

# 2012 Pennsylvania State University Combined Research and Extension Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

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

The College has been very proactive in its planning. Recognizing the need for organizational change, the College began a process several years ago designed to develop and implement a new business model and address budget strategies. The initiative--called AG Futures--identified opportunities for strategic growth and resulted in an aggressive College strategy.

As a result, the College has taken bold measures to reduce costs, increase operational efficiencies, and maintain the highest possible level of services to our students and stakeholders. Specifically, to date, the following has been accomplished:

- Consolidating the College's graduate/undergraduate degree programs under nine (from 12) new academic departments<sup>1</sup>. The new departments were officially launched on July 1, 2012.
- Shifting to a district model to provide administrative services to Penn State Extension county offices to improve operational efficiency, eliminate duplication, and maximize productivity. The new district model became operational in 2012 and district directors are working collaboratively with their respective counties to develop a new district business model.
- Shifting from a geographically based extension program model to a program-team approach structured around areas of excellence, expertise, and agricultural sectors. New Extension Program Leaders are now in place and are working with their program teams and stakeholders to provide access to relevant and high quality programming across the state.
- Basing program priorities on core mission areas of the College; identifying areas for disinvestment, including family financial management, emergency preparedness, elderly care staff development, grant writing, tourism, workforce training in prisons, and adult leadership. Extension has shifted resources and leveraged cost-sharing dollars from counties to add positions in Pennsylvania priority areas, including ag entrepreneurship, dairy, poultry, food safety/quality, field and forage crops, vegetable production, and mushrooms.
- Evaluating all cost-saving options in programs, farms/facilities, extension, administration, and academic units. The College has cut more than \$19 million out of its permanent budget over the last six years and continues to look at implementing new technologies to increase effectiveness and efficiency and at shifting to private market solutions where outsourcing is appropriate.
- Partnering with Pa. Department of Agriculture on three resource centers to engage Pennsylvania stakeholders around priority topics to include food safety, plant health, and animal care. The centers will

better connect regulatory development and compliance with research, education, and solutions; serve as educators and information consolidators; better leverage the resources of each organization; and provide a focus for programs and stakeholders while allowing umbrellas to address a broad spectrum of issues and connections between respective staff and stakeholders.

We are confident that this new initiative will result in increased focus on College initiative areas, key opportunities and focus areas, intra-college connections, university partnership opportunities, academic programs, and extension alliances.

In light of all the restructuring, our College continues to operate on the basis of shared decision-making regarding investment of AES and CES resources. The College continues to engage in developing implementation strategies for our current strategic plan to move forward an agenda around our five strategic initiatives: entrepreneurship; energy; water; pest prediction and response; and food, diet, and health.

Research and extension are integrated largely through joint appointments in the College of Agricultural Sciences. Of 618 administrators, faculty and staff at University Park, 222 have a combination of research and extension funds supporting their positions. During the past year, we have completed a reframing exercise within PA CES that has identified 11 overarching program priority initiatives and created 13 statewide extension teams (SETs), to focus on these issues. The SETs serve to unite faculty and county-based educators in a common goal of generating new knowledge; offering high quality, focused extension education programs on stakeholder-identified subjects; and identifying and addressing science gaps on the basis of feedback from these educational programs. We connect in research with resources across campus through the Penn State Institute system (Life Sciences, Materials, Social Science, Environment and Energy), and the CES SETs provide a mechanism to connect with and leverage research expertise outside the AES purview from across campus.

Our programs continue to focus on high profile problems that, in addition to their impact in Pennsylvania, frequently also represent regional and national priorities. Our work on nutrient management in the Chesapeake Bay is a regional issue of great interest to the U.S. government, and this work is quite possibly setting benchmarks by which other U.S. watersheds will be approached. Our continued efforts in Marcellus shale natural gas, now much more focused on extraction and related environmental and community problems, demonstrate how we are addressing issues in energy and the environment. For example, extension education programs increased lease payments by a conservative \$250 million for Pennsylvania landowners. We are building predictive models that allow more targeted 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 end results and impacts of all the changes in the College during the last program year allow us to focus our program deliverables, eliminate program areas strategically, align program priorities with budget realities, excel in research and education on topics of greatest impact to Pennsylvania citizens, operate as a cohesive organization, and be more efficient in our operations.

<sup>1</sup>Old units: Food Science, Agricultural and Biological Engineering, Dairy and Animal Science, Poultry Science, Veterinary and Biomedical Sciences, Agricultural Economics and Rural Sociology, Agricultural Extension Education, Plant Pathology, Entomology, Horticulture, School of Forest Resources, Crop and Soil Sciences.

New units: Food Science; Agricultural and Biological Engineering; Animal Science; Veterinary and Biomedical Sciences; Agricultural Economics, Sociology, and Education; Plant Pathology and Environmental Microbiology; Entomology; Plant Science; Ecosystem Science and Management

A few explanatory notes are necessary regarding the report that follows. First, 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.

We are discontinuing our state-defined outcome on volunteers and are reporting the appropriate numbers in the input section of each planned program. We appreciate this field being added to the reporting software.

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

**Total Actual Amount of professional FTEs/SYs for this State**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	390.0	0.0	264.0	0.0
Actual	420.4	0.0	579.3	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 Cooperative Extension and Agricultural Experiment Station programs undergo very thorough and comprehensive review processes.

As discussed in the "Stakeholder Input Process" section, all Cooperative Extension state planning efforts are thoroughly grounded in the needs identified during our statewide needs assessment process. After the needs assessment and program identification process was completed, each of the identified programmatic issues was assigned to one of eleven integrated, multidisciplinary State Extension Teams

(SETs) made up of field-based extension educators and faculty with split appointments in both extension and research efforts. Team members from the field were chosen to broadly represent all parts of the Commonwealth, and faculty members were chosen to represent the research and extension perspectives of all relevant disciplines. Extension Program Leaders (EPLs) provide overall leadership to the SETs with district and state administrators and academic unit leaders serving in liaison roles to each team. All of the programs have been reviewed by research and/or extension administrators. Additionally, logic models were developed by each SET to guide the programming efforts of field-based educators and faculty members with extension appointments, who contribute to applied research priorities.

Pennsylvania Agricultural Experiment Station projects, which partially comprise our planned programs, are reviewed by qualified and knowledgeable scientists. Non-multistate projects are reviewed internally, while multistate projects are reviewed by external reviewers.

As new Penn State Extension programmatic issues or Agricultural Experiment Station projects are implemented, stakeholder groups and/or program advisory groups will provide ongoing review of the educational and research programs to ensure that programs are focusing on priority needs as identified by key advisory groups in the college. All reviewers' critiques and comments provide us with mechanisms for enriching and improving our educational and research programs. Ag Council, Penn State Extension Council, and SET advisory committees serve in an advisory capacity for extension teams.

Through the evaluation process that is part of the logic model, feedback from stakeholders identifies areas that applied research needs to address. In addition, after resources have been identified to direct extension program areas where limited knowledge occurs, fundamental and applied research are identified to be carried out during the period of the program. Fundamental research is largely driven by availability of extramural funding sources and the peer review process associated with that funding.

### **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 of the general public
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public

#### **Brief explanation.**

Stakeholder input is actively sought to help set the course for CES and AES programs. Our primary stakeholder input is received through Cooperative Extension. CE engages in periodic statewide needs assessments, and the results of these assessments are incorporated into our Extension Program SharePoint site and our Extension Program Activity System (EPAS). These

tools, which are built on components of the logic model, are used to prepare the annual Cooperative Extension programs. Thus, stakeholder input is a key attribute of extension programming. This, in turn, provides input into our research agenda, especially through faculty who are jointly appointed on extension and research funding. In addition, extension county-based personnel confer with their program advisory groups as they determine the local focus of their educational programs.

College administration and faculty advisory groups confer regularly with key stakeholder groups. The Penn State Agricultural Council (<http://agcouncil.cas.psu.edu>) provides 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 seek input for all sectors representing the interests of Pennsylvania citizens. In addition, college leadership meets multiple times per year with individual stakeholder groups including, but not limited to, the Pennsylvania Farm Bureau, PennAg Industries, Pennsylvania Forest Products Association, Pennsylvania Department of Agriculture, County Commissioners Association of Pennsylvania, etc.

Through direct faculty and extension educator contacts, we have regular contact with the private sector to assess their specific needs. For example, the following groups provide valuable feedback--Pennsylvania Nutrition Education Network, the Intergenerational Initiatives Advisory Group, the StrongWomen program leaders, the PROSPER program collaborators, and the PA Office of Financial Education. Penn State has a well-developed organizational structure for interacting with industry; our Industrial Research Office serves as a liaison to specific industrial partners.

Also in our stakeholder base are state and federal partners; we have regularly scheduled meetings with agencies such as the 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. These stakeholder meetings provide feedback on programming for Hatch, McIntire-Stennis, Smith Lever, and Animal Health funds.

**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 External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

**Brief explanation.**

County, district, and SET program advisory committees continue their role in providing valuable information on extension programming needs. Program advisory committee members are selected to represent program areas, emerging issues, geographic areas, and population diversity. These groups help 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.

In the establishment of program advisory committees, our policy is that these committees need to represent the demographics of the commodity, community, or workforce. District and county extension boards and program advisory committees are representative of demographics of the county/district and, where appropriate, Hispanics, African Americans, Asians, or other minorities serve on these groups and provide input to extension programs. Annual reports from counties/districts document these efforts. The same is true in the establishment of internal and external focus groups. Penn State Agricultural Council meetings are publicly announced and our broad representation is constantly reassessed to ensure that new and traditionally underserved audiences are included.

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

**1. Methods for collecting Stakeholder Input**

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public
- Other (Focus Groups)

**Brief explanation.**

To collect stakeholder input, educators or faculty met with program advisory committees or individuals or solicited input at educational meetings. During and after extension educational programs, program participants request additional programs or updates, or make suggestions on new topics where an educational program would be helpful to them.

This input may be verbal only or collected in meeting survey instruments. To collect more detailed information from traditional and non-traditional stakeholders, sophisticated survey instruments or focus group meetings are implemented and the data collected are summarized. Requests for information from county extension offices through telephone calls is also a measure of clientele needs. If similar information is requested repeatedly, that is a sign that an issue is of concern to the public.

**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

**Brief explanation.**

Information collected from stakeholders was used to adjust issue areas that determined Cooperative Extension programming. These stakeholder priorities also directly influenced applied research activity through local decisions about research priorities, availability of funding from certain extramural funding sources, including stakeholder groups such as industry associations, and hiring decisions for faculty and extension educators. Stakeholder input not only informs planning, but also influences resource allocations. Stakeholder feedback also indicates where volunteers and donors would be interested in assisting with the program.

As part of the implementation plan for our current strategic plan, we have engaged representatives of the Penn State Agricultural Council as key team members on our internal implementation teams. This serves to inform our programs on the real-world demands for new information and programs.

Both Ag Council and Penn State Extension Council serve in an advisory capacity to the SETs structure implemented in CES; advisory committees for SETs will seek membership from a large stakeholder base.

**Brief Explanation of what you learned from your Stakeholders**

Stakeholders provide a grassroots view of what is important. Public meetings about Marcellus shale natural gas development continue to have high attendance; many meetings focused on emerging issues related to Marcellus drilling, such as water resources and forest management. Stakeholders statewide are concerned about water quality and quantity and the long range effects the natural gas drilling will have on PA natural resources. Extension helped many county governments to form county Marcellus shale task forces; these efforts were through extension work at the state organization of the County Commissioners Association of Pennsylvania.

Most popular programs continue to be in 4-H youth development and horticulture and green industry; both programs engage volunteers in their delivery and therefore have larger participant numbers. Other programs with high participation are agronomic production; agricultural profitability; animal production; strengthening and supporting families; and diet, nutrition, and health. Programs that are growing are related to renewable resources; agricultural profitability; and diet, nutrition, and health. Stakeholders in agricultural programs continued to be focused on the safe production of food and profitability of such enterprises, and new Good Agricultural Practices (GAP) regulations in edible horticulture production as key for producers' profitability. Diet, nutrition, and health programs are focused on childhood obesity, diabetes, and older women's health, all key public health issues. Extension continues to strategically work with diverse audiences in many programs. Minorities serve on extension boards and advisory committees and are key to helping market extension programs in their communities.

IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
10210803	0	7505159	0

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	9568652	0	7707373	0
<b>Actual Matching</b>	20895843	0	26955268	0
<b>Actual All Other</b>	17533984	0	37558298	0
<b>Total Actual Expended</b>	47998479	0	72220939	0

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous</b>				
<b>Carryover</b>	2247650	0	3650021	0



**V. Planned Program Table of Content**

<b>S. No.</b>	<b>PROGRAM NAME</b>
1	Agricultural Systems
2	Families, Youth, and Communities
3	Natural Resources and Environment
4	Pest Management
5	Global Food Security and Hunger
6	Climate Change
7	Sustainable Energy
8	Childhood Obesity
9	Food Safety

**V(A). Planned Program (Summary)****Program # 1****1. Name of the Planned Program**

Agricultural Systems

 Reporting on this Program**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
112	Watershed Protection and Management	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		5%	
204	Plant Product Quality and Utility (Preharvest)	5%		5%	
205	Plant Management Systems	5%		5%	
206	Basic Plant Biology	5%		5%	
212	Pathogens and Nematodes Affecting Plants	5%		5%	
213	Weeds Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
305	Animal Physiological Processes	5%		5%	
307	Animal Management Systems	5%		5%	
315	Animal Welfare/Well-Being and Protection	5%		5%	
501	New and Improved Food Processing Technologies	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
604	Marketing and Distribution Practices	5%		5%	
606	International Trade and Development	5%		5%	
608	Community Resource Planning and Development	5%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	5%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		5%	
	<b>Total</b>	100%		100%	

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

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	103.0	0.0	93.0	0.0
Actual Paid Professional	94.8	0.0	203.4	0.0
Actual Volunteer	1.1	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
3645883	0	3204130	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
7168449	0	10228573	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
3134047	0	10557877	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

Penn State research activities in agricultural systems during the last reporting period include, among many other things, investigation of pathogen effects on plant odors to mediate vector attraction and host exposure; pioneering use of the Profitability Assessment Dairy Tool and the Income Over Feed Cost (IOFC) Tool to improve dairy farm profitability; profiles of the largest and most influential Chinese international furniture supply trade shows, to allow PA lumber exporters efficient and effective use of marketing budgets; development of new fresh-market and processing tomato breeding lines with improved resistance to early and/or late blight or high in lycopene; exploration of weed suppression measures in organic cropping systems; development of production and marketing strategies for colored potato chips; developing dairy cows that efficiently convert feed resources into milk; assessment of vaccine and antibiotic usage on PA beef farms; evaluating the benefits of humates in fruit production; and testing and optimizing high-pressure processing, a new treatment for ground beef against 6 important and virulent Shiga toxin-producing E. coli.

Extension activities in agricultural systems during the last reporting period include, among many other things, workshops on Good Agricultural Practices (GAP), requirements for the Food Safety Modernization Act, and other food safety requirements; workshops for the green industry on pest, weed, and disease identification, soil management, and environmentally sound operations; and nutrient management workshops.

**2. Brief description of the target audience**

Insect and plant scientists; crop scientists; extension educators; pest control specialists; certified crop advisors; IPM practitioners; dairy producers; ag processing industries; local governments; business

development centers; academics; veterinarians; agricultural producers/farmers/landowners; agriculture services/businesses; nonprofit associations/organizations; business and Industry; community groups; education; general public; government personnel; special populations (at-risk and underserved audiences); students/youth

**3. How was eXtension used?**

The Penn State Equine Extension Stewardship Program has used the national eXtension Horse Quest and My Horse University online sites for webinars, frequently asked questions, and as a resource for articles for their Equine PSU Horse Extension website. This and other projects have advertised programming and activities through the website's national events promotion. Team members have served on the national eXtension programming planning committee, chaired sections and communities of practice, and presented PSU research on national webinars.

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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	127371	2004503	5275	2177

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 9

**Patents listed**

Serial No. 13/563,065; Filed 7/31/12; Title: Methods and Compositions for Improving the Nutritional Content of Mushrooms and Fungi

Serial No: 13/435,761; Filed: 3/30/12; Title: Compositions and Methods Relating to Continuation Transgenic Plants and Cellulosic Ethanol Production

Serial No: 61/697,400; Filed 9/6/12; Title: Activated Carbon for the Removal of Chemicals from Water

Serial No: 61/622,955; Filed 4/11/12; Title: Methods to Enhance Conversion of Cellulosic Biomass

Serial No: 61/582,703; Filed: 1/3/12; Title: Activated Carbon Material

Serial No: 61/603,580; Filed: 2/27/12; Title: Methods and Compositions Relating to Starch Fibers

Serial No: 61/618,026; Filed: 3/30/12; Title: Compositions and Methods Relating to Avocado Seed Extracts

Serial No: 13/443,339; Filed: 4/10/12; Title: Apparatus and Method for No-Till Inter-Row Simultaneous Application of Herbicide and Fertilizer, Soil, Preparation, and Seeding of a Cover Crop in a Standing Crop

Serial No: 13/574,625; Filed: 7/23/12; Title: Method of Increasing Soil Resource Capture in a Plant

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	0	422

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of invention disclosures submitted in support of all programs related to Agricultural Systems

<b>Year</b>	<b>Actual</b>
2012	11

**Output #4**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Agricultural Systems

<b>Year</b>	<b>Actual</b>
2012	124533

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Agricultural Systems who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Agricultural Systems who were evaluated in a follow-up and who implemented/adopted practices.
6	Investigated pathogen effects on plant odors to mediate vector attraction and host exposure
7	Number of farms that completed use of the Profitability Assessment Dairy Tool and the Income Over Feed Cost Tool to improve dairy farm profitability
8	Peer-reviewed journal article profiling the largest and most influential Chinese international furniture supply trade shows, to allow PA lumber exporters efficient and effective use of marketing budgets
9	Development of new fresh-market and processing tomato breeding lines with improved resistance to early and/or late blight or high in lycopene
10	Exploration of weed suppression measures in organic cropping systems
11	Development of production and marketing strategies for colored potato chips
12	Research aimed at developing dairy cows that efficiently convert feed resources into milk
13	Percentage of attendees at a workshop on Good Agricultural Practices (GAP) who, after completion of the workshop, said they now have adequate resources to write their own food safety plan
14	Percentage of clients who participated in Green Industry educational offerings and who, upon follow-up, had made changes and/or implemented new practices suggested by the educator
15	Percentage of nutrient management workshop participants who, on follow-up, had implemented and/or adopted practices from the workshop
16	Assessed vaccine and antibiotic usage on PA beef farms
17	Evaluating the benefits of humates in fruit production

**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Agricultural Systems who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	15580



### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

#### What has been done

#### Results

### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
501	New and Improved Food Processing Technologies
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
606	International Trade and Development
608	Community Resource Planning and Development
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

### Outcome #5

#### 1. Outcome Measures

Number of participants in all programs related to Agricultural Systems who were evaluated in a follow-up and who implemented/adopted practices.

#### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	8931

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
501	New and Improved Food Processing Technologies
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
606	International Trade and Development
608	Community Resource Planning and Development
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and

## Naturally Occurring Toxins

### **Outcome #6**

#### **1. Outcome Measures**

Investigated pathogen effects on plant odors to mediate vector attraction and host exposure

#### **2. Associated Institution Types**

- 1862 Research

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Pathogens can alter host phenotypes in ways that influence interactions between hosts and other organisms, including insect disease vectors. Such effects have implications for pathogen transmission, as well as host exposure to secondary pathogens, but are not well studied in natural systems, particularly for plant pathogens.

##### **What has been done**

Determined that a bacterial pathogen of gourds changes the volatile emissions of the plant to attract vectors (beetles) for spread.

##### **Results**

The beetle-transmitted bacterial pathogen *Erwinia tracheiphila*, which causes a fatal wilt disease, alters the foliar and floral volatile emissions of its host (wild gourd, *Cucurbita pepo* ssp. *texana*) in ways that enhance both vector recruitment to infected plants and subsequent dispersal to healthy plants. Moreover, infection by zucchini yellow mosaic virus (ZYMV), which also occurs at the study sites, reduces floral volatile emissions in a manner that discourages beetle recruitment. This therefore likely reduces the exposure of virus-infected plants to the lethal bacterial pathogen, a finding consistent with our previous observation of dramatically reduced wilt disease incidence in ZYMV-infected plants.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants

## **Outcome #7**

### **1. Outcome Measures**

Number of farms that completed use of the Profitability Assessment Dairy Tool and the Income Over Feed Cost Tool to improve dairy farm profitability

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	38

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Improvements in dairy farm profitability can be made through focus on increasing income over feed costs (IOFC) and by systematically identifying bottlenecks in production and financial management using benchmarking. Effective use of evaluation assessments like the Profitability Assessment Dairy Tool (PA Dairy Tool) and the IOFC Tool can help producers to target the most economically beneficial areas for changes to improve their bottom line.

#### **What has been done**

A study used the PA Dairy Tool and IOFC Tool to (i) identify bottlenecks limiting dairy farm profitability on Pennsylvania dairy farms and (ii) show dairy producers how to make improvements to both overall profitability and IOFC. 38 farms completed both tools in year 1.

Offered Best Milking Practices workshop in Spanish and English. Said one farmer: "Our Spanish-speaking milkers [now] have a better understanding of...how to do their job."

Offered Managing Your Milk Margin to Improve Your Dairy's Cash Flow workshops.

#### **Results**

The PA Dairy Tool used year-end numbers for 2009 and showed the greatest economic losses were due to milk yield (\$296/cow/year), but the majority of farms had economic losses with replacements (age at first calving; 31 of 38 farms), udder health (somatic cell linear score >4.0; 29 of 38 farms), and reproduction (pregnancy rate; 25 of 38 farms). From January through October 2010, IOFC ranged from \$3.08 to \$10.61/lactating cow/day. A significant economic loss was from mastitis, as measured by somatic cell count (SCC).

A survey of participants of the Best Milking Practices program revealed 83% (N=17) experienced a decrease in SCC by implementing workshop recommendations. The average reduction in SCC was 162,000. This reduction from PA herd average would result in 1% less loss of production, which translates to \$4,000 increased profit per farm.

The Cash Flow Program results indicate that farms positioned to grow as much of their feed as possible stand the best chance of being sustainable over the long term, especially if they can sell the surplus.

To date, 81 of 98 NRCS-certified feed management planners in the U.S. have attended this nutrient management program.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

#### Outcome #8

##### 1. Outcome Measures

Peer-reviewed journal article profiling the largest and most influential Chinese international furniture supply trade shows, to allow PA lumber exporters efficient and effective use of marketing budgets

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	1

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

China is now the largest furniture producer and exporter in the world and the leading importer of U.S. hardwoods. In 2011, U.S. hardwood lumber exports to China totaled \$506 million USD. At the international marketing level, firms must target their promotional mix more effectively and efficiently toward relevant buyers from around the world. Understanding of and use of international trade shows in China can make U.S. wood product exporters more competitive through cost-effective and efficient network building, market intelligence gathering, and product sales.

###### **What has been done**

This study was conducted to increase awareness of the importance of US-Chinese hardwood trade and knowledge of Chinese international furniture supply trade shows (IFS-TSs). A total of 27 Chinese IFS-TSs were identified through a two-part process: a review of secondary sources and personal communication with key trade show informants in China.

### Results

A peer-reviewed article in Forest Products Journal (2/12) profiled the largest and most influential Chinese IFS-TSs (n = 9) in terms of the number of attendees and exhibitors, and other relevant factors. A better understanding of these trade shows will help US hardwood manufacturers make show participation decisions. This information also has implications for suppliers and buyers from furniture and other related furniture supply sectors, such as woodworking machinery, wood-based panel products, hardware, etc., who may consider participation in Chinese IFS-TSs.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
606	International Trade and Development

### Outcome #9

#### 1. Outcome Measures

Development of new fresh-market and processing tomato breeding lines with improved resistance to early and/or late blight or high in lycopene

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2012	0

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

Tomatoes are the 2nd most important vegetable crop in PA, with an annual farm value of \$41 million. Plant diseases are the number 1 concern to the industry. The most destructive diseases in PA and the Northeast are early blight (EB) and late blight (LB). The use of resistant cultivars will reduce fungicide use and production cost and improve environmental safety.

Consumption of lycopene, the red pigment in tomatoes, has been linked to decreased incidence of certain cancers, coronary heart diseases, and cataracts. Tomatoes are the major source of lycopene in the US diet.

**What has been done**

Researchers have identified new sources of EB/LB resistance in wild tomato, characterized the genetic basis of resistance, and transferred resistance to cultigen. They have developed fresh-market and processing tomato breeding lines with improved resistance to EB and/or LB.

Researchers have identified strong sources of lycopene in wild tomato, characterized the genetic basis of the trait, and transferred high lycopene into breeding lines. They have released several high lycopene fresh-market tomato breeding lines and more are to come.

**Results**

The new breeding lines will be used to develop tomato hybrid cultivars with resistance to EB and/or LB. The result will benefit tomato growers, processors, and consumers alike, because less fungicide would be needed to control these diseases.

The release of the high-lycopene lines will benefit the tomato industry and consumers.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)

**Outcome #10**

**1. Outcome Measures**

Exploration of weed suppression measures in organic cropping systems

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Problems of effective weed control emerge in organic cropping systems. Possible solutions include cover crops, altering planting date, and supplemental control using mechanical cultivation.

**What has been done**

In an organic cropping system experiment, cover crops, planting date, and supplemental control using mechanical cultivation were evaluated for their weed management contribution in corn and soybean. Two rotations compared how to integrate winter canola; it was planted after corn silage or after alfalfa with or without tillage.

**Results**

Late cover crop termination resulted in greatest weed suppression in corn. This work has indicated that weed suppression benefits obtained from delayed cover crop termination may be achievable without yield loss.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
213	Weeds Affecting Plants

**Outcome #11**

**1. Outcome Measures**

Development of production and marketing strategies for colored potato chips

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Growers need to continually innovate with their vegetable offerings to ensure continued success.

**What has been done**

The research team identified potato lines that produce potatoes of deep, consistent skin and flesh color. They evaluated the lines for suitability as chips. They believe that the key to development of the colored potato chip market is to link the colors with sales at universities and/or sporting events, especially football. Examples would be Temple University, whose school colors are red and white, or University of Pennsylvania, whose colors are red and blue.



**Results**

The research team identified suitable potato varieties. The chips would be available during the football season, terminating at the end of the bowl games in January. This would eliminate the need for long-term storage and year-round procurement of the colored potatoes. Potato growers near Philadelphia might supply the colored potatoes to the facility.

Dialogue continued with potato chip companies on the potential of incorporating colored potato chips into their existing line of products and also with entrepreneurs in Philadelphia about setting up a facility. The research team also worked with politicians and community leaders to see if the necessary seed money to get the project underway was available. They also worked with personnel at the universities and colleges in the city that could potentially participate in the program.

**4. Associated Knowledge Areas**

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

**Outcome #12**

**1. Outcome Measures**

Research aimed at developing dairy cows that efficiently convert feed resources into milk

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The long-term goal of this project is the development of dairy cows that efficiently convert feed resources into milk without compromising cow health and reproductive fitness.

**What has been done**

Research focused on how efficiently cows digest feed and the relationship of milk production efficiency with cow fertility, survival, and metabolic profiles. The performance of crossbred cows in

grazing herds, telomere length variation among cows, and the associations of cow survival with herd management system were also evaluated.

### **Results**

Cows genetically inclined toward higher levels of feed efficiency were demonstrated to have lower levels of fertility and blood glucose, higher levels of growth hormone, and longer life spans. These results emphasize the need for balanced breeding programs that consider all economically important aspects of dairy cattle production. Alternative measures of feed efficiency are needed due to the high cost of collecting feed intake data.

Telomeres have been suggested as an indicator of stress in humans and other animals. We demonstrated that telomeres shorten slightly with age and that cows with short telomeres were more likely to be culled.

Crossbred cows are popular in grazing environments that have a low level of concentrate supplementation. Our research suggests that Normande crossbreds maintain milk production levels during periods of slow pasture growth in a more stable manner than traditional dairy breeds, but their milk production levels were inferior to traditional dairy breeds during other periods of the year.

Results of the project were disseminated to dairy producers through popular press articles in Hoard's Dairyman and Farmshine.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals

### **Outcome #13**

#### **1. Outcome Measures**

Percentage of attendees at a workshop on Good Agricultural Practices (GAP) who, after completion of the workshop, said they now have adequate resources to write their own food safety plan

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	65

#### **3c. Qualitative Outcome or Impact Statement**

### **Issue (Who cares and Why)**

The Food Safety Modernization Act (FSMA) aims to ensure the U.S. food supply is safe by shifting the focus of federal regulators from responding to contamination to preventing it. This law will have a huge impact on the food industry in Pennsylvania. Emphasis is on training workers in safe food handling, sanitation, and production. This extension program focuses on Good Agricultural Practices (GAP), how to compare local farming practices with nationwide GAP standards, and how to start writing a farm food safety plan.

### **What has been done**

An important audience is Amish and Mennonite produce growers (60% of participants). Changes in food safety standards and upcoming regulations threaten their livelihood. By offering them knowledge and skills needed to comply with GAP standards, these growers will maintain profitable operations while protecting consumer health.

We worked closely with a local foods distributor in Philadelphia to write a general food safety plan for plain sect farmers setting GAP standards for growers with mixed operations, including work horses. This plan was piloted with farmers in Lancaster County.

### **Results**

~75% of respondents had never attended a farm food safety workshop, which reflects extension's effective outreach to newer grower audiences and the growing demand for this training. 72% of respondents grade and pack the produce in their own packing house, and around 33% pack their produce in the field for immediate delivery. Most respondents do not directly sell at least 50% of their produce directly to consumers, supermarkets, and/or restaurants, and around 85% sell some or all of their produce within the state. Around 25% sell their produce in other states within 275 miles of their farm. 91% of respondents reported the gross value of produce sales in 2011 as less than \$500,000.

On some knowledge-based questions, a decrease in correct response rate to the questions on FSMA requirements, safe use of manure-based compost, and USDA audit standards indicates a need for extension educators and specialists to emphasize these topics. The number of respondents reporting having adequate resources to write their own food safety plan nearly doubled after the workshops.

Of the 176 respondents, 132 (75.0%) indicated they preferred to receive information from Penn State Extension.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

## **Outcome #14**

### **1. Outcome Measures**

Percentage of clients who participated in Green Industry educational offerings and who, upon follow-up, had made changes and/or implemented new practices suggested by the educator

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	100

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Workers in the green industry learned to recognize plants; match plant needs with those of the habitat; identify arthropod pests, weeds, and plant pathogens; and select the most efficient and environmentally sound fertilizer and irrigation practices. Clientele learned to soil test for organic amendments and fertilizer requirements and to obtain a complete diagnosis before applying an arthropod, disease, or weed control measure. These approaches minimize the unnecessary use of fertilizers and pesticides and help minimize the cost of maintaining plant quality.

#### **What has been done**

The Green Industry team offered to clientele single and multiday conferences, short courses, lectures, workshops, field days, webinars, pest walks, train-the-trainer events, volunteer training, and one-to-one assistance. Educational materials were made available indirectly through blogs and newsletters; sent via e-mail or posted on the web; as newspaper articles; as posters and oral presentations at professional meetings; and as fact sheets on websites or mailed directly to clientele. The Woody Ornamental Insect, Disease, and Mite manual was updated.

#### **Results**

42 visits (105 people total) were made to greenhouses, residential and commercial landscapes, nurseries, and schools. 100% of clients made changes and/or implemented new practices suggested by the educator.

Participants were better able to choose cultural rather than chemical solutions to plant problems. Participants were better able to understand pesticide resistance and to rotate chemical mode-of-action groups. Participants were better able to time pesticide applications for maximum efficacy and to reduce pesticide use overall.

The team's gardening column in the Lock Haven Express and the Williamsport Sun-Gazette was

the national winner in the National Association of County Agricultural Agents communication awards.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
216	Integrated Pest Management Systems

#### Outcome #15

##### 1. Outcome Measures

Percentage of nutrient management workshop participants who, on follow-up, had implemented and/or adopted practices from the workshop

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	72

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The Chesapeake Bay is under the microscope for improving impaired watersheds for nitrogen and phosphorus. Feed management is being recognized as an important means of reducing the nutrients before being excreted. It also allows improvements in feed efficiency and reductions in manure volume.

###### **What has been done**

The Integrated Crop Management Program uses a variety of methods delivered by both specialists and educators to teach about nutrient management. These range from webinars, email, and an online newsletter to meetings, conferences, and industry update training sessions for Certified Crop Advisors, to one-on-one activities.

###### **Results**

Nutrient management planners were trained and successfully completed the requirements for certification in PA. To date >2,000 nutrient management plans have been developed and approved. As a result, the latest Chesapeake Bay report card again gave the upper Chesapeake Bay, which is dominated by the Susquehanna River flowing out of PA, the highest score. This program continued to provide educational and technical support to government agencies and nongovernmental organizations for the development of nutrient management programs to

maximize economic benefit from nutrients while minimizing the environmental impact. A critical activity has been educational support for the development of the Chesapeake Bay total maximum daily load (TMDL) by USEPA and of the Implementation Plan for Agriculture. Related to this effort, the TMDL called for revision of the Pennsylvania Manure Management Manual; this program provided educational and technical support to do so. This program is now providing educational support to farmers for implementation of these plans on an estimated 40,000 farms in PA over the next several years.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
112	Watershed Protection and Management

**Outcome #16**

**1. Outcome Measures**

Assessed vaccine and antibiotic usage on PA beef farms

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The improper use of vaccines and/or antibiotics in livestock can result in 'super bugs' resistant to treatment.

**What has been done**

A survey was conducted amount 166 beef producers in Pennsylvania to determine the extent of vaccine and antibiotic use.

**Results**

Nearly half of all farms either sometimes or never used vaccines, and over one-third of those using vaccines sometimes or never used a booster. Most farms (56.4%) used vaccines on the farm. A similar percentage routinely boosted the vaccines. Most diseases targeted with vaccines were the BRD complex, scours, and pinkeye. More than 40% of farms said there were no major health problems on the farm. This would be typical of smaller, closed herds. Over 28%

of farms never used a vaccine on the farm, which generally indicates there were no health problems identified that required control measures. Many beef farms are not using a comprehensive disease prevention program through correct vaccination use.

Antibiotic use on beef farms was negligible, with more than 80% of farms treating 0-5% of their cattle, and nearly 90% of farms not using any antibiotics in the feed or water at subtherapeutic levels. These results indicate that antibiotic use on beef farms in PA is very low.

#### 4. Associated Knowledge Areas

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

#### Outcome #17

##### 1. Outcome Measures

Evaluating the benefits of humates in fruit production

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Healthy agricultural soil is fertile, high in organic matter, and teeming with beneficial microbes responsible for nutrient recycling and decomposition, which produces humic acids (humates). In tree fruit production, the practice of maintaining a vegetation-free zone under trees lowers soil organic matter and humic acid. This produces a less fertile and more compacted soil that can negatively affect the orchard's vigor, yield, and longevity. To counter this effect, many commercial humic acid products claim to provide the same benefits as naturally occurring humates.

