

Determination that pulsed ultraviolet (UV) light can inactivate microorganisms *Penicillium roqueforti* and *Listeria monocytogenes* on the surface of hard cheeses.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cheese surfaces may be contaminated by spoilage and pathogenic microorganisms during production, packaging, and postpackaging processes. *Penicillium roqueforti* is often found on cheese surfaces at refrigeration temperatures. Consumption of cheese contaminated with *Listeria monocytogenes* can trigger listeriosis. Therefore, cheese should be decontaminated at postprocessing stages. Pulsed UV light is a nonthermal way to ensure microbial decontamination on the surface of foods or packaging materials.

What has been done

This study investigated the efficacy of intense, short-duration pulsed UV light for inactivation of *P. roqueforti* and *L. monocytogenes* inoculated onto packaged and unpackaged hard cheeses. Treatment times and distance from the UV strobe were varied to establish optimum treatment conditions. Packaged and unpackaged cheeses were treated at 5, 8, and 13 cm for up to 60 s.

Results

For *P. roqueforti*, maximum reduction after 40 s at 5 cm was 1.32 log CFU/cm² on unpackaged cheese and 1.24 log CFU/cm² on packaged cheese. Reductions of *L. monocytogenes* under the same conditions were about 2.9 and 2.8 log CFU/cm² on packaged and unpackaged cheeses, respectively. Changes in color and lipid oxidation were examined for mild (5 s at 13 cm), moderate (30 s at 8 cm), and extreme (40 s at 5 cm) treatments. The color and chemical quality of cheeses were not significantly different after mild treatments ($P > 0.05$). The mechanical properties of the polypropylene plastic packaging were also evaluated after the 3 treatments. No significant differences were found in elastic modulus (a measure of stiffness) between untreated samples and those given mild and moderate treatments ($P > 0.05$). Overall, the study showed

that pulsed UV light can inactivate *P. roqueforti* and *L. monocytogenes* on the surface of hard cheeses. The work appeared in the *Journal of Food Protection*.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |

Outcome #3

1. Outcome Measures

Strains of *B. pertussis* (whooping cough) derived from recent hospital cases in which the genome was sequenced.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 28 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Centers for Disease Control and Prevention classifies whooping cough, caused by the bacteria *Bordetella pertussis*, as a reemerging disease. Case numbers are rising steadily—even where vaccine coverage is high—from hundreds per year in the 1970s to >41,000 in 2012. Recent high-profile epidemics in California (in 2010) and Washington (in 2012) contribute to growing concerns and feed speculation about the ongoing evolution of *B. pertussis*.

What has been done

To better understand genetic diversity of the circulating *B. pertussis* strains, researchers collected 28 clinical isolates from those and other outbreaks and analyzed genome sequences.

Results

Genome sequences suggest that isolates of *B. pertussis* currently circulating in the U.S. derive from a single genetic background. However, the genomes were subject to massive genome rearrangements and different gene losses that account for most of the diversity among strains. The researchers are now conducting a full analysis of the virulence genes and the evolution of the organism. Having a sequenced genome facilitates further research on the strains. The work appeared in the journal *Genome Announcements*.

Other work in which these researchers were involved (published in mBio) concluded that global transmission of new strains is happening very rapidly and that the worldwide population of B. pertussis is evolving in response to vaccine introduction. This could enable vaccine escape.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 722 | Zoonotic Diseases and Parasites Affecting Humans |
| 723 | Hazards to Human Health and Safety |

Outcome #4

1. Outcome Measures

Determination that all Listeria spp. isolates found in a small-scale mushroom production facility have rarely been reported in foodborne disease outbreaks.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Listeria monocytogenes is a foodborne pathogen of significant concern to the agricultural and food processing industry because of its ability to grow and persist in cool and moist environments and its ability to cause listeriosis, a disease with a very high mortality rate. USDA estimated in 1996 that annual costs related to foodborne Listeria infections in the U.S. amounted to \$200-300 million, including about 1,600 cases per year and 425 deaths.