###### **What has been done**

Researchers evaluated the effect of applying supplemental humates to orchard and vineyard soils and determined what, if any, benefits may be achieved with regard to crop performance, soil health, and nematode management.

###### **Results**

In the first year of testing, statistical differences in plant growth were not observed in any of the experiments. Nematodes collected at the beginning and end of the season were identified and counted. Populations of plant-parasitic and predatory nematodes increased slightly at the end of the season but showed no significant differences between treatments. However, populations of 'free-living' nematodes increased; there were an average of 23% more free-living nematodes in humate-treated soil.

These experiments were repeated with similar results, except that free-living nematodes increased an average of 18% in the second year. Although there is still much to be learned about the role of microbial life in the soil, soil ecologists are in general agreement that an abundance of free-living nematodes is considered an indicator of a 'healthy' soil environment. These data suggest that supplemental applications of humates may have some beneficial effects. This information has been presented at grower field days in Pennsylvania and published in the Pennsylvania Fruit News.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
206	Basic Plant Biology

#### 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

The FDA Food Safety Modernization Act (FSMA) aims to ensure the U.S. food supply is safe by shifting the focus of federal regulators from responding to contamination to preventing it. This law will have a huge impact on the food industry in Pennsylvania, including food manufacturers, food service, wholesale, and retail, as well as food producers. A major emphasis is placed on training workers on safe food handling, sanitation, and production practices. Penn State has been working in this area for many years, but is building programming in response to these new regulations to reflect the changes.

Outcomes were affected by varying food safety documentation and training requirements among grocery chains and produce distributors. Passage of the 2011 FSMA and upcoming produce safety standards from the U. S. Food and Drug Administration is likely to increase interest among growers and buyers. Competition for extension educator buy-in time limited Cooperative Extension involvement, although this has improved since



last year. Many educators who did not formally commit buy-in time contributed by offering workshops and presenting information at regular horticulture meetings. Extramural funding remains strong and will likely be maintained or increased due to interest in how the FSMA will affect smaller growers.

Because green industry professionals are affected by weather events, program attendance is also negatively affected. Economic issues also can affect attendance as people become more selective with registrations. The economy affects program participation for fee-based programs.

The volatility of the grain and milk markets has forced dairy producers to be more involved in how to use risk management to cover their margin and produce an increased amount of high quality milk. Very dry or wet weather has had major implications for somatic cell count. This can have huge impacts on a producer's income due to decreased milk production and decrease of milk premium earned.

Because of the recession, banks are requiring a cash flow plan before considering whether to make loans. Producers need to know their breakeven income over feed cost and milk margin so they can make smart decisions. Weather extremes can have major implications in feed quality and quantity. This can have huge impacts on purchased feed costs and whether an operation can remain profitable.

The Chesapeake Bay is under the microscope for improving impaired watersheds for nitrogen and phosphorus. Feed management is being recognized as an important means of reducing the nutrients before being excreted. It also allows improvements in feed efficiency and reductions in manure volume.

Nutrient management educational programming is driven largely by state and federal policies. The nutrient management extension program is involved in providing education to policy makers as they develop policies, to the agencies and nongovernmental organizations that work with the policies, and to the farmers who must ultimately implement these on their farms. In the Chesapeake Bay watershed, we are in the midst of major changes in policy, with the development of a TMDL, a presidential executive order, and renewal of the Chesapeake Bay program. All of these are having a profound impact on the extension needs of our clientele and necessitate a flexible approach to keep up with the changes.

## **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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

### **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**

Families, Youth, and Communities

Reporting on this Program

**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
112	Watershed Protection and Management	5%		5%	
134	Outdoor Recreation	1%		0%	
312	External Parasites and Pests of Animals	5%		5%	
503	Quality Maintenance in Storing and Marketing Food Products	1%		0%	
504	Home and Commercial Food Service	5%		0%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	1%		1%	
607	Consumer Economics	3%		8%	
608	Community Resource Planning and Development	10%		8%	
701	Nutrient Composition of Food	2%		2%	
702	Requirements and Function of Nutrients and Other Food Components	4%		10%	
704	Nutrition and Hunger in the Population	10%		0%	
721	Insects and Other Pests Affecting Humans	5%		1%	
723	Hazards to Human Health and Safety	5%		11%	
801	Individual and Family Resource Management	3%		6%	
802	Human Development and Family Well-Being	5%		5%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	1%		12%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	0%		1%	
805	Community Institutions, Health, and Social Services	0%		4%	
806	Youth Development	33%		6%	
903	Communication, Education, and Information Delivery	1%		15%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

<b>Year: 2012</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>

Plan	167.0	0.0	32.0	0.0
Actual Paid Professional	177.8	0.0	54.9	0.0
Actual Volunteer	46.0	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
2414455	0	561955	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
6132513	0	2940173	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
8864212	0	2865424	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Some of Penn State's research projects in families, youth, and community during the last program year included assessing discrimination against immigrant farm workers; studying perceptions of parents of 4-H participants about the effectiveness of 4-H programs; quantifying safety standards for ventilating confined-space manure storages to protect human health and life; and studying the molecular mechanism of action of selenium in human health.

Select Penn State Extension projects during the last program year included fostering mentor-youth partnerships through the 4-H Youth and Families with Promise mentoring program; connecting youth with local waterways and water educators with each other through the PA 4-H Stream Teams program and the Dive Deeper conference; maintaining and strengthening the Better Kid Care program to educate teachers of young children; helping people with diabetes develop healthy dietary, exercise, and self-care habits through the Dining with Diabetes program; and helping older women improve their physical health and eating habits through the StrongWomen/Growing Stronger program.

### 2. Brief description of the target audience

Nonprofit Associations/Organizations, Business and Industry, Education General Public, Human Service Providers, Students/Youth, Community Groups, Special Populations (at-risk and underserved audiences), Government Personnel, and Military

### 3. How was eXtension used?

The Families, Youth, and Communities COP serves as a source of articles for families and child care providers. Some extension educators use the parenting information in their programs and as a reference. eXtension links to the Better Kid Care site for the extensive resources there.

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.

2012 Pennsylvania State University Combined Research and Extension Annual Report of Accomplishments and Results  
 org. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	124555	3046839	557072	310860

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 5

**Patents listed**

- Serial No: 61/622,955; Filed 4/11/12; Title: Methods to Enhance Conversion of Cellulosic Biomass
- Serial No: 61/618,026; Filed: 3/30/12; Title: Compositions and Methods Relating to Avocado Seed Extracts
- Serial No: 61/635,458; Filed: 4/19/12; Title: Compositions, Methods and Kits for Treating Leukemia
- Serial No: 13/538,297; Filed: 6/29/12; Title: Compositions, Methods and Kits for Treating Leukemia
- Serial No: PCT/US2012/04494 6; Filed: 6/29/12; Title: Compositions, Methods and Kits for Treating Leukemia

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	0	0	162

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
 Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of invention disclosures submitted in support of all programs related to Families, Youth, and Communities

<b>Year</b>	<b>Actual</b>
2012	4

**Output #4**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Families, Youth, and Communities

<b>Year</b>	<b>Actual</b>
2012	318551

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Families, Youth, and Communities who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Families, Youth, and Communities who were evaluated in a follow-up and who implemented/adopted practices.
6	Assessing discrimination against immigrant farm workers
7	Perception of parents of 4-H participants that the 4-H program is most effective in providing a safe place for learning and growing (4.44 on a 5-point Likert scale)
8	An international safety standard (ANSI/ASABE Standard S607 Ventilating Manure Storages to Reduce Entry Risk) for ventilating confined-space manure storages was passed based on research conducted
9	Studying the molecular mechanism of action of selenium in human health
10	Number of new mentor-youth partnerships created through the 4-H Youth and Families with Promise mentoring program
11	Organized and held first Dive Deeper-Youth Water Educators' Summit
12	Percentage of respondents attending a Better Kid Care workshop who could list at least one change to their childcare practices they planned to make as a result of their participation
13	Percentage of participants in Dining with Diabetes who experienced statistically significant improvements in waist circumference and in systolic and diastolic blood pressure
14	Percentage of participants in StrongWomen/Growing Stronger who indicated that their health improved in three or more categories

**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Families, Youth, and Communities who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	26359

**3c. Qualitative Outcome or Impact Statement**



**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
134	Outdoor Recreation
312	External Parasites and Pests of Animals
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
512	Quality Maintenance in Storing and Marketing Non-Food Products
607	Consumer Economics
608	Community Resource Planning and Development
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
704	Nutrition and Hunger in the Population
721	Insects and Other Pests Affecting Humans
723	Hazards to Human Health and Safety
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
805	Community Institutions, Health, and Social Services
806	Youth Development
903	Communication, Education, and Information Delivery

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Families, Youth, and Communities who were evaluated in a follow-up and who implemented/adopted practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	3360

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
134	Outdoor Recreation
312	External Parasites and Pests of Animals
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
512	Quality Maintenance in Storing and Marketing Non-Food Products
607	Consumer Economics
608	Community Resource Planning and Development
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
704	Nutrition and Hunger in the Population
721	Insects and Other Pests Affecting Humans
723	Hazards to Human Health and Safety
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
805	Community Institutions, Health, and Social Services

806 Youth Development  
903 Communication, Education, and Information Delivery

**Outcome #6**

**1. Outcome Measures**

Assessing discrimination against immigrant farm workers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Minorities in rural areas may face discrimination. Assessing the depth of this problem is important given the shifts underway within the farm labor force, as well as potential changes in federal immigration policy and the growing reliance on immigrant workers.

**What has been done**

Research examined the circumstances of Dominican immigrants living in an agricultural county (Berks) in Pennsylvania, with emphasis on processes of economic assimilation and experiences with discrimination.

**Results**

Results indicate that a substantial share of Dominican immigrants claim to have personally experienced discrimination in Berks County and that some types of experiences with discrimination are associated with skin tone. Evidence for the consequences of discrimination was vague.

**4. Associated Knowledge Areas**

**KA Code**    **Knowledge Area**  
802            Human Development and Family Well-Being

## **Outcome #7**

### **1. Outcome Measures**

Perception of parents of 4-H participants that the 4-H program is most effective in providing a safe place for learning and growing (4.44 on a 5-point Likert scale)

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

4-H is one of the leading youth organizations in the U.S. 4-H is the most highly recognized of all Cooperative Extension programs. For over 110 years, 4-H has been helping young people ages 5-19 reach their fullest potential. Participation in 4-H fosters knowledge acquisition, leadership and personal development, and citizenship through projects, activities, and programs. Parents are a vital part of the 4-H program. They help ensure the best growth experience possible for their child, help their kids with 4-H projects, and strengthen their social networks with other parents and youth in the community.

#### **What has been done**

The overall purpose of this study was to assess the effectiveness of PA's 4-H program as perceived by parents of 4-H participants. The following objectives guided the study:

1. Describe the demographic profile of parents of 4-H participants.
2. Determine effectiveness of 4-H program as perceived by parents of 4-H participants.
3. Determine parents' perceptions of what their children are learning in 4-H programs.
4. Assess parents' skill levels that could be used in 4-H program.

#### **Results**

Overall, parents perceived that the 4-H program is effective in 1) providing a safe place for their kids to learn and grow (4.44 on a Likert scale of 1-5), 2) offering a variety of subject matter interests that help youth to learn valuable life skills, and 3) making a positive influence on their family life. However, parents perceived that the program was somewhat ineffective in 1) attracting diverse children from various ethnic backgrounds and 2) marketing and advertising of 4-H programs.

Parents perceived that their kids learned valuable skills by participating in 4-H programs: skills

learned by participating in 4-H projects, self-confidence, self-esteem, communication skills, and relationship-building skills.

Parents perceived that they were 'ok to good' in teaching life skills to youth, including helping youth to feel important, listening to youth, understanding youth's point of view, keeping youth from hurting each other, and encouraging youth to take leadership roles. However, parents perceived that they were 'okay' or need help to teach skills to youth relative to relationship-building, conflict management, and social and decision-making skills.

Parents also thought that 4-H should enhance its efforts relative to attracting children from diverse cultural and ethnic backgrounds. This is especially true considering the changing demographics in America.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
903	Communication, Education, and Information Delivery

#### Outcome #8

##### 1. Outcome Measures

An international safety standard (ANSI/ASABE Standard S607 Ventilating Manure Storages to Reduce Entry Risk) for ventilating confined-space manure storages was passed based on research conducted

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Setting official standards for ventilating confined-space manure storages will guard against injuries and deaths in these settings. Manufacturers can begin to build equipment that meets the new international standard.

There are many additional hazards to farm workers, and tracking and publicizing them helps to

reduce injuries and deaths by heightening awareness.

#### **What has been done**

Research was conducted previously on the necessary ventilation to protect human health in confined-space manure storages. A new international safety standard (ANSI/ASABE Standard S607 Ventilating Manure Storages to Reduce Entry Risk) has been set based on that research.

#### **Results**

A mobile demonstration unit was constructed to educate different target audiences about confined-space manure hazards, ventilation, entry into confined spaces, and emergency rescue. Fact sheets and videos for manure storage safety have been produced. Education about injury incidents involving production of hydrogen sulfide gas from manure bedding with recycled gypsum board has begun. Various other methods of education about confined-space manure hazards and other farm hazards were also developed and applied.

Fatal injury statistics among Pennsylvania residents involved in farm work incidents were collected and analyzed throughout the project period, with 148 fatalities recorded statewide.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
723	Hazards to Human Health and Safety

#### **Outcome #9**

##### **1. Outcome Measures**

Studying the molecular mechanism of action of selenium in human health

##### **2. Associated Institution Types**

- 1862 Research

##### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

##### **3c. Qualitative Outcome or Impact Statement**

###### **Issue (Who cares and Why)**

Selenium can negatively impact inflammation, which is a major underlying factor in many diseases, such as arthritis, cancer, HIV, and atherosclerosis. Selenium plays a pivotal role in down-regulating the expression of many proinflammatory genes, which are critical in setting up

inflammation. The goal of this work has been to understand the underlying molecular mechanism of action of selenium.

**What has been done**

Researchers examined the health benefits of selenium, a micronutrient that is absolutely essential for humans and animals. The studies have revealed much new information relating to selenium's anti-inflammatory, antiviral and anticarcinogenic properties.

**Results**

Studies using a parasite (helminth) model of infection demonstrated that selenium status could protect mice from helminth infection and associated pathologies in the small intestine.

Using an HIV-1 infection model, researchers have examined the antiviral property of selenium supplementation that negatively impacts the transcription of HIV-1 provirus. This is highly relevant given the fact that HIV-1 positive individuals have low levels of selenium in their serum. Per these studies, the activation of expression of a selenoprotein thioredoxin reductase and its targeting of a crucial transcription factor expressed by the virus, Tat, seems to be the underlying mechanism of action of selenium. The researchers anticipate that these findings support several epidemiological studies that have shown that selenium supplementation confers benefit to HIV-positive individuals.

In summary, during the last project period, these studies have demonstrated that selenium supplementation at nontoxic doses promotes good health and well being of humans and animals.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
702	Requirements and Function of Nutrients and Other Food Components

**Outcome #10**

**1. Outcome Measures**

Number of new mentor-youth partnerships created through the 4-H Youth and Families with Promise mentoring program

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	200

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The 4-H Youth and Families with Promise mentoring program was implemented in two counties within the state. The mission of the program is to increase the developmental assets of youth, ages 10-14, and their families. This mission is accomplished by utilizing culturally appropriate, early-intervention strategies such as mentoring, involvement in 4-H, and family activities. The program is designed to increase youth's interpersonal competence, improve youth's academic performance, and strengthen family relationships.

#### What has been done

4-H YFP utilizes Search Institutes' 40 Developmental Assets Approach as a framework for staff, volunteers, youth, and families. 4H YFP specifically targets 8 of Search Institute's Developmental Assets relating to two of the program's goals. The main components of the program were designed to: 1) increase youths' ability to form caring relationships with mentors and peers, 2) increase participation in out-of-school time activities (e.g., field trips to museums, PSU campus), 3) provide assistance with school work in a small group format.

#### Results

The programs enabled mentoring practitioners and academic researchers to gear their efforts toward solving contemporary social problems that plague today's youth. The information created gave the youth mentoring practitioners a new way to view their roles. Using the principles of activity theory, the researchers introduced a participatory paradigm as a basis for shared youth development work between practitioners and academic researchers.

The program resulted in the creation of culturally relevant curriculum, exposing students to a variety of activities and ideologies that assist in the social and behavioral development of youth, especially in urban areas. The program created activities that moved away from using a deficit model, and built bridges between nearly 200 youth and 50 mentors. We assisted mentors and adults who work with youth organizations to shift group dynamics and the relationship between the mentors. Additional outcomes from this project were relationships being formed between university staff and secondary school districts and a collaboration between communities and university researchers.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

#### Outcome #11

##### 1. Outcome Measures

Organized and held first Dive Deeper-Youth Water Educators' Summit

##### 2. Associated Institution Types



- 1862 Extension

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

If youth are to develop a life-long respect for an area's waterways, they need to understand their history, cultural importance, natural history, and physical geography. The PA 4-H Stream Teams program strives to provide that lasting connection between youth and a local waterway, as a gateway to greater environmental awareness and action.

#### What has been done

Extension personnel organized and held the first Dive Deeper-Youth Water Educators' Summit in September. The conference was held in conjunction with the PA 4-H Stream Teams program. The conference was a gathering of youth water educators in the Mid-Atlantic Region where knowledge and resource sharing was paired with outstanding networking opportunities.