What has been done

A study was completed to determine the prevalence of Listeria spp. in a small-scale mushroom production facility on the Penn State campus. Isolates of L. monocytogenes were confirmed and serotyped by multiplex PCR. The epidemiological relatedness of the three L. monocytogenes isolates to those serotypes or lineages frequently encountered in listeriosis infections was determined by multi-virulence-locus sequence typing using six virulence genes.

Results

Of 184 samples taken from 5 production zones within the facility, 15.8% tested positive for *Listeria* spp. Among the *Listeria* spp. isolates, *L. innocua* was most prevalent (10.3%), followed by *L. welshimeri* (3.3%), *L. monocytogenes* (1.6%), and *L. grayi* (0.5%). *L. monocytogenes* was recovered only from the phase I raw material composting area. All *L. monocytogenes* isolates were grouped with serotype 4a, lineage IIIA. To date, this serotype has rarely been reported in foodborne disease outbreaks. The research appeared in the *Journal of Food Protection*.

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 |

Outcome #5

1. Outcome Measures

Exploration of efficacy of UV processing to reduce levels of the mycotoxin patulin in apple beverages.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Patulin is a mycotoxin produced by certain species of molds that grow on various foods, including fruit. Patulin occurs in apple juice, where it can pose a safety concern. Thermal processing (pasteurization) appears to only moderately reduce patulin levels. The U.S. Food and Drug Administration recommends a patulin level of 50 µg/kg or less in apple juice. The export market alone for U.S. apple juice in 2012 was nearly \$37.4 million.

What has been done

This study evaluated the potential to reduce patulin levels in a malic acid model system, apple cider, and apple juice by ultraviolet (UV) radiation treatment.

Results

This study showed that apple juice constituents affect patulin degradation during UV treatment. Initial patulin concentration, pH, glucose, sucrose, and ascorbic acid had no significant effect on patulin degradation. Tannic acid reduced patulin degradation. High turbidity levels may make use of UV technology impractical in apple cider. UV irradiation decreased patulin levels in clarified apple juice, but the required dose level was higher than that required for 5-log reduction of *Escherichia coli* O157:H7. Fructose had an accelerating effect on patulin reduction in the model system studied, so adding high-fructose sweeteners to apple beverages prior to UV processing may aid patulin reduction. Effective UV processing for patulin degradation without quality losses may require filtration, phenolic adsorption treatments, and the addition of polyphenols to speed degradation. The *Journal of Food Processing and Preservation* carried the paper.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 501 | New and Improved Food Processing Technologies |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |

Outcome #6

1. Outcome Measures

Annual value (in \$) of averted infections with waterborne cryptosporidiosis assuming that educational programs of Safe Drinking Water extension team prevent just 5% of expected yearly cryptosporidium infections in Pennsylvania.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 504000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Though there are 1 million private wells in Pennsylvania serving 3.5 million people, only about half of homeowners across the state regularly test their water. That's a problem, since half of the wells tested have at least one water quality problem. PA and Alaska are the only states that don't have private water well construction or location standards. Extension has become one of the few unbiased, research-based resources to help meet the water needs of Pennsylvania's large rural population.

What has been done

The extension team provides educational resources on management of private water systems, including wells, springs, and cisterns. They conduct workshops and help individuals identify water issues, determine which tests might be necessary, interpret test results, and suggest solutions to private water system problems. Yearly, they train new Master Well Owner Network volunteers, who commit to performing a certain level of outreach themselves in return for training.

Results

The Centers for Disease Control and Prevention report that an average of 478 cases of the waterborne illness cryptosporidiosis occurred in PA in 2009 and 2010, and that for each case of cryptosporidiosis, hospital costs averaged \$21,000. So the value of preventing just 5% (24 cases) of cryptosporidiosis cases in PA via this extension project would be \$504,000/year.

In a separate project, water samples were collected from 35 PA roadside springs, most of which were within state highway rights-of-way. Analysis for 20 common inorganic and microbiological water quality parameters showed that 97% of the springs tested failed to meet at least one EPA drinking water standard. The most common health-related pollutants were coliform bacteria, E. coli bacteria, and lead. These results suggest that untreated water from roadside springs should generally be avoided as a source of drinking water.

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 #7

1. Outcome Measures

Potential value (in \$) of prevented food service company losses if just 5% of expected foodborne illnesses are avoided due to increased employee knowledge after participating in the retail ServSafe program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
|-------------|---------------|

2014

31283161

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The PA Department of Agriculture requires retail food service operations to have one person certified in food safety to meet regulatory requirements. The Extension Food Safety Team offers ServSafe classes to help restaurant and retail food service managers understand and implement safe food handling practices. With reporting of foodborne illness outbreaks and food recalls, there is increased awareness among the public of food safety in commercial food service operations.

What has been done

By offering the nationally recognized food safety training ServSafe in 2014, thirteen Extension educators offered 138 classes to 2,223 registered participants in 48 of Pennsylvania's 67 counties. Eleven of those educators indicated they helped over 1,130 food service facilities meet Pennsylvania Department of Agriculture licensure requirements to continue operating in their community.

Results

These establishments employ some 13,000 workers and serve over 186,000 customers/day, making a positive contribution to the local economy. Companies that produce safe food help ensure economic stability for themselves and their employees and communities. For the consumer, buying safe products prevents foodborne illness that can lead to healthcare costs, lost wages, or even death.

A 2014 study (USDA-ERS) estimated the costs of illnesses caused by 15 major foodborne pathogens at more than \$15.6 billion/yr in the U.S. There are an estimated 8.9 million cases of foodborne illness yearly in the U.S. and nearly 2,400 deaths, so it is critical that food service operators understand safe food handling practices and educate their staff. Assuming that foodborne illness patterns mirror population patterns, and assuming that the ServSafe program reduces foodborne illness in Pennsylvania by even just 1%, it would prevent more than \$6 million in economic losses and more than 3,500 cases annually.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 503 | Quality Maintenance in Storing and Marketing Food Products |
| 504 | Home and Commercial Food Service |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |

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

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 economic climate continues to have a significant impact on the ability of clientele to attend meetings and conferences.
- There is continued interest in consumer issues, especially related to home food preservation, as a result of the economy and the increasing cost of food.

Government Regulations

- PA has adopted the FDA Food Code, resulting in some changes to regulations governing food service operations. Our curricula cover these new regulations.
- The Food Safety Modernization Act is having an enormous impact on the food supply chain.
- U.S. and foreign government regulations can influence the feasibility and necessity of various work.

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.
- Public interest in locally grown foods, the sustainability of the food supply, and a desire to know what is in the foods we eat have more people interested in home food preservation.

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) are scheduled to be implemented in fall 2015 to 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 # 7

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 |
|---------|--|-----------------|-----------------|----------------|----------------|
| 102 | Soil, Plant, Water, Nutrient Relationships | 0% | | 4% | |
| 307 | Animal Management Systems | 0% | | 4% | |
| 401 | Structures, Facilities, and General Purpose Farm Supplies | 5% | | 1% | |
| 610 | Domestic Policy Analysis | 0% | | 8% | |
| 703 | Nutrition Education and Behavior | 20% | | 4% | |
| 704 | Nutrition and Hunger in the Population | 10% | | 2% | |
| 723 | Hazards to Human Health and Safety | 0% | | 30% | |
| 724 | Healthy Lifestyle | 3% | | 4% | |
| 801 | Individual and Family Resource Management | 5% | | 1% | |
| 802 | Human Development and Family Well-Being | 9% | | 15% | |
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities | 5% | | 1% | |
| 805 | Community Institutions and Social Services | 0% | | 2% | |
| 806 | Youth Development | 40% | | 20% | |
| 901 | Program and Project Design, and Statistics | 3% | | 1% | |
| 903 | Communication, Education, and Information Delivery | 0% | | 3% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|--------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} | {NO DATA ENTERED} |
| Actual Paid | 23.4 | 0.0 | 0.6 | 0.0 |

| | | | | |
|-------------------------|-----|-----|-----|-----|
| Actual Volunteer | 2.1 | 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 |
| 2465697 | 0 | 83487 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 3032877 | 0 | 179297 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 8533391 | 0 | 483963 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

This planned program focuses on understanding factors that promote positive human development at all stages of the life course. Efforts to foster healthy individuals cut across local, national, and global levels and require knowledge of how processes of individual, community, and regional development interact.