#### Results

83 educators attended the first Dive Deeper -- Youth Water Educators' Summit. 86% of attendees were able to identify specific new plans resulting from their participation in the conference, including trying new curriculum and continuing to network with newly discovered colleagues. 61% (51/83) of attendees increased their understanding of the use of inquiry-based learning in science education.

A total of 1,049 youth and 21 volunteers participated in the 4-H Stream Teams program, which includes water education, place-based connections to small watersheds of importance to the youth, and water-based community service and outreach projects. A total of 295 4-H Stream Team Members participated in 12 different community service and outreach projects that directly benefited their local watersheds in and around the pilot program area. The Dive Deeper conference showcased the 4-H Stream Teams process and accomplishments.

PA 4-H science volunteers volunteered an estimated 10,000 hours during the reporting period.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
806	Youth Development

## **Outcome #12**

### **1. Outcome Measures**

Percentage of respondents attending a Better Kid Care workshop who could list at least one change to their childcare practices they planned to make as a result of their participation

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	100

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The Penn State Extension Better Kid Care program is designed to empower and strengthen the capacity of families and professionals to nurture, support, and guide children ages birth to 12 years to become caring, competent, and healthy adolescents. Research-based educational information for early care and after-school/school-age practitioners, parents, communities, etc., is provided through a variety of program delivery methods. The focus for educational courses is to support quality early learning.

#### **What has been done**

More than 8,000 childcare providers attended community-based workshops through the Better Kid Care program.

#### **Results**

An average of 5,500 distance education lessons are completed each month in the Better Kid Care professional development system. More than half of these are completed online using the On Demand learning system. There are currently more than 19,000 professionals using this system for professional development. The online learning environment is filling a critical gap for childcare providers who can't attend meetings and conferences or who do not have access to community-based professional development opportunities. An evaluation summary of responses from all participants (N=19,000) for all modules (N=105) indicated an average of 3.0 or higher for knowledge gained and intent to use information on a 5-point Likert scale.

More than 8,000 childcare providers completed evaluation surveys following their attendance at a community-based workshop. 96% of participants rated these sessions as good to excellent. 100% of the respondents could list at least one change they planned to make as a result of their participation (e.g., implement more observation methods, communicate better with parents, help children solve their own problems, create a visual schedule, etc.).

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
903	Communication, Education, and Information Delivery

#### Outcome #13

##### 1. Outcome Measures

Percentage of participants in Dining with Diabetes who experienced statistically significant improvements in waist circumference and in systolic and diastolic blood pressure

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	100

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Making wise food choices can delay or halt the onset of diabetes and/or help in its management. Dining with Diabetes is delivered face to face in 4 weekly classes and a 3-month follow-up. Each class includes a nutrition lesson, recipe demonstration and testing, and physical activity promotion. The program is delivered by a Family and Consumer Sciences educator and a program assistant. The program is open to anyone with or at risk for type 2 diabetes and their family members (at least 18 years). All participants are offered the testing as part of the program. This is an approved research project.

###### **What has been done**

All participants increased number of days taking their medications to lower blood sugar; number of days they eat various fruits and veggies; and number of days they exercise for at least 20 minutes. Percentages indicate number of participants who reported gaining some to a great deal of knowledge from the program:

How carbohydrates affect one's blood sugar -- 95%  
Using food labels to determine amount of carbohydrate in food -- 95%  
Heart-healthy fats for food preparation -- 98%  
Ways to reduce sodium in diet -- 95%  
Role of fiber in blood sugar control -- 98%

**Results**

The Dining with Diabetes program continues to include at-risk family members. As a result of analyzing data on this subgroup, 32% were found to be at risk for prediabetes or diabetes. By screening and educating these participants before they develop complications, the long-term impact of preventing or reducing the risk of complications from undiagnosed/uncontrolled diabetes is enhanced. Additionally, all participants benefit from the healthy lifestyle changes and knowledge gained as a result of attending the program. According to Joslin Diabetes Center, the changes in blood pressure that have consistently been observed over the course of the program are notable as well. This impact is even more significant than what has been seen in some clinical trials and added to the eligibility of the program for new funding opportunities.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
802	Human Development and Family Well-Being

**Outcome #14**

**1. Outcome Measures**

Percentage of participants in StrongWomen/Growing Stronger who indicated that their health improved in three or more categories

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	97

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Older women who exercise regularly and eat right can delay or reverse the onset of various debilitating diseases. The StrongWomen/Growing Stronger strength training/aerobic and nutrition program is delivered by trained site leaders, meeting criteria established by Tufts University and Penn State University. This evidence-based program is delivered as a series of 24 classes, meeting twice weekly for 12 weeks, with classes typically lasting 60-75 minutes.

**What has been done**

170 twelve-week series of classes were conducted at 61 sites. 56 sites operated in donated

space. Trained site leaders guide participants through 30 minutes of aerobic activity and simple, safe, and effective exercises using free and ankle weights, then a nutrition lesson focuses on heart-healthy eating. Leaders regularly facilitate discussions focusing on nutrition and health and reinforce the rationale for making lifestyle changes. This research program is a partnership between Penn State and Tufts University and is funded by a grant from the Centers for Disease Control.

### **Results**

When participants were asked about their intake of nutritious foods, 76% (1097 of 1438) said they increased intake of fruits, vegetables, fiber, whole grains, healthy fats, calcium, and vitamin D since beginning the program. Participants were asked to identify the level of intake of these items. On average, there was a 17% increase on each item between the 1st timers and those continuing in the program. Intake of desired items improved the longer participants were in the program.

When participants were asked about improved aspects of health, 97% (1396 of 1437) indicated that their health improved in 3 or more categories, such as feeling physically stronger, doing everyday activities more easily, increased amount of weight lifted, increased flexibility, relief of joint pain, improved balance, and improved weight since beginning the program.

As a result of participating, 15% (146 of 960) of those who were taking medications for diseases such as cholesterol, osteoporosis, blood pressure, glucose control, or other illnesses decreased the amount taken.

The program had 3,183 registered participants in 23 counties. 182 volunteers logged 4,392 hours, equivalent to \$96,053.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
802	Human Development and Family Well-Being

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

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

### **Brief Explanation**

Extramural funding had a significant influence on the outcomes demonstrated by the PA 4-H Science Program in 2012.

The most notable factor that affected 4-H Volunteer Management and Development this year was the changes in screening and background check procedures, as well as the need to complete new background checks on all current volunteers in a 2-month time frame. This change in policy and procedure was closely followed by the need to have all volunteers complete child abuse training. Another factor that affected outcomes was the conversion of the 4-H program database from edata to Access 4-H. These fundamental management functions absorbed significant amounts of staff time and energy to meet

mandated requirements in order to keep 4-H volunteers enrolled in the program.

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

Almost all Better Kid Care programming is supported with external funding provided by the Office of Child Development and Early Learning (DPW and PDE), NIFA, the Department of Defense, and local community grants and foundations. Cuts to funding directly affect the ability to deliver programs.

Funding for the Dining with Diabetes program was significantly decreased during 2011-2012. The grant with PA DOH was completed, as was a significant portion of USDA funding. Due to a special project undertaken with Joslin Diabetes Center, funding was available to support 10 programs. There was some endowment funding for programs in Franklin County and other smaller grants that enabled the program to continue. Significant personnel reduction also affected the ability to deliver the program statewide. However, as a result of a continued partnership with Joslin Diabetes Center, new funding is available through the Centers for Medicare and Medicaid Services that will support the program through June 2015. A goal of the new project is to establish the program as a reimbursable form of diabetes education through health insurance companies.

Due to the economic situation, numerous counties are providing financial scholarships for StrongWomen/Growing Stronger, reduced fees for returning participants, and alternative payment models, such as installments. Due to recent staff layoffs, we have fewer counties participating, thus slightly fewer volunteers participating than last year.

## **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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

### **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**

Natural Resources and Environment

 Reporting on this Program**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
101	Appraisal of Soil Resources	6%		10%	
102	Soil, Plant, Water, Nutrient Relationships	5%		10%	
104	Protect Soil from Harmful Effects of Natural Elements	6%		0%	
112	Watershed Protection and Management	6%		15%	
122	Management and Control of Forest and Range Fires	6%		0%	
123	Management and Sustainability of Forest Resources	6%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
135	Aquatic and Terrestrial Wildlife	4%		6%	
136	Conservation of Biological Diversity	4%		2%	
141	Air Resource Protection and Management	5%		1%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	5%		5%	
213	Weeds Affecting Plants	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
306	Environmental Stress in Animals	5%		5%	
315	Animal Welfare/Well-Being and Protection	5%		5%	
402	Engineering Systems and Equipment	5%		5%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
511	New and Improved Non-Food Products and Processes	2%		1%	
723	Hazards to Human Health and Safety	5%		5%	
806	Youth Development	5%		5%	
	<b>Total</b>	100%		100%	

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

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	28.0	0.0	30.0	0.0
Actual Paid Professional	23.8	0.0	52.6	0.0
Actual Volunteer	15.7	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
690095	0	635114	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1530165	0	2861025	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1293005	0	2821361	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Penn State's research in the Natural Resources and Environment planned program over the last program year included, among other topics, technical assistance and data contributed to the Pennsylvania Department of Environmental Protection for livestock nutrient management regulation; development of new compostable and edible coating for cellulose substrates; development of PaOneStop website for farm planning and nutrient management; quantification of effects of simulated increased temperature and precipitation on a central PA deciduous forest plot; studying how fish behavior changes in response to environmental stressors; supporting commercial development of a hen manure gasification plant through manure and ash analysis and testing the ash as a feed P/Ca supplement for poultry diets; and assessing the spread of herbicide-resistant weeds.

Highlights of Extension work in this planned program included pond management workshops; water test interpretation workshops; updated estimates of ownership of private forest land in PA and resulting emphasis on forest land legacy planning; experimental reclamation of abandoned mine land at the National Park Service Flight 93 Memorial site to support tree planting; and connecting youth to nature through the Junior Forest Steward program.

### 2. Brief description of the target audience

Ag producers/farmers/landowners; agriculture services/businesses; nonprofit associations/organizations; business and industry; community groups; education; general public; government personnel; human service providers; special populations (at-risk and underserved audiences); students/youth; academic researchers; forest managers; global change ecologists; ag media; volunteers/extension educators; consumers

### 3. How was eXtension used?



The Penn State Equine Extension Stewardship Program has used the national eXtension Horse Quest and My Horse University online sites for webinars, frequently asked questions, and as a resource for articles for their Equine PSU Horse Extension website. This and other projects have advertised programming and activities through the website's national events promotion. Team members have served on the national eXtension programming planning committee, chaired sections and communities of practice, and presented PSU research on national webinars.

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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	24065	468507	8652	30354

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 1

**Patents listed**

Serial No: 61/622,955; Filed 4/11/12; Title: Methods to Enhance Conversion of Cellulosic Biomass

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	0	0	195

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
 Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of invention disclosures submitted in support of all programs related to Natural Resources and Environment

<b>Year</b>	<b>Actual</b>
2012	5

**Output #4**

**Output Measure**

- A. Number of people enrolled and/or registered in all programs related to Natural Resources and Environment

<b>Year</b>	<b>Actual</b>
2012	32622

**Output #5**

**Output Measure**

- A1. Number of people enrolled and/or registered in the Equine Environmental Stewardship program.

<b>Year</b>	<b>Actual</b>
2012	2765

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Natural Resources and Environment who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Natural Resources and Environment who were evaluated in a follow-up and who implemented/adopted practices.
6	Technical assistance and data contributed to Pennsylvania Department of Environmental Protection for livestock nutrient management regulation
7	Development of new compostable and edible coating for cellulose substrates
8	Development of PaOneStop website ( <a href="https://www.paonestop.org">https://www.paonestop.org</a> ) for farm planning and nutrient management
9	Quantified effects of simulated increased temperature and precipitation on central PA deciduous forest plot
10	Studying how fish behavior changes in response to environmental stressors
11	Assessing the spread of herbicide-resistant weeds
12	Percentage of participants in pond management workshops who were evaluated in a follow-up and who implemented and/or adopted recommended practices
13	Percentage of attendees of water test interpretation workshops who were evaluated on follow-up and had taken actions on their water supply
14	Updated estimates of ownership of private forest land in PA
15	Number of acres of abandoned mined land at the National Park Service Flight 93 Memorial site enriched with a mixture of manure and paper mill sludge to support memorial tree planting
16	Pennsylvania youth who participated in a forest stewardship activity and learned about forest stewardship through the Junior Forest Steward program
17	Supported commercial development of hen manure gasification plant

**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Natural Resources and Environment who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	5273

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Natural Resources and Environment who were evaluated in a follow-up and who implemented/adopted practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	3901

**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
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes

#### Outcome #6

##### 1. Outcome Measures

Technical assistance and data contributed to Pennsylvania Department of Environmental Protection for livestock nutrient management regulation

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Of the 31,000 operations housing horses in Pennsylvania, 75% are noncommercial and over 75% are on limited acreage, requiring intensive management. Horse farm operations have not been eligible for cost-share funding in the past and have not been regulated directly. Under newly revised regulations, equine operations now fall under Act 38, Pennsylvania Nutrient Management

regulations. Operations with more than 8 animal units per acre now need a nutrient management plan.

**What has been done**

Team members provided technical assistance to agency and legislative representatives initiating nutrient regulation. A webinar and four regional training workshops were held for 145 NRCS and conservation district personnel.

**Results**

Data collected on project farms were used to revise horse manure nutrient levels, served as baseline data for the PA Department of Environmental Protection Manure Manual, and were used in the PA Agronomy Guide animal body weight tables. 85% of those surveyed reported that the training increased their understanding of equine behavior and grazing patterns. 82% said the information would help them develop recommendations for pasture management and animal sacrifice areas. 78% stated that they developed a better understanding of the industry and horse owners.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
112	Watershed Protection and Management

**Outcome #7**

**1. Outcome Measures**

Development of new compostable and edible coating for cellulose substrates

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

As landfills fill up and are increasingly difficult to site, easily biodegradable disposable paper products are needed. A coating that works over a broad range of environmental conditions would find wide application.

**What has been done**

A new coating based on polysaccharides was developed. It dramatically improves the wet strength and liquid barrier properties of cellulose substrates.

#### Results

The coating works well over a pH range of 3 to 9 and from room temperature to 80 degrees C. The coating is completely compostable and edible. Commercialization activities are underway to develop new products in the food handling and packaging areas (e.g., disposable cups, plates, and other packages). Five patent disclosures have been filed.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

#### Outcome #8

##### 1. Outcome Measures

Development of PaOneStop website (<https://www.paonestop.org>) for farm planning and nutrient management

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

In Pennsylvania, the need for online tools to assist farmers in meeting environmental regulations such as erosion and sediment control planning, nutrient management planning, manure management planning, and manure transfers is increasing. Farmers have traditionally found it difficult and/or relatively expensive to produce these plans because they needed tools that were not readily available to them. These types of farm plans will help to reduce agricultural pollution to Chesapeake Bay and other watersheds.

###### What has been done

PaOneStop provides tools that assist in meeting farm management requirements. The PaOneStop tool has been heavily supported by the Pennsylvania Department of Agriculture, Department of Environmental Protection, and the State Conservation Commission as a tool for farmers and Conservation District personnel to help produce ag erosion and sedimentation (E&S)



plans.

**Results**

The system has more than 1,800 registered users who have produced maps for more than 4,500 farms and 29,000 fields. Chapter 102 requires written ag E&S plans for all "agricultural plowing and tilling activities" greater than 5,000 square feet. The State Conservation Commission estimates that nearly 40,000 farms have no current written conservation or E&S plan. With nearly 60,000 farms in the state, this gives the PaOneStop site a significant market for farmers who need immediate assistance in producing plans. PaOneStop addresses a critical gap in Pennsylvania's Watershed Improvement Plan, which required significant reductions in agricultural pollutant loadings to the Chesapeake Bay watershed.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
112	Watershed Protection and Management

**Outcome #9**

**1. Outcome Measures**

Quantified effects of simulated increased temperature and precipitation on central PA deciduous forest plot

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Experimental study of the effects of projected climate change on plant phenology allows us to isolate effects of warming on life-history events such as leaf-out.

**What has been done**

Researchers simulated a 2°C temperature increase and 20% precipitation increase in a recently harvested temperate deciduous forest community in central Pennsylvania, and observed the leaf-out phenology of all species for 2 years. Over 130 plant species were monitored weekly in study plots, but due to high variability in species composition among plots, species were grouped into five functional groups: short forbs, tall forbs, shrubs, small trees, and large trees.

**Results**

Tall forbs and large trees, which usually emerge in the late spring, advanced leaf-out 14-18 days in response to warming. Short forbs, shrubs, and small trees emerge early in spring and did not alter their phenology in response to warming or increased precipitation treatments. Earlier leaf-out of tall forbs and large trees coincided with almost 3 weeks of increased community-level leaf area index, indicating greater competition and a condensed spring green-up period. Although phenology of large trees and tall forbs appears to be strongly influenced by temperature-based growth cues, our results suggest that photoperiod and chilling cues more strongly influence the leaf-out of other functional groups. Reduced freeze events and warmer temperatures from predicted climate change will interact with nontemperature growth cues to have cascading consequences throughout the ecosystem.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

**Outcome #10**

**1. Outcome Measures**

Studying how fish behavior changes in response to environmental stressors

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Understanding how animals react to changes in environmental stressors is key because climate change and anthropogenic changes are likely to make environments less predictable. So understanding how natural populations adjust and cope with such unpredictability through their behavioral responses provides us with important information.