Extension provides a wide range of evidence-based programming to support healthy families, build positive youth and healthy lifestyle skills, strengthen intergenerational relationships within both rural and urban communities, and improve farm and rural safety.

Extension in the College of Agricultural Sciences is unique in providing one of the largest youth development programs in the nation. 4-H reaches more than 200,000 youth between the ages of 8 and 18 in Pennsylvania and more than 6 million nationwide. These programs teach youth leadership skills and provide science, technology, engineering, and math (STEM) education. These programs can serve as an avenue to a viable career. Volunteers are critical to the success of 4-H, and build skills for personal and professional development while aiding youth.

In addition to 4-H, extension also works closely with the College of Health and Human Development on the PROSPER program, a youth and family resilience program designed to prevent development of negative behavior in children. Youth programs provide opportunities for learning about healthy eating and physical activity and create a culture of leadership and community service among youth. We continue to focus on the creation and delivery of research-based knowledge on decision-making to augment after-school programs and dovetail with state educational standards. We continue to be national leaders in farm safety education.

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 Cooperative 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 Cooperative Extension supports the professional development offered through eXtension.org.

At least some members of most extension teams answer ask the 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 website on their site.

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). We have expanded the CoP to more than 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), mobile app promotion, and online courses (Moodle). Grant funding was obtained this fiscal year that will continue to enhance and expand the FReSH CoP. Our role with eXtension has enabled the Ag Safety and Health Program to generate close to \$2 million in an 8-year period for program development and expansion. During this reporting period, there were more than 25,000 visitors to the FReSH site (5,004 returning and 20,445 new visitors).

The Rural Health and Safety Extension team provides day-to-day management of the Ag Safety Community of Practice through eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 33014 | 530603 | 37487 | 4664 |

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

Patent Applications Submitted

Year: 2014
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|------------------|-----------------|--------------|
| Actual | 7 | 5 | 12 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 114196 |

Output #2

Output Measure

- Number of technology disclosures involving college faculty, staff, extension educators, or students.

| Year | Actual |
|-------------|---------------|
| 2014 | 0 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Designation of the Clearinghouse for Military Family Readiness as a university-wide research center. |
| 2 | Identification of a system of services, programs, collaborations, and advocacy to help meet the challenges facing families in which grandparents care for their grandchildren. |
| 3 | Finding that policymakers and practitioners should aim opioid interventions at urban illicit drug users, particularly those under age 18. |
| 4 | Minimum estimated value (in \$) of 4-H youth community service project work completed in 35 counties. |
| 5 | Potential savings (in \$) if half of the participants in the Strong Women program avert a hospitalization for osteoporosis-related complications in their lifetime due to participation in this strength-training and nutrition program. |
| 6 | Estimated national value of yearly wages (in \$) of 1,000 youth per year certified for farm work under the National Safe Tractor and Machinery Operation Program. |

Outcome #1

1. Outcome Measures

Designation of the Clearinghouse for Military Family Readiness as a university-wide research center.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Military families face unique challenges and stressors, including prolonged separations, frequent relocations, and living with knowing that loved ones are in harm's way. Federal agencies want to help address these issues using evaluated programs - those known to be effective. The Clearinghouse for Military Family Readiness brings research in the science of prevention, intervention, dissemination, and evaluation to bear on issues facing military families.

What has been done

The clearinghouse, leveraged by federal appropriations, helps professionals who work with military families bring evidence-based approaches to the military context. It catalyzes new research to translate science from multiple disciplines into the development, implementation, dissemination, and evaluation of programs and practices that ameliorate military families' challenges. The clearinghouse also builds public awareness, evaluates programs, creates curricula, and recruits and develops a new generation of applied researchers.

Results

Designation of the clearinghouse as a Penn State research center increases its visibility, scope, and impact. The clearinghouse is a web-based resource for professionals at bases around the world assisting military families. There, providers can find programs to support military families and assessments of the evidence behind those programs. The clearinghouse acts as a "consumer report" by presenting information in reviews on the website. This allows providers to make informed decisions based on their needs. Staff also set up applied research opportunities, and conduct assessments, evaluations, and rapid research literature reviews on specific topics. Issues may include parenting, substance abuse and prevention and intervention, suicide prevention, obesity prevention, and social-emotional learning or skill development programs at the elementary-school age.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 703 | Nutrition Education and Behavior |
| 724 | Healthy Lifestyle |
| 801 | Individual and Family Resource Management |
| 802 | Human Development and Family Well-Being |
| 805 | Community Institutions and Social Services |
| 806 | Youth Development |
| 901 | Program and Project Design, and Statistics |
| 903 | Communication, Education, and Information Delivery |

Outcome #2

1. Outcome Measures

Identification of a system of services, programs, collaborations, and advocacy to help meet the challenges facing families in which grandparents care for their grandchildren.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

About 5.2 million U.S. children are being raised by their grandparents (about 7% of the total). These families face emotional, legal, health, and daily living challenges. Many of these families lack adequate resources for this care, especially in rural areas (about 25% of these families), where housing, transportation, child care, and health care can be more difficult to arrange than in urban areas.

What has been done

The researchers conducted a literature review and outlined various programs, services, and practices that could help meet the challenges these families face. The strategies are meant to help these families and the professionals who support them. The strategies seek to help establish collaboration among social service agencies, identify gaps in services, and advocate for helpful

services and policies. An online database helps these families in PA find resources and services they need.

Results

The researchers identified various helpful strategies, including support groups, family-to-family matching, training for service providers, kinship family retreats, "Kinship Navigator" programs that give caregivers a single point of entry into the social services system, interagency collaboration, advocacy initiatives, and respite care. The researchers advocate that these strategies be used in concert to strengthen family relationships and encourage individual agencies to be more responsive and work more collaboratively for the needs of these families. They advocate for the use of evidence-based approaches to better these families' lives. This work was summarized in the Journal of Intergenerational Relationships.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 801 | Individual and Family Resource Management |
| 802 | Human Development and Family Well-Being |
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities |
| 805 | Community Institutions and Social Services |
| 806 | Youth Development |

Outcome #3

1. Outcome Measures

Finding that policymakers and practitioners should aim opioid interventions at urban illicit drug users, particularly those under age 18.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the United States, prescription opioid misuse (POM) has increased dramatically over the past two decades. However, there are still questions regarding whether rural/urban differences in adult POM exist, and more important, which factors might be driving these differences.

What has been done

Using data from the 2011 and 2012 National Survey on Drug Use and Health, researchers conducted unadjusted and adjusted binary logistic regression analyses to determine the association between metropolitan status and POM.

Results

The study showed that urban adults were more likely to engage in POM compared to rural adults because of their higher use of other substances, including alcohol, cannabis, and other illicit and prescription drugs, and because of their greater use of these substances as children. This study fills an important gap in the literature by not only identifying urban/rural differences in POM, but by also pointing out factors that mediate those differences. Because patterns and predictors of POM can be unique to a geographic region, this research is critical to informing tailored interventions and drug policy decisions. Specifically, these findings suggest that interventions should be aimed at urban illicit drug users and adults in manual labor occupations.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 723 | Hazards to Human Health and Safety |
| 724 | Healthy Lifestyle |
| 805 | Community Institutions and Social Services |

Outcome #4

1. Outcome Measures

Minimum estimated value (in \$) of 4-H youth community service project work completed in 35 counties.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 201646 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Positive Youth Development program educates youth about, among other things, leadership skills, citizenship, and public issues in their community and across the state. Youth need to learn how to work with others; be responsible; build self-confidence; develop communication skills;

exhibit sportsmanship; and learn planning, problem-solving, teaching, and decision-making skills. 4-H Citizenship Service projects are done in many 4-H clubs, no matter the club's main focus (e.g., equestrian).

What has been done

More than 467 community service projects were conducted last year. Typical projects include improving a public place by painting or grounds work, picking up litter, collecting food for a food bank, collecting items for the military or a nursing home, collecting items for an animal shelter or volunteering at an animal shelter, volunteering at a nursing home, reading to children, collecting clothes for or serving at a local shelter, and collecting emergency supplies for storm or disaster victims.