**What has been done**

Researchers investigated the relationship between hormonal and behavioral stress responsiveness in populations of a tropical freshwater fish, *Brachyrhaphis episcopi*, that

experiences different levels of predation and hence encounters different rates of stressful events. Predation can impose strong selection pressure, and living with high risk of predation is known to select for specific behavioral traits. Researchers quantified variation in stress responsiveness via cortisol release rates (exp. 1) and behavior in an open field test followed by cortisol release rates (exp. 2).

### Results

Populations exposed to high levels of predation were consistently more exploratory and active and had lower release rates of cortisol in response to a stressor than fish of the same species sampled at sites with few predators. Fish adjust their decision-making strategies to cope with living in a dangerous environment. Fish from high predation populations make more rapid but less accurate decisions compared to fish from low predation environments. Fish from high predation sites are more impulsive, but they learn and remember information for longer than their low predation counterparts. This work on fish cognition has caught attention from the general media (newspapers, magazines and radio), and so we are also reaching the general public.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals

### Outcome #11

#### 1. Outcome Measures

Assessing the spread of herbicide-resistant weeds

#### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2012	0

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

Over-reliance on glyphosate-type herbicides for weed control on U.S. farms has created a dramatic increase in the number of genetically resistant weeds. About 95 percent of the current soybean crop is modified by inserting herbicide-resistant genes into the plants. Projections are that herbicide use may double in the next decade, posing a threat to ecosystems, water quality, and human health.

### **What has been done**

Our work on the spread of herbicide-resistant weeds has been underway for some 15 years now, and over the past year culminated in the publication of several high profile papers. Our work on genetically modified herbicide-resistant crops and integrated weed management was communicated in some 270 newspapers nationwide, on National Public Radio, and in a number of nationally distributed magazines.

### **Results**

The evolution of glyphosate-resistant weeds has continued at a constant rate over the past 10 years. 22 species are now resistant to this widely used herbicide. From our own research and through a comprehensive meta-analysis, we conclude that introducing multiple herbicide genes in newly produced crop cultivars will only serve to accelerate the herbicide resistance problem. We therefore conclude that a much greater emphasis should be placed on more robust and sustainable integrated weed management methods to address the problem. We underscore the importance of integrated weed management. This involves implementing practices that effectively fragment the landscape for invasive plants and limiting connections that facilitate their recruitment success and spread.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
213	Weeds Affecting Plants

## **Outcome #12**

### **1. Outcome Measures**

Percentage of participants in pond management workshops who were evaluated in a follow-up and who implemented and/or adopted recommended practices

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	83

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The goal of the pond and lake management program is to provide educational resources on proper management of ponds and lakes in the areas of aquatic plants and algae, fisheries, pond structure, and water quality.

**What has been done**

Agents offered 15 face-to-face pond management workshops using PowerPoint presentations and hands-on instruction to assist participants in managing their pond/lake; 3 presentations at turfgrass management conferences; 2 webinars on pond management, fisheries, and management of aquatic invasive species; an online aquatic pesticide course; and consultation to 427 individuals through 1-on-1 education, phone, email, and pond visits.

**Results**

433 pond/lake owners representing approximately 1,322 acres of ponds/lakes attended programs. 98% of attendees rated the workshops as excellent, very good, or good. 83% of attendees indicated that they had never tested their pond/lake water quality. 100% of attendees indicated that they learned some new pond/lake management concepts at the workshop. 83% of participants were evaluated in a follow-up and had implemented and/or adopted suggested practices. The most common actions taken included managing a plant/algae (39%), testing pond/lake water (23%), installing buffer strip around pond/lake (33%), using barley straw for algae control (13%), and adding fish structure to the pond or lake (10%).

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

**Outcome #13**

**1. Outcome Measures**

Percentage of attendees of water test interpretation workshops who were evaluated on follow-up and had taken actions on their water supply

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	78

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Many owners of private water supplies have never had their water supplies tested. Many know essentially nothing about how the system works, how to maintain it, or what types of conditions might indicate a problem. Recent drilling for Marcellus shale natural gas has heightened the need

for this type of programming.

#### **What has been done**

The Safe Drinking Water Extension specialist delivered 52 programs/workshops. Programs reached 5,756 private water supply owners. There were 622 attendees at nine water test interpretation workshops.

Master Well Owner Network volunteers provided direct assistance or presentations to 2,350 private water supply owners and indirect assistance to 10,777 private water supply owners.

#### **Results**

96% of attendees of the water test interpretation workshops felt comfortable in interpreting their water test report after attending the program. 95% felt the information presented was unbiased. A follow-up survey was emailed to 373 attendees (46% response rate). 78% had taken actions on their water supply, including water testing (5%), improved construction of water supply (16%), installation of water treatment devices (11%), shock disinfection to remove bacteria (21%), added lease stipulations to protect water (3%), and had water quantity documented before drilling (15%). Nearly 65% of respondents indicated that they shared what they learned at the workshop with others.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
723	Hazards to Human Health and Safety

#### **Outcome #14**

##### **1. Outcome Measures**

Updated estimates of ownership of private forest land in PA

##### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

##### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

##### **3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Forest parcelization, the ownership of ever smaller parcels of forest land, affects forest values and management. Areas of core forest, which are essential to many species, very often shrink.

**What has been done**

The third and final part of the Pennsylvania Forest Landowner study was completed to estimate landowner populations and to link findings to ownership patterns, decision-making, and issues affecting forest management and legacy.

**Results**

Pennsylvania now has 738,000 private forest land owners. This is approximately 200,000 more than the 2008 estimate by the U.S. Forest Service. Owners of small parcels (i.e., 410,000 owners), those of less than 20 acres, hold about 1 in 4 of Pennsylvania's private forest acres. The data now suggest that 1 in 7 Pennsylvania households owns an acre or more of woodlands. Unfortunately, the data suggest that the parcelization of private forests continues to be a major concern, as 56% of forest owners plan to leave their land to more than one heir. To stem the loss of working forests, the team embarked on a joint effort with Cornell University to develop resources for peer-to-peer and professional outreach to encourage forest owners to plan for their forest legacy.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
123	Management and Sustainability of Forest Resources

**Outcome #15**

**1. Outcome Measures**

Number of acres of abandoned mined land at the National Park Service Flight 93 Memorial site enriched with a mixture of manure and paper mill sludge to support memorial tree planting

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	20

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

In Pennsylvania excess manure nutrients in areas of intensive animal agriculture and severely disturbed mined lands can both contribute to degraded water quality.

### What has been done

Research has been conducted on mined lands investigating using agricultural manure to achieve rapid improvement in mine soil quality and significant biomass production. Mine soil reclamation with a mixture of manure and paper mill sludge sequesters manure nutrients and organic carbon in the soil, allowing large applications with minimal risk of nutrient loss by leaching or runoff.

Research was initiated to implement a production cycle in which spent mushroom substrate is used for mine soil reclamation and annual nutrient supply to produce straw for mushroom substrate feedstock.

### Results

Sustained switchgrass production of 5-6 Mg ha<sup>-1</sup> has been achieved with no annual fertilizer additions. Credits generated under PA's nutrient trading program have covered the cost of manure transport from production areas to mine sites and paper mills cover the cost of paper mill sludge transport, so these materials can be delivered to mine sites at no cost to the reclamation operation. This approach to mine soil reclamation was used at the National Park Service Flight 93 Memorial site to prepare ~20 acres of abandoned mined land for planting 20 of the 40 memorial groves, with plans to do the same for the remaining 20 groves. The potential for significant biomass production on mined lands is of interest to PA's mushroom producers, who are finding it increasingly difficult to source straw feedstocks for production of mushroom substrate.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
403	Waste Disposal, Recycling, and Reuse

## Outcome #16

### 1. Outcome Measures

Pennsylvania youth who participated in a forest stewardship activity and learned about forest stewardship through the Junior Forest Steward program

### 2. Associated Institution Types

- 1862 Extension

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	341



### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The Junior Forest Steward Program offers youth (ages 8-12 years) an opportunity to learn about the forests of PA and the important concept of forest stewardship. PA youth often know very little about the forests and natural areas that cover the state. This educational initiative can get kids excited about and interested in Penn's Woods. The Pennsylvania Bureau of Forestry is a partner.

#### What has been done

Participation in the Junior Forest Steward Program is free and relies on cooperating adults (such as teachers, youth group leaders, 4-H volunteers, Scout leaders) to help facilitate learning. Adults need only an interest and willingness to learn right along with youth. The program works in both formal and non-formal educational settings. Youth read an interactive publication (individually or as a group), discuss the questions, and then participate in a forest stewardship activity led by the adult educator or helper. Youth then receive a Junior Forest Steward patch.

#### Results

341 youth across Pennsylvania participated in the Junior Forest Steward Program. 100% of these youth were reported by the adult volunteers to have increased their knowledge 'a great deal.' These same volunteers also reported that the program made a 'large' long-term impact on the youth involved (75%) or a 'medium' impact (25%), and they rated the usefulness of the program materials highly. Some of the stewardship projects included interviewing a PA Forest Steward or state land manager about land management practices used, constructing a brush pile for wildlife habitat, erecting bird boxes, eliminating invasive weeds, litter pickup, and tree planting.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

#### Outcome #17

##### 1. Outcome Measures

Supported commercial development of hen manure gasification plant

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The proliferation of concentrated animal feeding operations has raised issues of how to safely and efficiently dispose of the animal waste while protecting environmental and water quality. Turning the waste into a fuel and possibly a feed supplement greatly increases the efficiency of nutrient utilization and helps with energy source diversification.

#### What has been done

Researchers supported the commercial development of a hen manure gasification plant (3.24 megawatt) on a 5.6 million hen complex in PA with manure and ash analysis and testing the ash as a feed P/Ca supplement for poultry diets.

#### Results

This plant went online in 2012 and will remove 195,000 tons of manure annually from the Chesapeake Bay watershed.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
302	Nutrient Utilization in Animals
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse

### V(H). Planned Program (External Factors)

#### External factors which affected outcomes

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

#### Brief Explanation

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

The summer drought and 2011 and 2012 fall floods had real impacts on some research projects, requiring the adjustment of time lines.

Attendance at pond/lake workshops continues to be strong. Increasing government regulation of pond/lake owners provides new opportunities to continue educational programs. Even in an economic downturn, pond/lake owners are willing to pay \$10-35 for quality educational programs. New federal National Pollutant Discharge Elimination System (NPDES) aquatic herbicide permitting and changes in available aquatic herbicides will provide even greater opportunities for education in this area.

Interest in safe drinking water programs is strong based largely on increased drilling for Marcellus shale gas. Demand for Master Well Owner Network programs is also strong, but external funding for this program has been minimal and flat, resulting in relatively constant numbers of volunteers reporting. Penn State Extension is the one of the few unbiased providers of safe drinking water programs in the state, especially regarding potential impacts of natural gas drilling. Increasing amounts of professional water testing of private water supplies in gas drilling areas will provide opportunities for education around water test interpretation and basic private water supply management. Private water supply owners have traditionally been unwilling to pay more than \$10 for educational programs, but natural gas programming has the potential to bring in greater revenue from this audience.

Afterschool events will always compete with other youth activities, especially sports. The limited number of personnel working on the Connecting Youth with Nature project are taxed to the maximum, and funding is extremely tight at both county and state levels.

## **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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

Based on program evaluations and information obtained from industry surveys, a strong need exists to continue to offer programs that address environmentally and economically sustainable farm management practices. Various growers, producers, and farmers have cited lack of information and knowledge and lack of funds as major barriers to implementing best management practices.

### **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**

Pest Management

 Reporting on this Program**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
204	Plant Product Quality and Utility (Preharvest)	5%		5%	
206	Basic Plant Biology	5%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	7%		18%	
212	Pathogens and Nematodes Affecting Plants	8%		5%	
213	Weeds Affecting Plants	6%		5%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	5%		3%	
215	Biological Control of Pests Affecting Plants	5%		2%	
216	Integrated Pest Management Systems	7%		7%	
311	Animal Diseases	5%		5%	
312	External Parasites and Pests of Animals	5%		5%	
313	Internal Parasites in Animals	5%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%		5%	
404	Instrumentation and Control Systems	2%		2%	
721	Insects and Other Pests Affecting Humans	5%		5%	
722	Zoonotic Diseases and Parasites Affecting Humans	5%		5%	
802	Human Development and Family Well-Being	5%		5%	
901	Program and Project Design, and Statistics	5%		3%	
902	Administration of Projects and Programs	5%		5%	
	<b>Total</b>	100%		100%	

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

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	35.0	0.0	69.0	0.0
Actual Paid Professional	42.6	0.0	204.9	0.0
Actual Volunteer	58.7	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
1353571	0	2056140	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2435517	0	7774441	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1499876	0	18229036	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Research programs during the reporting period covered, among other things, multifaceted activities to develop sustainable, IPM-friendly management programs and monitoring options for brown marmorated stink bug (*Halyomorpha halys* Stål) (BMSB); testing the prevalence of antibiotic-resistant bacteria on U.S. conventional poultry farms that transitioned to organic practices; discovering learning impairment in honey bees caused by agricultural spray adjuvants; studying slug ecology and management in no-till field crops; exploring potential for novel fungus-based biopesticides for malaria vector control; developing methods for and extension materials for assessment of house fly problems in livestock facilities; identification of thyme oil as effective in controlling verticillium dry bubble disease in commercial button mushrooms; and continuing to support a web-based system to forecast the international aerial movement of Asian soybean rust, which saves growers about \$200 million/year in pesticide application costs.

Highlights of Extension activities included dozens of Master Gardener programs, increasing vineyard sustainability, and integrated pest management in orchards and for small fruits and vegetables.

### 2. Brief description of the target audience

Agricultural Producers/Farmers/Landowners, Agriculture Services/Businesses, Nonprofit Associations/Organizations, Business and Industry, Community Groups, Education, General Public, Government Personnel, Human Service Providers, Special Populations (at-risk and underserved audiences), Students/Youth

**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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

eXtension was used as a professional development tool to hone plant diagnostic skills through participation in Introduction to Diagnostics for Master Gardener Volunteers, a 3-hour credit course. The eXtension website is used to search for answers to specific questions from clientele.

Several Horticulture educators serve as a resource for Ask the Expert and answer questions that are assigned to them.

Vegetable team members published two videos on eXtension. They were case studies at Quiet Creek Farm designed to show example systems to help new farmers get started.

One educator worked with eXtension group to produce The Life Cycle of the White Grub.

The eXtension grape community of practice is an important resource and teaching tool for all viticulture extension educators in the U.S. In 2012 an educator wrote 2-3 articles for e-Viticulture, which also has a section for Spanish language visitors. The e-Viticulture website was awarded the eXtension achievement award in 2012.

Two faculty members are involved in e-apples (<http://www.extension.org/pages/60760/apples-community-information>).

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	301472	4189955	67067	5620

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

**Patent Applications Submitted**

Year: 2012  
Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2012</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	0	0	267

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of invention disclosures submitted in support of all programs related to Pest Management

<b>Year</b>	<b>Actual</b>
2012	1

**Output #4**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Pest Management

<b>Year</b>	<b>Actual</b>
2012	79823

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of decision support tools adopted based upon predictive modeling research.
5	Number of participants in all programs related to Pest Management who were evaluated and demonstrated increased knowledge and skills.
6	Number of participants in all programs related to Pest Management who were evaluated in a follow-up and who implemented/adopted practices.
7	Discovering the basic biology of brown marmorated stink bugs (BMSB) and best methods for immediate (pesticide recommendations) and long-term control
8	Lower prevalence of antibiotic-resistant bacteria on U.S. conventional poultry farms that transitioned to organic practices
9	Discovered learning impairment in honey bees caused by agricultural spray adjuvants
10	Slug ecology and management in no-till field crops
11	Exploring potential for novel fungus-based biopesticides for malaria vector control
12	Annual dollar increase in growers' profits via reduced pesticide application costs enabled by web-based system to forecast the international aerial movement of Asian soybean rust
13	Number of Master Gardeners volunteer hours
14	Percent of growers attending Grape IPM Workshop who expect their vineyard to be more profitable based on the information they learned
15	Average percentage of respondents attending a workshop on integrated pest management in orchards who learned something that has potential to make their business more profitable
16	Total pesticide application costs saved by using data from Penn State's pest monitoring program to make spray decisions for about 600 acres of sweet corn
17	Percentage of participants in the small farm fly control program who adopted 2-3 fly monitoring and control practices discussed



18	Identification of thyme oil as effective in controlling verticillium dry bubble disease in commercial button mushrooms
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**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of decision support tools adopted based upon predictive modeling research.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	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**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
311	Animal Diseases
404	Instrumentation and Control Systems
901	Program and Project Design, and Statistics
902	Administration of Projects and Programs

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Pest Management who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
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2012

1497

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

#### What has been done

#### Results

### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
311	Animal Diseases
313	Internal Parasites in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
722	Zoonotic Diseases and Parasites Affecting Humans
802	Human Development and Family Well-Being
901	Program and Project Design, and Statistics
902	Administration of Projects and Programs

### Outcome #6

#### 1. Outcome Measures

Number of participants in all programs related to Pest Management who were evaluated in a follow-up and who implemented/adopted practices.

#### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	550

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
311	Animal Diseases
313	Internal Parasites in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
722	Zoonotic Diseases and Parasites Affecting Humans
802	Human Development and Family Well-Being
901	Program and Project Design, and Statistics
902	Administration of Projects and Programs

## **Outcome #7**

### **1. Outcome Measures**

Discovering the basic biology of brown marmorated stink bugs (BMSB) and best methods for immediate (pesticide recommendations) and long-term control

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Many of the insecticides currently available to growers have variable effects on resident BMSB populations and little or no residual effects on future invaders into treated fields and orchards. Many insecticides that have been traditionally effective are not available for use on fruit or are discouraged because of harmful effects on natural enemies of BMSB and other beneficial insects.

#### **What has been done**

Laboratory and field evaluations of insecticides against BMSB adults and nymphs conducted during the 2012 season tested the effectiveness of multiple insecticide chemistries registered for use on fruit.

#### **Results**

Active ingredients belonging mostly to two groups of products--pyrethroids and neonicotinoids--provided the highest mortality of BMSB adults and nymphs. However, the combination of low residual activity of insecticides against BMSBs coupled with their ability for unrestricted movement and continuous reinfestation of orchards creates a challenging situation for pest management. Consequently, only multiple, frequent applications of broad-spectrum insecticides proved effective in managing the pressure from BMSBs. However, the preferred products used for such treatments exhibit highly negative effects on most beneficial organisms in orchards. As a result of the unbalanced needs for insecticide treatments to control BMSBs, some isolated orchards are already experiencing outbreaks of mites, wooly apple aphids, or scale insects, which are normally controlled by natural enemies. Although nonpesticidal control (e.g., biological or cultural methods) is the ultimate goal for BMSB management, the short-term solutions unfortunately still seem to rely mostly on insecticides.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

**Outcome #8**

**1. Outcome Measures**

Lower prevalence of antibiotic-resistant bacteria on U.S. conventional poultry farms that transitioned to organic practices

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

In U.S. conventional poultry production, antimicrobials are used for therapeutic, prophylactic, and nontherapeutic purposes. Researchers have shown that this can select for antibiotic-resistant commensal and pathogenic bacteria on poultry farms and in poultry-derived products. However, no U.S. studies have investigated on-farm changes in resistance as conventional poultry farms transition to organic practices and cease using antibiotics.

**What has been done**

Researchers investigated the prevalence of antibiotic-resistant Enterococcus on U.S. conventional poultry farms that transitioned to organic practices. They evaluated the presence of resistant bacteria in poultry by collecting water, feed, and litter samples from 10 newly organic and 10 conventional farms.

**Results**

Bacterial evaluation showed that concentration of antibiotic-resistant bacteria can be decreased fairly rapidly (3 - 4 years) by changing to an organic-certified growing environment. This can decrease possible environmental contamination of water, litter, and broilers.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
313	Internal Parasites in Animals

**Outcome #9****1. Outcome Measures**

Discovered learning impairment in honey bees caused by agricultural spray adjuvants

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Spray adjuvants are often applied to crops in conjunction with agricultural pesticides to boost the efficacy of the active ingredient(s). The adjuvants are largely assumed to be biologically inert and are therefore subject to minimal scrutiny and toxicological testing by regulatory agencies. Honey bees are exposed to a wide array of pesticides as they conduct normal foraging operations, meaning that they are likely exposed to spray adjuvants. It was previously unknown whether these agrochemicals have any deleterious effects on honey bee behavior.

**What has been done**

An improved, automated version of the proboscis extension reflex assay with a high degree of reproducibility was used to measure the olfactory learning ability of honey bees treated orally with sublethal doses of the most widely used spray adjuvants on almonds in the Central Valley of California. Three adjuvant classes (nonionic surfactants, crop oil concentrates, and organosilicone surfactants) were investigated.

**Results**

Researchers demonstrated for the first time that learning was impaired after ingestion of 20 µg organosilicone surfactant, indicating harmful effects on honey bees caused by agrochemicals previously believed to be innocuous. Organosilicones were more active than the nonionic adjuvants, while the crop oil concentrates were inactive. Ingestion was required for the tested adjuvant to have an effect on learning. Exposure via antennal contact only induced no impairment.

Olfactory learning is important for foraging honey bees because it allows them to exploit the most productive floral resources in an area at any given time. Impairment of this learning ability may have serious implications for foraging efficiency at the colony level, as well as potentially many

social interactions. Organosilicone spray adjuvants may therefore contribute to the ongoing global decline in honey bee health.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

#### Outcome #10

##### 1. Outcome Measures

Slug ecology and management in no-till field crops

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

As row crops managed with conservation tillage increase, more growers are encountering slugs. Slugs can eat virtually all crops. They inflict most damage during crop establishment and early growth in the spring and fall. This damage tends to be most severe under cool, wet conditions. These mollusks are particularly troublesome within the Chesapeake Bay watershed, where conservation tillage is encouraged to minimize agricultural run-off into waterways. Slugs are challenging to control because of the limited number of management tactics available.

###### **What has been done**

Researchers reviewed the species of slugs commonly found in mid-Atlantic field crop production and investigated their natural history, ecology, and some of the factors limiting their populations. The researchers suggested cultural, biological, and chemical management options, particularly for corn production, and suggested elements of a potential integrated management program for slugs.

###### **Results**



Tactics that reduce the amount of surface residue, such as shallow disking, decrease slug populations. Natural enemies in no-till fields can be enhanced by increasing crop diversity and using insecticides sparingly. Early planting may give crops a jump on slugs if there is significant growth before many eggs hatch. Growers can further contribute to better early growth by selecting crop varieties that are rated 'excellent' for emergence and seedling vigor.

Many insecticides, like chlorinated hydrocarbons or organophosphates, do not appear to be toxic to slugs, show inconsistent molluscicidal activity, or require a very large dose to have any influence. Carbamate insecticides, however, can have activity against slugs, and some compounds appear to provide control of slug populations in some settings.

It's safe to say that there is not a 'silver bullet' for slug problems in no-till crop fields. Many tactics used provide some relief under certain circumstances. But inconsistencies can be decreased by employing many tactics in concert. Growers should always begin management by scouting for slugs. It may be best to reduce plant residue before planting.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

#### Outcome #11

##### 1. Outcome Measures

Exploring potential for novel fungus-based biopesticides for malaria vector control

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Studies suggest that residual treatments of biopesticides comprising certain naturally occurring fungi could play a role in management of adult Anopheles mosquitoes, the major vector of malaria. Isolates belonging to 2 cosmopolitan fungal species have been shown to infect and significantly reduce Anopheles's longevity, killing them within 14 days. The reduction in mosquito longevity is sufficient to significantly reduce the vectorial capacity. Pre-lethal effects reducing

sporozoite formation and feeding propensity increase the potential impact on malaria transmission.

#### **What has been done**

Researchers tested the effects of various fungal-based biopesticides on Anopheles mosquitoes. They tested for the co-occurrence of resistance to the major classes of insecticides and fungal biopesticides. They attempted to quantify the efficacy of spray residues of some fungal biopesticides.

#### **Results**

Researchers found that the observed pre-lethal reduction in host-feeding propensity could be linked to reduced sensitivity of the olfactory organs (i.e., fungal-infected mosquitoes essentially suffer a 'head cold' and can't smell host odor cues as effectively). Infected mosquitoes also exhibited increased metabolic activity (a metabolic 'fever'), a stress that results in reduced ability to sustain flight.

Resistance to the major classes of insecticides did not confer cross-resistance to fungal pathogens in key African malaria vectors.

Short-term (30 minutes) exposure of adult mosquitoes to a range of realistic substrates treated with fungi was sufficient to cause high levels of infection. Simple spray residues could remain infective for up to 5 months after treatment.

Overall, the combined pre-lethal and lethal effects of fungi, together with resistance-breaking properties, make possible a new paradigm for insecticidal control of malaria: blocking of malaria transmission without fast-acting neurotoxins.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
722	Zoonotic Diseases and Parasites Affecting Humans

#### **Outcome #12**

##### **1. Outcome Measures**

Annual dollar increase in growers' profits via reduced pesticide application costs enabled by web-based system to forecast the international aerial movement of Asian soybean rust

##### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

##### **3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	2000000000

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Asian soybean rust entered the United States in 2004. The disease causes lesions on the plant that can lead to early defoliation and yield loss.

**What has been done**

The Integrated Aerobiology Modeling System to forecast the aerial movement of soybean rust, *P. pachyrhizi*, in the U.S., Mexico, and Canada has been operated with international observation network information as part of the ipmPIPE from 2005 to present. Through the web-based platform, soybean extension specialists, agricultural service companies, independent consultants, producers, and other stakeholders could track the disease from its first day of entry into North America.

**Results**

Predictions of distribution and timing of disease matched field observations, and soybean rust has not been detected in PA. Smartphone applications have been developed and deployed as a "push" technology to enable Extension specialists to input observations from the field and to reach crop consultants and growers with pest decision support information in a real-time framework. Products include maps created by day, degree, infection, and atmospheric transport models. The site includes a publicly available map with summarized data and products.

The PIPE system has recently achieved sustainability based on a business model by which the corn and soybean industries and grower organizations support monitoring and information dissemination activities of interest to all stakeholders.

The PIPE has had a major impact in reducing sprays applied for Asian soybean rust. PIPE increased producers' profits by between \$11 and \$299 million in 2005 and ca. \$200 million/yr over the subsequent 5 years. It provides benefits to U.S. agencies and producers through a better understanding of the movement of migratory or invasive pests.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

**Outcome #13**

**1. Outcome Measures**

Number of Master Gardeners volunteer hours

**2. Associated Institution Types**

- 1862 Extension

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	119306

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Master Gardeners (MGs) across PA work in schoolyard gardens, with juvenile offenders, and other community groups, teaching people how to garden. MGs are alert for invasive insect pests and spread the word about environmental concerns and Extension's mission.

#### What has been done

The Penn State Master Gardeners greatly magnify the reach and ability of Penn State Extension. Through their outreach, Penn State Master Gardener volunteers collaborate with many community groups and increase public visibility of Penn State Extension. They are often the first contact the public has with Extension. They are trained to help in Extension's role of first detector of invasive pests, and they are politically engaged in their communities.

#### Results

43 counties had 1,989 active MGs. Collectively, they reported 119,306 volunteer hours, with an estimated value of \$2,599,677. They made 306,076 direct educational contacts with the public. At least 252 new MGs completed their training during the reporting cycle.

In educational gardens around the state, MGs oversaw the growing of 31,751 lbs. of produce donated to food banks.

In York County, 21 MGs gardened weekly with 30 juvenile offenders, donating 5,634 lbs. of produce to food banks.

211 home gardens were certified as "Pollinator Friendly."

MGs maintained a garden hotline in 39 counties, reporting 17,236 educational public contacts.

Bucks County MGs sold 664 compost bins, 132 rain barrels, 200 compost turners, and 185 kitchen compost buckets. Over 500 lbs. per household of food and yard waste was diverted from landfills, resulting in an estimated diversion of over 60 tons per year.

The first official endowment for a county-based MG program was established in Lehigh and Northampton Counties.

## 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)
802	Human Development and Family Well-Being

### **Outcome #14**

#### **1. Outcome Measures**

Percent of growers attending Grape IPM Workshop who expect their vineyard to be more profitable based on the information they learned

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	65

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Growers work hard all year and then watch the crop diminish in quality and size just before harvest. Complications begin with the weather, but are exacerbated by late-season threats, including birds, bees, diseases, and insects. Wine makers need clean and healthy fruit to make fine wines.

##### **What has been done**

The annual Grape IPM Workshop gives growers access to the latest scientifically based information to help manage vineyard pests. The Grape IPM workshop is held each spring to review the disease and pest season from the previous year and look ahead to growing defect-free fruit in the next growing season.

##### **Results**

65% (N=23) of growers attending Grape IPM Workshop expect their vineyard to be more profitable based on the information they learned; 61% (N=24) of workshop participants surveyed will adopt new disease management practices; 57% (N=22) will adopt new weed management practices; 54% (N=21) will adopt new cultural practices; 48% (N=24) have a high to very high confidence to design a vineyard IPM program; 96% will share the information they learned.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants

**Outcome #15**

**1. Outcome Measures**

Average percentage of respondents attending a workshop on integrated pest management in orchards who learned something that has potential to make their business more profitable

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	93

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Growers need access to the latest scientifically based information to help them manage fruit pests.

In 2011, there was an outbreak of apple scab in orchards, and producers estimated losses to be \$1.9 million.

**What has been done**

9 full-day Integrated Crop Management Workshops and ten 2-hour meetings/tours around the state. Electronic and print instructional materials (e.g., 2012-13 PA Tree Fruit Production Guide). Timely updates through monthly Fruit Times newsletters, email, and regular updates of appropriate websites.

Extension educators in cooperation with scientists at the Fruit Research and Extension Center responded to the apple scab outbreak immediately by conducting extensive surveys and fungicide resistance trials and by offering in-depth educational programs and regular disease alerts.

**Results**

Program participants who completed post-program evaluations represented more than 33,000 acres of tree fruit.

88-99% of respondents learned something from the workshop that has potential to make their

business more profitable.

95% of respondents reported increased knowledge about Penn State pest management and cultural recommendations for tree fruit crops.

91% use the PA Tree Fruit Production Guide. 81% of that group said it is very useful.

71% use the PA Fruit Times newsletter. 99% of that group said it is moderately to very useful.

164% increase in visits to Fruit Times website after workshops.

60-75% plan to implement changes in stink bug, apple scab, or orchard floor management.

31% are already adopting advanced IPM strategies.

Impact of increased fruit quality: \$171-1,584 per acre; impact of increased management efficiency: \$245-500 per acre; impact of reduced damage from two major fruit pests: \$26 per acre.

Impact analyses demonstrated that incidence of apple scab was reduced by 88% in 2012.

#### 4. Associated Knowledge Areas

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

#### Outcome #16

##### 1. Outcome Measures

Total pesticide application costs saved by using data from Penn State's pest monitoring program to make spray decisions for about 600 acres of sweet corn

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	16207

##### 3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Commercial growers of small fruits and vegetables in Pennsylvania are using research-based information to produce high-quality foods in a manner that protects the environment and meets current market demand.

**What has been done**

Through participation in vegetable and small fruit production extension programs, commercial growers have learned about and adopted best management practices for, among other things, choosing specialty crops and monitoring and managing pests and beneficial insects.

**Results**

On post-program evaluations, producers view Penn State as a highly valued source of information and attribute participation in this program with improving their farm's profitability. 66-89% indicated that they have adopted vegetable and small fruit production practices learned through previous Penn State Extension programs, including insect, disease, and weed management; variety selection; and cultural practices.

Sweet corn growers in 13 counties, representing more than 600 acres of production, responded to surveys in 2010 and 2011 on their collaboration in Penn State's pest monitoring program. They reported saving a total of \$16,207 in pesticide application costs by using the data to make spray decisions. The same growers reported that the total worth of the crop they protected from insect damage that could potentially have made it unmarketable was \$389,000 over two years.

**4. Associated Knowledge Areas**

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

**Outcome #17**

**1. Outcome Measures**

Percentage of participants in the small farm fly control program who adopted 2-3 fly monitoring and control practices discussed

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
------	--------



### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Vectors that can transport bacteria from place to place are a concern to animal producers. Measuring such vectors should be part of any integrated pest management program. When coupled with cultural methods to reduce vectors, scouting for vector counts is a method to maintain pests below a critical control point. Fly and pest control is critical in the U.S. Food and Drug Administration's egg rule.

#### What has been done

Three extension programs were given to assist operators and technicians of large-sized farms dealing with house fly issues. Smaller farms, seeing the success of the larger farm programs, have adopted scouting methods explained in programs given directly to them. The programs train those working with fly issues on farms to understand the identification, life cycle, and integrated controls of flies on the farm.

#### Results

Of the 33 large-scale farm workshop participants, 80% stated that they learned something new about the house fly and its ecology. 40% stated that they felt comfortable performing farm fly assessments. Control of flies was achieved in all but two instances on poultry farms. Adoption of scouting methods for IPM has begun with larger (50,000 hens+) egg farms. Over 78% of the PA farms scouting are using materials distributed via Extension programs. Egg farms outside of PA are also using the count sheets and other materials. Interest from Europe and Asia was seen this year from web statistics. Due to this higher level of on-farm fly scouting, calls to the PA SWAT fast response fly team have dropped in comparison to previous years. Use of the suggested fly monitoring and control practices helps producers comply with the FDA egg rule.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
902	Administration of Projects and Programs

### Outcome #18

#### 1. Outcome Measures

Identification of thyme oil as effective in controlling verticillium dry bubble disease in commercial button mushrooms

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The identification and use of environmentally nontoxic biopesticides will reduce the need for chemically based pesticides that can be harmful to the environment.

#### What has been done

Researchers evaluated essential oils and other biopesticides for the control of several fungal diseases of the commercial button mushroom, *Agaricus bisporus*.

#### Results

The application of an essential oil, thyme oil, was found to control the development and symptoms of verticillium dry bubble disease. The higher concentrations of this oil showed some promise as a possible biopesticide, but the economics of the material and application timing need to be investigated. The slow release of thyme oil when added to an adsorbing gel was also effective in reducing the incidence and severity of the disease, so this method of delivery shows some promise. The results of this study suggest that thyme oil could be used as an effective compound to control verticillium dry bubble. Further testing for concentrations and timing of the applications may improve the effectiveness of this biopesticide.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

### V(H). Planned Program (External Factors)

#### External factors which affected outcomes

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

#### Brief Explanation

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

### 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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

**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 Food Security and Hunger

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	17%		15%	
601	Economics of Agricultural Production and Farm Management	17%		15%	
606	International Trade and Development	16%		25%	
611	Foreign Policy and Programs	17%		15%	
722	Zoonotic Diseases and Parasites Affecting Humans	16%		15%	
723	Hazards to Human Health and Safety	17%		15%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	10.0	0.0
Actual Paid Professional	2.7	0.0	11.2	0.0
Actual Volunteer	0.0	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
25361	0	111217	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
138193	0	782156	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
159844	0	574152	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Research in global food security and hunger for this reporting period focused on studying the effectiveness of economic incentives to reduce pesticide use and related environmental effects, and on linking investment spikes and productivity growth in the U.S. food industry, among other topics.