Results

4-H adult leaders and youth volunteered 4,560 hours to community service projects. Using the value of volunteer time in Pennsylvania (\$21.94) from independentsector.org, this comes to \$100,046. Each project leader estimated the value of in-kind donations. More than 14,000 pounds of food and produce were donated, which we assume to have a value of \$1 per pound. The total estimated value of the community service projects was \$201,646. The value of 4-H Citizenship Service projects in Pennsylvania is probably much higher because only 52% of counties submitted data about projects. Through service to their communities, youth build life skills, take pride in their community, and make connections and gain experience that may help them as they seek employment in the future.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 801 | Individual and Family Resource Management |
| 802 | Human Development and Family Well-Being |
| 805 | Community Institutions and Social Services |
| 806 | Youth Development |

Outcome #5

1. Outcome Measures

Potential savings (in \$) if half of the participants in the Strong Women program avert a hospitalization for osteoporosis-related complications in their lifetime due to participation in this strength-training and nutrition program.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 24804000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Aging is commonly associated with decline in physiological and functional ability of adults, which can cause them to be susceptible to falls, fractures, and chronic diseases such as osteoporosis, arthritis, and type 2 diabetes. But if older adults regularly participate in a program of strength training, it can improve muscle mass and increase bone mineral density and body strength, while reducing chronic diseases, fractures, and mortality.

What has been done

The StrongWomen Program is an evidence-based, nationally disseminated group strength-training and nutrition program for women and men. The program translates research-based, strength-training exercise and nutrition requirements into a detailed and easy-to-follow curriculum for use in community settings. The program is being expanded to rural communities through a USDA grant.

Results

In 2013-2014, bone density test scores for 639 participants continuing in the program for more than one session stayed the same for 32% and increased for 22%. Maintaining or even increasing test scores is important for overall health in preventing falls, fractures, and osteoporosis as people age.

The Pennsylvania Health Care Cost Containment Council reports that the average cost of a hospitalization for osteoporosis is \$18,000. Using current projections, half of the 2,756 participants would be expected to suffer a fracture related to osteoporosis in their lifetime had they not started a strength-training regimen. At \$18,000 per hospitalization, more than \$24.8 million in health care costs could potentially be saved through strength training and nutrition for 1,378 of these participants.

Participants also report increasing or maintaining independence as a result of participation, so costs related to deferred long-term care would also be significant.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 703 | Nutrition Education and Behavior |
| 802 | Human Development and Family Well-Being |
| 805 | Community Institutions and Social Services |
| 903 | Communication, Education, and Information Delivery |

Outcome #6

1. Outcome Measures

Estimated national value of yearly wages (in \$) of 1,000 youth per year certified for farm work under the National Safe Tractor and Machinery Operation Program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 600000 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Since 1969, the U.S. Department of Labor has declared many agricultural tasks to be hazardous to youth younger than 16. With certain exemptions, employment of youth under 16 for tasks that require operation of a tractor and machinery is illegal unless the youth are certified. By successfully completing this certification program, 14- and 15-year-old youth may be legally employed.

What has been done

The National Safe Tractor and Machinery Operation Program (NSTMOP) is a 24-hour training that can be conducted in a traditional classroom setting, through independent study, or as a combination of the two. Training is designed to consistently cover core content areas, including safety basics, agricultural hazards, tractors, connecting and using implements with tractors, and materials handling. Youth are certified if they pass a written exam and skills and driving tests.

Results

The NSTMOP through Penn State currently has 300 current instructors across the country. Approximately 1,000 youth completed the program in the last year to receive their U.S. Department of Labor certificate. With the program, youth can begin to hold a part-time job up to 2 years before they normally could. Being able to employ youth might make the difference in whether some farms remain financially sustainable. Youth may be more willing to work on farms than older people are, so they can provide a vital source of labor.

If we assume that 1,000 youth are certified each year, and they each earn \$10/hour and work 10 hours/week for 6 months/year, the value of their wages is \$600,000 nationally.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 401 | Structures, Facilities, and General Purpose Farm Supplies |
| 806 | Youth Development |
| 903 | Communication, Education, and Information Delivery |

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Natural Disasters

- Adverse weather factors continued to influence clientele participation.