There were no extension projects in this emphasis area for this reporting period.

**2. Brief description of the target audience**

Policy makers; agricultural, environmental, and rural development economists; students; general public; scientific community

**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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	0	63

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Global Food Security and Hunger

Year	Actual
2012	311

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Study of effectiveness of economic incentives to reduce pesticide use and related environmental effects
5	Linking investment spikes and productivity growth in the U.S. food industry

**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Study of effectiveness of economic incentives to reduce pesticide use and related environmental effects

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**



Chemical pesticides constitute an important input in crop production. But their indiscriminate use can negatively affect agricultural productivity, human health, and the environment. Recently, attention has been focused on the use of economic incentives to reduce pesticide use and its related indirect effects.

**What has been done**

This work assessed the effectiveness of various economic instruments such as taxes and levies in encouraging farmers to decrease pesticide use and their environmental effects. A policy simulation model was employed using data from Dutch cash crop producers, including two pesticide categories differing in terms of toxicity and pesticides' environmental effects. Four different instruments were selected for evaluation: pesticide taxes, price penalties on pesticides' environmental spillovers, subsidies, and quotas.

**Results**

The results of the study indicate that even high taxes and penalties would result in a small decrease in pesticide use and environmental spillovers. Taxes that differentiate according to toxicity do not lead to substitution of high- with low-toxicity pesticides. Subsidies on low-toxicity products are not able to affect the use of high-toxicity products. Pesticide quotas are more effective in reducing pesticide use and environmental spillovers.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
723	Hazards to Human Health and Safety

**Outcome #5**

**1. Outcome Measures**

Linking investment spikes and productivity growth in the U.S. food industry

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

When U.S. food companies invest in new or improved factories and facilities, their leaders need to understand how productivity is likely to grow. There are differences in productivity growth and investment spike patterns across different subindustries and the food manufacturing industry in general.

#### **What has been done**

This study examined empirically the widely assumed relationship between productivity and investment spikes by means of a rich U.S. Census Bureau plant-level (factory-level) data set. This link was investigated without imposing any causal relationship between productivity growth and investment for the U.S. food manufacturing industry.

#### **Results**

There was significant variation in productivity growth among plants in the same industry. Productivity growth at the industry level differed from growth measurement based on a quartile group of plants.

There was strong evidence of a link between productivity growth and investment age in existing plants. Results showed that productivity growth increases after investment spikes over time and then trails off, even after controlling for plant fixed effects in most of the plants, suggesting a plant-level efficiency gain or learning effect.

Efficiency and the learning period associated with investment spikes differed across industries. The meat and dairy industry plants saw the positive effects right away once the new technology was adopted. This suggests that these plants experience an immediate increase in efficiency, or the new technology learning period is relatively short. However, for all food industry plants in general, the impact of investment spike on productivity growth was positive but gradually declined after an investment spike, suggesting that the learning period is longer and productivity benefits from these investments are realized more slowly.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
601	Economics of Agricultural Production and Farm Management

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Appropriations changes
- Competing Programmatic Challenges
- Other (Extramural Funding)

##### **Brief Explanation**

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

#### **V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

There are no extension projects in this emphasis area for this reporting period, so we are not reporting on evaluation.

**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**

Climate Change

 Reporting on this Program**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
101	Appraisal of Soil Resources	5%		5%	
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		5%	
111	Conservation and Efficient Use of Water	5%		5%	
112	Watershed Protection and Management	5%		5%	
123	Management and Sustainability of Forest Resources	5%		5%	
132	Weather and Climate	5%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
135	Aquatic and Terrestrial Wildlife	5%		5%	
136	Conservation of Biological Diversity	5%		5%	
141	Air Resource Protection and Management	5%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
402	Engineering Systems and Equipment	5%		5%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
605	Natural Resource and Environmental Economics	5%		5%	
608	Community Resource Planning and Development	5%		5%	
610	Domestic Policy Analysis	5%		5%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	5%		5%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	14.0	0.0
Actual Paid Professional	3.7	0.0	22.7	0.0
Actual Volunteer	3.3	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
140429	0	687326	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
252839	0	1210265	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
218459	0	1070392	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Research highlights include constructing a model predicting the future of wastewater disposal from Marcellus shale natural gas drilling under three possible scenarios; exploring how Marcellus shale drilling is changing Pennsylvania landscapes; examining the effects of structural and nonstructural adaptation measures on hurricane damages; projecting potential impacts of invasive Asian longhorn beetles on northeastern forests (in collaboration with colleagues at the Cary Institute); developing and contributing information important to the development of primary and secondary National Ambient Air Quality Standards for ozone; studying N and P loss under different soil temperature regimes to determine optimal manure application times; study of the effect of dietary protein concentration on ammonia and greenhouse gas emissions from dairy manure; and revealing new insights into the potential for water quality trading to achieve water quality objectives at lower cost.

Extension work in climate change includes the Managing Community and Urban Natural Resources program, which organizes educational programming and municipal/agency technical assistance under two statewide themes: Community and Urban Forestry and Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry TreeVitalize/Tree Tender initiatives.

**2. Brief description of the target audience**

Federal, state, and municipal government agencies involved in natural resource and environmental policy (USEPA, USDOJ, USDA, PADEP, PADCNR, etc.); research community, both domestic and international; graduate and undergraduate students; nonprofit associations/organizations; business and industry; community groups; education; general public; special populations (at-risk and underserved audiences); students/youth; volunteers/extension leaders; commercial crop producers and farmers; forest landowners; natural resource professionals

**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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	5939	6250	3317	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 1

**Patents listed**

Serial No: 13/435,761; Filed: 3/30/12; Title: Compositions and Methods Relating to Continuation Transgenic Plants and Cellulosic Ethanol Production

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	0	0	110

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
 Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
 Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Climate Change

<b>Year</b>	<b>Actual</b>
2012	5757

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Climate Change who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Climate Change who were evaluated in a follow-up and who implemented/adopted practices.
6	Model predicting the future of Marcellus shale natural gas drilling wastewater disposal under three possible scenarios
7	Exploring how Marcellus shale natural gas drilling is changing Pennsylvania landscapes
8	Effects of adaptation measures on hurricane damages
9	Report on ecological and economic impacts of a regional outbreak of Asian longhorned beetle
10	Investigations contributing to primary and secondary National Ambient Air Quality Standards for ozone
11	Study of N and P loss under different soil temperature regimes to determine optimal manure application times
12	Project report to the Organization for Economic Cooperation and Development, Directorate for Trade and Agriculture
13	Effect of dietary protein concentration on ammonia and greenhouse gas emissions from dairy manure



**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Climate Change who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	1397

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
302	Nutrient Utilization in Animals
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Climate Change who were evaluated in a follow-up and who implemented/adopted practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	82

**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
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
302	Nutrient Utilization in Animals
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

## **Outcome #6**

### **1. Outcome Measures**

Model predicting the future of Marcellus shale natural gas drilling wastewater disposal under three possible scenarios

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

As natural gas drilling in the Marcellus shale region progresses, the issue of wastewater disposal has emerged. In 2010, the Pennsylvania Department of Environmental Protection issued more stringent total dissolved solids regulations effectively prohibiting the discharge of wastewater into Pennsylvania's surface waters. In April 2011, the PA DEP requested that drilling operators cease sending wastewater to municipal sewage treatment plants. These policies have increased the use of underground injection, particularly in Ohio, and recycling and reuse as disposal methods.

#### **What has been done**

A master's student thesis sought to determine the factors that a drilling company considers in its choice of wastewater disposal method through the use of a mixed logit model. The model included price, distance, size, competition, distance to nearest large city, and river basin dummy variables. The model was then estimated and the coefficient estimates obtained were used to calculate the marginal effects of the variables on the probabilities that a brine or industrial waste treatment plant, an injection well, or recycling and reuse would be the disposal method chosen.

#### **Results**

The results show that the price of the disposal method and the cost of transporting the wastewater have the largest impacts on the probability that a particular alternative will be chosen. So policies affecting the price or location of disposal methods will be most effective in influencing the use of a particular method. An increase in competition would strain the supply of freshwater withdrawals available for the fracking process, which would create a market for the treated water produced by recycling facilities. This would encourage the use of recycling and reuse facilities to treat wastewater.

The results of the model estimation can be used to predict what the future of wastewater disposal will look like under three possible future scenarios (a business-as-usual scenario, a permanent

moratorium in Youngstown, Ohio, and a scenario in which Pennsylvania takes primacy of its underground injection program). The conclusions can be considered by policymakers and used to influence future policies in Pennsylvania.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
403	Waste Disposal, Recycling, and Reuse
605	Natural Resource and Environmental Economics

#### Outcome #7

##### 1. Outcome Measures

Exploring how Marcellus shale natural gas drilling is changing Pennsylvania landscapes

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The Marcellus shale formation underlies over 95,000 square miles in six states, including the northern and western half of Pennsylvania. Due to recent advances in drilling technologies, accessing this gas is now technologically possible and economically feasible. Exploration and development produces a large footprint with the potential to affect natural resources in Pennsylvania. Research has examined the impacts of Marcellus development on forest habitat and birds.

###### **What has been done**

Geographic information system analysis was used to determine where gas development was occurring, along with land ownership and cover, and forest fragmentation status on those sites. Various databases were combined to investigate how Pennsylvania's land cover is changing due to Marcellus gas exploration.

The Marcellus electronic field guide provides up to date information on impacts of Marcellus

development on natural resources and methods of minimizing effects.

### Results

Most of the development is occurring on private land, and the greatest amount of development falls within the Susquehanna River basin. Slightly more than half of the well pads in Pennsylvania occur on agricultural land; most of the rest are on forest land, but many of those are on core forest on private land. Shale gas development could substantially alter Pennsylvania's landscape. The development of new roads to support drilling could affect forest ecosystem integrity via increased fragmentation. The concentration of existing core forest in the northern part of the state, where the focus of drilling is, largely on private land, means that remaining areas of public land are key refuges for the protection of wildlife, ecosystems, and their associated ecosystem services. These areas should receive further protection. A regional approach to site drilling infrastructure is needed to help minimize development in core forest and productive agricultural lands and to decrease the potential risk to waterways.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
136	Conservation of Biological Diversity

### Outcome #8

#### 1. Outcome Measures

Effects of adaptation measures on hurricane damages

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2012	0

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

Escalating costs of hurricane disasters in recent decades heighten public and private concern. The federal government spends millions of dollars annually in the form of hazard mitigation and public assistance grants to help impacted communities recover. Without empirical evidence, we can say little about how effective these programs are in promoting local resilience.

### **What has been done**

Researchers investigated the roles of adaptation and mitigation in reducing economic impacts of hurricanes in terms of property loss. We conducted an empirical study of property damage in 864 counties along the Atlantic basin during 1989-2009. Controlling for important drivers of property losses given by hazard incidents, economic and population growth as well as socio-economic vulnerability, we contribute to existing literature by explicitly accounting for a wide range of public and local adaptation measures.

### **Results**

Our results suggest that physical and socioeconomic vulnerability are primary factors explaining high damages from hurricanes. We found clear evidence of the importance of regulatory-based loss mitigation strategies as exhibited by improved building codes and effectiveness of enforcement. Results suggest that where to build (zoning, land-use planning, etc.) is a significant policy complemented by how to build (building codes, retrofitting, etc.). Major structural and infrastructural projects were found to exacerbate property losses, suggesting evidence of induced development or protective capacity limits of structural measures. Overall, the most efficient disaster loss mitigation strategy entails coordinated actions of federal and local government coupled with private self-insurance and is highly skewed towards nonstructural projects.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

## **Outcome #9**

### **1. Outcome Measures**

Report on ecological and economic impacts of a regional outbreak of Asian longhorned beetle

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

### **Issue (Who cares and Why)**

Research focused on quantifying the potential ecological and economic impacts to forest resources in the northeastern U.S. from a region-wide outbreak of Asian longhorned beetles (ALB). The overall goal was to model the ecological and economic impact of ALB over the next 25, 50, and 100 years. There were two main objectives: 1) development of an ecological model to predict changes in forest composition and structure over 25-100 year time scales from ALB infestations; and 2) estimate the economic costs of ALB infestations, including an analysis of non-forest product economic impacts.

### **What has been done**

A widely used model of forest dynamics (SORTIE-ND) served as the basis for projecting ecological impacts. The model was parameterized using data from the Forest Service Forest Inventory and Analysis forest plots and other sources. The costs of ALB infestation were calculated by projecting the impact on markets for timber and nontimber products, i.e., logging, maple syrup, outdoor recreation, tourism, wildlife, and aesthetics. Financial analysis compared the impacts with and without ALB. The scenarios looked at total live volume impacts and impacts on harvested volume.

### **Results**

The intensity of the ALB outbreak occurs between years 10 and 50. The apex of the outbreak is at year 25, when > 71 billion board feet are killed throughout the study region. 83% of the ALB killed volume is from two maple species. Other species lost are sweet and yellow birch and quaking aspen. These 5 species account for > 95% of volume killed. Harvested volumes are most affected between years 15 and 33, when the ALB killed volume is more than the volume harvested. Over 100 years, the difference in total discounted harvest value between with and without ALB is \$20.6 billion. Essentially the entire maple syrup industry in the Northeast, valued at > \$150 million in 2011, will be lost due to ALB.

As for ecosystem services, infestation by ALB will have three main effects. First, it will increase the number of dead and dying trees in the forest. Second, until new growth comes in, there will be reduced tree biomass and cover. Third, ALB infestation will change tree species composition, decreasing maples and increasing ash and hemlock. These changes will produce higher peak stream flows and reduced erosion control. Economic changes include reduction in foliage tourism and timbering and their associated jobs.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics



## **Outcome #10**

### **1. Outcome Measures**

Investigations contributing to primary and secondary National Ambient Air Quality Standards for ozone

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Tropospheric ozone air pollution continues to pose serious problems for the growth and productivity of agricultural crops across much of the eastern United States. During the most recent review of the primary and secondary National Ambient Air Quality Standard (NAAQS) for tropospheric ozone exposures, there was insufficient information on ozone-induced foliar injury and relationships to crop growth and productivity effects to force consideration of developing a standard that would better protect important agricultural crops, forests, and native plant resources.

#### **What has been done**

Researchers conducted experiments on plant sensitivity to ground-level ozone to provide needed information concerning the relationships between ambient ozone exposures and induced foliar injury more commonly observed on ozone-sensitive plants.

#### **Results**

Total weight of bean pods harvested for fresh-market consumption was 40 to 50% lower for sensitive genotype vs. tolerant genotype when ozone concentrations were moderate to high. Ambient ozone concentrations adversely affected the foliage of some of the most important agricultural crops (beans and grape) found in Pennsylvania. In fact, ambient ozone levels in Pennsylvania during the growing season were sufficient to induce foliar symptoms on all surveyed flora species. Our research results were considered in the review of the NAAQS as conducted by the U.S. EPA. This resulted in more stringent primary and secondary standards recommended by the Agency's Office of Air Quality Planning and Standards.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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141	Air Resource Protection and Management
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
610	Domestic Policy Analysis

## **Outcome #11**

### **1. Outcome Measures**

Study of N and P loss under different soil temperature regimes to determine optimal manure application times

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Soil freezing and thawing, frost formation, snow melt, temperature, and timing of manure application can significantly affect nutrient runoff, infiltration, and other losses from manure applications during fall and winter. Climate change scenarios indicate the potential for more unstable winter conditions with increased freezing and thawing events. The ability to recreate freezes/thaws in a lab allows controlled study of the effects of seasonal soil temperature changes on N and P losses.

#### **What has been done**

A soil thermal cycling system was developed to determine the effects of soil temperature on N and P losses in runoff and leachate, and to determine overwinter N and P losses based on application date and temperature. Lysimeters were installed in bins, encased in sand, and heated from the bottom. Dairy manure was surface-applied at soil temperatures of 16°C, 5°C, and -1°C, to represent early fall, late fall, and winter applications. N and P losses from the lysimeters were measured during a series of rainfall simulations and natural precipitation from October (early fall) to March (prolonged winter).

#### **Results**

Both nitrogen and phosphorus losses were influenced by the soil temperature. Decreases in soil temperature throughout the fall/winter caused ammonium-N, organic N, and total N to increase exponentially; dissolved reactive P, total dissolved P, and total P also increased. Early fall manure application also caused significant overwinter losses of nitrate, whereas winter-applied manure had more overwinter ammonium-N losses. Total P losses were two times higher for the winter-

applied manure when compared to the early fall-applied manure. To control P losses, manure should be spread in the early fall, when soil infiltration capacity is greater, before soil temperatures fall below 10°C. However, early fall manure application may increase the potential for increased nitrate-N leaching and ammonia volatilization. The effects of changes in manure N and P forms and losses from cold and frozen manure on nutrient runoff and infiltration were identified as variables warranting further investigation, along with larger scale experiments.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

#### Outcome #12

##### 1. Outcome Measures

Project report to the Organization for Economic Cooperation and Development, Directorate for Trade and Agriculture

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Water quality trading refers to the application of emissions trading to water pollution control. Applications of emissions trading to date have largely occurred in the domain of air pollution. There is now substantial interest in extending the method to water pollution, including to water pollution from agriculture. Water quality trading initiatives have been implemented in Australia, Canada, New Zealand, and the US, and are being studied elsewhere, including by countries surrounding the Baltic Sea to address nutrient pollution there.