Economy

- The economic climate continues to have a significant impact on the ability of clientele to attend meetings and conferences.
- Funding is limited to conduct agricultural safety and health trainings.
- A tight economy leaves limited personal and programmatic funds to offer leader training and/or provide travel and registration support for volunteers to participate in training opportunities.
- Fixed fee structures for the Strong Women program are sometimes too high for participants. Some counties are provided scholarships, reduced fees for returning participants, and alternative payment models.
- The 4-H Science team had difficulty in recruiting high quality staff to deliver targeted science programs, thereby decreasing the reach and efficiency of the programmatic efforts.

Competing Public Priorities

- Competing public priorities force us to continually align our program priorities with budget realities.
- Most staff members are stretched very thin due to multiple needs from phone calls, emails, programming, and various producer or industry groups. The small staff is working to prioritize issues and address the most pressing ones.
- Local YMCAs, community centers, and senior centers offer a program similar to the Strong Women program for free in some communities.

Programmatic challenges

- Programmatic challenges that impacted program delivery in the Better Kid Care program at the county level include delayed contract processing and statewide learning

management system changes that reduced the number of approved instructors available to extension.

- The availability of volunteers can be a limiting factor.

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.
- 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) are scheduled to be implemented in fall 2015 to 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 # 8

1. Name of the Planned Program

Climate Change

- Reporting on this Program
 - Reason for not reporting
 - Adapted our reporting to align with the College's new strategic plan.

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 | 100% | | 100% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 4.6 | 0.0 | 23.2 | 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. The program will deliver a climate change webinar series. In addition to the renewable natural resource extension webinar series, an on-going delivery mechanism that targets practitioners working with Pennsylvania producers will continue to feature whole farm systems approaches to greenhouse gas (GHG) reduction and mitigation. This program is delivered through webinars and incorporates research and extension on best practices for air and water quality protection, including best management practices (BMPs) that reduce emissions of GHGs.

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

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

Patent Applications Submitted

Year: 2014

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|-------------|---------------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-----------------------------|
| 101 | Appraisal of Soil Resources |

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 |
|-------------|---------------|
| 2014 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-----------------------------|
| 101 | Appraisal of Soil Resources |

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 # 9

1. Name of the Planned Program

Childhood Obesity, Chronic Health Issues, and Healthy Lifestyles

- Reporting on this Program
 - Reason for not reporting
 - Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 181.9 | 0.0 | 31.7 | 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

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

Patent Applications Submitted

Year: 2014

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|-------------|---------------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 # 10

1. Name of the Planned Program

Food Safety

- Reporting on this Program
 - Reason for not reporting
 - Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 18.7 | 0.0 | 17.8 | 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

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

Patent Applications Submitted

Year: 2014
 Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|------|--------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|------|--------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 # 11

1. Name of the Planned Program

Global Food Security and Hunger

Reporting on this Program

Reason for not reporting

Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 14.9 | 0.0 | 168.9 | 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

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

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

Patent Applications Submitted

Year: 2014

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|-------------|---------------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 # 12

1. Name of the Planned Program

Sustainable Energy

- Reporting on this Program
 - Reason for not reporting
 - Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 16.7 | 0.0 | 17.4 | 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

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

Patent Applications Submitted

Year: 2014
 Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|-------------|---------------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 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 |
|------|--------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 # 13

1. Name of the Planned Program

Economic and Community Development

Reporting on this Program

Reason for not reporting

Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 52.5 | 0.0 | 37.0 | 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 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

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

Patent Applications Submitted

Year: 2014

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|------|--------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 |
|------|--------|
| 2014 | 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 # 14

1. Name of the Planned Program

Environmental Management

Reporting on this Program

Reason for not reporting

Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 39.5 | 0.0 | 75.8 | 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

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

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

Patent Applications Submitted

Year: 2014

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|------|--------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|------|--------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 # 15

1. Name of the Planned Program

Food and Fiber Systems

Reporting on this Program

Reason for not reporting

Adapted our reporting to align with the College's new strategic plan.

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: 2014 | Extension | | Research | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 91.7 | 0.0 | 207.6 | 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

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

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

Patent Applications Submitted

Year: 2014
 Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | 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 |
|-------------|---------------|
| 2014 | 0 |

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

| Year | Actual |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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 |
|-------------|---------------|
| 2014 | 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}

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 with 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. |