###### **What has been done**

Agricultural water quality trading programs from around the world were reviewed to glean guidelines for the creation of successful trading models.

## Results

Guidelines for the creation of successful trading models were developed based on lessons learned from evaluations of early initiatives.

- Binding regulatory limits on pollution levels are essential for trading activity to occur. Such limits are essential to create the incentives for polluters to seek out options for pollution control cost savings.
- Trading activity requires sufficiently large differences in pollution control costs between polluters to make possible economic gains from trading, after deducting transaction costs incurred in trading.
- Trading rules must be clearly established and ensure that water quality goals will be satisfied, but must also be designed to facilitate trading. Rules that are overly complex and costly create barriers to trading activity.
- Successful trading requires the development of institutions for organizing trade that are trusted by and effective for intended program participants.

Some heuristics used in the design of point-nonpoint trading programs are scientifically flawed and may lead to designs that diminish the capacity of water quality trading to efficiently and effectively achieve water quality goals.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

## Outcome #13

### 1. Outcome Measures

Effect of dietary protein concentration on ammonia and greenhouse gas emissions from dairy manure

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Livestock, especially cattle, are known to be a significant source of greenhouse gases, specifically methane. This gas plays an important role in global warming because methane is very efficient in trapping solar radiation. Ammonia in dairy manure contributes significantly to acidic rain.

#### What has been done

Two experiments investigated the effect of dietary crude protein concentration on ammonia and greenhouse gas (nitrous oxide, methane, carbon dioxide) emissions from fresh dairy cow manure incubated in a controlled environment (exp. 1) and from manure-amended soil (exp. 2). Manure was from lactating Holstein cows fed diets with 16.7% (HighCP) or 14.8% crude protein (LowCP). HighCP manure had higher N content and proportion of ammonia-N and urea-N in total manure N. In exp. 2, manure from cows fed LowCP or HighCP diets was applied to lysimeters.

#### Results

The largest difference in the ammonia emitting potential (EP) occurred approximately 24 hours after manure application; it was approximately 3.5 times greater for HighCP than LowCP manure. The 100-hr cumulative ammonia emission was 98% greater for HighCP than LowCP manure. The EP of methane was increased and that of CO<sub>2</sub> tended to be increased by LowCP compared with HighCP manure. The cumulative methane emission was not different between treatments; the cumulative CO<sub>2</sub> emission was increased with manure from the LowCP diet. Nitrous oxide emissions were low in this experiment and did not differ between treatments.

In the conditions of these experiments, fresh manure from dairy cows fed an LCP diet had substantially lower ammonia EP, compared with manure from cows fed an HCP diet. The LCP manure increased soil methane EP due to a larger mass of manure added to meet plant N requirements compared with HCP manure. These results represent effects of dietary protein on ammonia and greenhouse gas EP of manure in controlled laboratory conditions and do not account for environmental factors affecting gaseous emissions from manure on the farm.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
141	Air Resource Protection and 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 such as extreme storms can kill or damage urban trees.

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

Natural resources projects must compete for limited public dollars with social services programs, and are often given short shrift.

The Managing Community and Urban Natural Resources program is heavily funded by USDA Forest Service grant funding. Any cuts in this federal grant affect our program's funding and our ability to provide staff and education and technical assistance.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

In the future, with better reporting from the Pennsylvania Bureau of Forestry, the Managing Community and Urban Natural Resources program plans to provide the number of trees planted in the state and the amount of relevant grants distributed to municipalities and nonprofit organizations.

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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

### **Key Items of Evaluation**

The Woods in Your Backyard workshop, conducted through the Managing Community and Urban Natural Resources program, focuses on how owners of less than 10 acres of land can promote wildlife habitat, water quality, and other natural resource benefits. In a post-class evaluation, 3 participants wrote:

- I "wanted neat manicured lawn, but [am] now thinking differently."
- I plan on developing a logical plan for the landscape while addressing invasive plants."
- I am going to turn some grass back into woodland by using native plants and trees."

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

**V(A). Planned Program (Summary)****Program # 7****1. Name of the Planned Program**

Sustainable Energy

 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	10%		10%	
125	Agroforestry	5%		5%	
131	Alternative Uses of Land	10%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	10%		10%	
202	Plant Genetic Resources	10%		10%	
204	Plant Product Quality and Utility (Preharvest)	10%		10%	
205	Plant Management Systems	10%		10%	
213	Weeds Affecting Plants	10%		10%	
215	Biological Control of Pests Affecting Plants	10%		10%	
402	Engineering Systems and Equipment	5%		5%	
605	Natural Resource and Environmental Economics	10%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	14.0	0.0	4.0	0.0
Actual Paid Professional	14.8	0.0	20.9	0.0
Actual Volunteer	0.3	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
437629	0	228942	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1113417	0	614710	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
225017	0	1117244	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Research in sustainable energy this year has involved densified biomass as a way to cost-effectively mitigate greenhouse gas emissions and address energy security in thermal applications; exploration of gut microbiota in Asian longhorned beetle with potential application to the biofuels industry; investigation of maximum force and energy consumption needed to cut common biofuels crops; and establishment of the NEWBio Consortium to develop a northeast biofuel supply chain from field to fuel tank.

Extension work in sustainable energy involved education about economic and environmental issues surrounding Marcellus shale natural gas drilling. These education programs increased lease payments by a conservative \$250 million for landowners.

**2. Brief description of the target audience**

Agricultural Producers/Farmers/Landowners, Agriculture Services/Businesses, Nonprofit Associations/Organizations, Business and Industry, Community Groups, Education, General Public, Government Personnel, Students/Youth, Scientific community, Biofuels industry, Machinery industry

**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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	28557	1310000	0	0

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

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	0	82

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
 Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
 Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Sustainable Energy

Year	Actual
2012	27958

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Sustainable Energy who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Sustainable Energy who were evaluated in a follow-up and who implemented/adopted practices.
6	Densified biomass can cost-effectively mitigate greenhouse gas emissions and address energy security in thermal applications
7	Exploration of gut microbiota in Asian longhorned beetle with potential application to biofuels industry
8	Education about issues surrounding Marcellus shale natural gas drilling
9	Investigated maximum force and energy consumption needed to cut common biofuels crops
10	Established NEWBio Consortium, a Northeast-wide Penn State-led partnership to develop a northeast biofuel supply chain from field to fuel tank

**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Sustainable Energy who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	828

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
125	Agroforestry
131	Alternative Uses of Land
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
402	Engineering Systems and Equipment
605	Natural Resource and Environmental Economics

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Sustainable Energy who were evaluated in a follow-up and who implemented/adopted practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	17

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
125	Agroforestry
131	Alternative Uses of Land
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
402	Engineering Systems and Equipment
605	Natural Resource and Environmental Economics

**Outcome #6**

**1. Outcome Measures**

Densified biomass can cost-effectively mitigate greenhouse gas emissions and address energy security in thermal applications

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

There has been significant effort to quantify the lifecycle greenhouse gas emissions for ethanol production from biomass. However, little information is available describing the potential of densified switchgrass for reducing greenhouse gas emissions when used for heat and power generation.

**What has been done**

Researchers measured the energy use from switchgrass seed to biomass production and quantified the net lifecycle greenhouse gas emissions of densifying the biomass as pellets, cubes, and briquettes.

**Results**

We found that switchgrass harvest season, due to feedstock moisture content, and type of densified end product had the largest effect on greenhouse gas emissions. This information will help biomass crop producers and biomass conversion facilities meet their goals of producing a quality product with the greatest greenhouse gas benefits.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #7**

**1. Outcome Measures**

Exploration of gut microbiota in Asian longhorned beetle with potential application to biofuels industry

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Researchers studied the gut microbiota of Asian longhorned beetles (ALB), an invasive, nonnative insect first identified in the U.S. in New York in 1996. ALB are destructive wood-boring pests of maple and other hardwoods. Microbiota active in the ALB gut might in the future aid in conversion of plant matter to biofuels.

**What has been done**

Many genes were discovered that produce enzymes that have potential application to bioprocessing of lignocellulose to cellulosic ethanol. Several genera of bacteria were detected that have been previously implicated in lignocellulose, hemicellulose, etc., and may participate in these processes in the beetle gut.

### Results

Through the study of ALB gut symbionts, researchers learned about the ability of the gut microbiota to help ALB overcome the nutritional and digestive challenges associated with feeding in healthy host trees, including digestion of lignin, cellulose, hemicellulose, and other prominent plant polysaccharides, detoxification of plant secondary metabolites and allelochemicals, and acquisition of essential nutrients absent from woody tissue.

Results confirmed that a resistant host tree, Chinese maple, which coevolved with ALB in China, markedly influences the gut microbiota, reducing diversity of taxa.

These findings will be of interest to the biofuels industry.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

### Outcome #8

#### 1. Outcome Measures

Education about issues surrounding Marcellus shale natural gas drilling

#### 2. Associated Institution Types

- 1862 Extension

#### 3a. Outcome Type:

Change in Condition Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2012	0

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

State and municipal officials and landowners need information about how to protect their economic, property, and environmental rights and interests before and during drilling for natural gas from the Marcellus shale.

##### What has been done

Fourteen team members made 478 presentations with 28,557 participants.

### Results



Landowners have seen lease payments increase by at least \$250 million through educational programs. They have also indicated a greater satisfaction with the nonmonetary contract addendums they negotiated with land lease agents.

Elected and appointed state and local officials attended the yearly Natural Gas Summit series started in 2008. 47% of officials (n=55) reported that they had received information regarding community planning that would cause them to reconsider or change some practices and/or policies.

Following presentations to landowners, 70% (n=243) indicated that they definitely will have their water wells tested and 77% of landowners (n=271) have already or definitely will contact an attorney before signing an oil and gas lease.

73% of those who viewed a webinar reported being very likely or likely to use the information they had learned.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
605	Natural Resource and Environmental Economics

#### Outcome #9

##### 1. Outcome Measures

Investigated maximum force and energy consumption needed to cut common biofuels crops

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Mechanical properties of energy crops are important when optimizing power performance of harvesting and processing machines.

###### What has been done

The most popular dedicated energy crops, switchgrass and miscanthus, were tested using an Instron testing machine. The measured mechanical properties included maximum forces and energy consumption during cutting, bending, and compressing a single plant stem. Two different cutting knives were used to study the effect of cutting mechanisms on energy consumption of processing energy crops.

### Results

Design engineers from industry who produce swathers (farm equipment that cuts hay or small grains and pushes them into a windrow) and other farm equipment have asked for and plan to use the experimental data to improve the machines and processing.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment

## Outcome #10

### 1. Outcome Measures

Established NEWBio Consortium, a Northeast-wide Penn State-led partnership to develop a northeast biofuel supply chain from field to fuel tank

### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Society is shifting to more sustainable and renewable energy fuels, and woody biomass is one important source. Research and extension activities provide important information about the feasibility, economics, and environmental concerns surrounding the use of wood-based bioenergy to target audiences.

#### What has been done

Extension materials, including webinars, fact sheets and websites, are sources of reliable information for stakeholders. Developed 2 extension fact sheets: Bioenergy Primer for the Forestry Community and Bioenergy Primer for Forest Landowners. Hosting monthly webinar series on woody biomass-related topics.

### Results

The NEWBio Consortium, a Penn State-led partnership among 20 universities, federal agency labs, and companies, aims to speed development of shrub willow, miscanthus, and switchgrass that can be grown on former strip mines and marginal farmland and abandoned lands. Its goal is to develop perennial feedstock production and supply chains to commercially produce liquid transportation and aviation biofuels. The project will target sustainable production practices to improve yield by 25% and reduce costs by 20%. NEWBio will center on four large demonstration projects, each with biomass production and supply chains operating at commercial scales of thousands of acres. The projects will be geared to produce from 500 to 1,200 tons per day of lignocellulosic biomass suitable for manufacturing advanced transportation fuels.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
125	Agroforestry
131	Alternative Uses of Land

#### 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

Drought in the state caused water withdrawals from some rivers to be suspended, affecting the number of wells that could be drilled.

The depressed economy, mild winter, and abundant supply of natural gas dramatically reduced the price of gas. These factors have been responsible for a reduction in the number of wells drilled and the level of economic activity.

Pennsylvania legislation Act 13 enacted an impact fee for unconventional wells and changes in environmental regulations and municipal zoning ordinances. Part of the act has been challenged in court.

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

#### 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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

## **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**

Childhood Obesity

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
703	Nutrition Education and Behavior	17%		32%	
704	Nutrition and Hunger in the Population	13%		10%	
724	Healthy Lifestyle	15%		3%	
801	Individual and Family Resource Management	10%		0%	
802	Human Development and Family Well-Being	15%		40%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	13%		10%	
806	Youth Development	17%		5%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	18.0	0.0	3.0	0.0
Actual Paid Professional	43.3	0.0	1.5	0.0
Actual Volunteer	0.3	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
310278	0	30870	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
668360	0	137401	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1584983	0	14237	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Research activities in childhood obesity include identifying a potential molecular target for the treatment of obesity-induced atherosclerosis and hepatic steatosis; continuing support for the PROSPER program, which strengthens families; and studying policy implications of structural changes in food retailing.

Extension activities in childhood obesity include the Family Fitness program, a pilot of the new Certified Food and Wellness Volunteers program, and the new MyPlate icon training, which explains the updated USDA recommendations for foods in a healthy diet.

### 2. Brief description of the target audience

nonprofit associations/organizations; community groups; education; general public; government personnel; human service providers; students/youth; volunteers/extension leaders; national and state program leaders and extension educators and paraprofessionals in Expanded Foods and Nutrition across the country; families and parents; human science researchers; special populations (at-risk and underserved audiences); regulatory associations; USDA/ERS

### 3. How was eXtension used?

The Families, Food and Fitness COP has a recipe database that is a helpful reference.

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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

## V(E). Planned Program (Outputs)

### 1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3266	1369119	2752	420

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

Year: 2012  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	0	19

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
 Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
 Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Childhood Obesity

<b>Year</b>	<b>Actual</b>
2012	9813

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Childhood Obesity who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Childhood Obesity who were evaluated in a follow-up and who implemented/adopted practices.
6	Potential molecular target for the treatment of obesity-induced atherosclerosis and hepatic steatosis
7	Families strengthened through PROSPER
8	Studied policy implications of structural changes in food retailing
9	Families participating in Family Fitness program



**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Childhood Obesity who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	1346

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Childhood Obesity who were evaluated in a follow-up and who implemented/adopted practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	209

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

#### Outcome #6

##### 1. Outcome Measures

Potential molecular target for the treatment of obesity-induced atherosclerosis and hepatic steatosis

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

<b>Year</b>	<b>Actual</b>
2012	1

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Obesity contributes to atherosclerosis and hepatic steatosis (chronic inflammation caused by activation of macrophages in blood vessels and liver, respectively). M1 macrophages are key to immunity by producing inflammatory chemicals that recruit immune cells to the site of infection, are microbicidal, and promote acquired immunity. M2 macrophages inhibit inflammation and promote tissue repair. M2 macrophages dominate non-inflamed tissue and lean animals, and there is a shift to M1 phenotype with obesity correlating with disease progression.

###### **What has been done**

The Ron receptor tyrosine kinase is expressed on tissue-resident macrophages and tumor-associated macrophages, both of which display characteristics of M2 cells. Stimulation of primary macrophages with the ligand for Ron, macrophage-stimulating protein, promotes expression of M2-associated genes while inhibiting the production of proinflammatory cytokines and nitrogen

radicals in response to microbial stimulation. Therapies such as Ron could be efficacious in treatment of inflammatory diseases associated with obesity.

**Results**

We have shown that the absence of Ron exacerbates the development of atherosclerosis and hepatic steatosis in mice on a high cholesterol diet. We have also shown that Ron is primarily expressed on adipose tissue macrophages with an M2 phenotype and that the absence of Ron alters the balance of macrophages in adipose tissue, increasing the percentage of M1 macrophages while decreasing the number of M2 macrophages. We have also shown that metabolites of omega-3 polyunsaturated fatty acids promote the expression of Ron in macrophages. We have identified a potential molecular target for the treatment of obesity-induced atherosclerosis and hepatic steatosis that can shift the balance of macrophage activation to limit inflammation and promote healing.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
724	Healthy Lifestyle

**Outcome #7**

**1. Outcome Measures**

Families strengthened through PROSPER

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	227

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

PROSPER is a model for diffusing evidence-based prevention programs to school and communities to strengthen families, build youth skills, and reduce youth substance use and other problem behaviors. Community teams facilitated by Penn State Extension lead PROSPER. PROSPER teams implement at least 1 out-of-school program (the Strengthening Families Program for Parents and Youth aged 10-14 [SFP 10-14] and Lifestyle Triple P) and at least 1 in-school program (LifeSkills Training, All Stars, Lions Quest, or Promoting Alternative Thinking Strategies [PATHS]).

**What has been done**

Faculty continued to maintain the original PROSPER (PROmoting School/community university Partnerships to Enhance Resilience) sites. The preparatory work with states ready for national expansion continued to progress with potential outside funding for expansion.

**Results**

Thirty 7-week Strengthening Families Programs for Parents and Youth 10-14 (SFP 10-14) were conducted. 227 families including 340 youth and 374 parents/caregivers attended at least one session. According to pre/post or retrospective surveys, parents/caregivers (N=178) attending SFP 10-14 reported:

- 79%, improved family cooperation and problem solving
- 75%, increased values and goals communication
- 69%, increased parental supportiveness

SFP 10-14 youth participants who completed pre/post or retrospective surveys reported:

- 65% (N=155), improved stress coping skills
- 64% (N=109), increased consistent discipline
- 61% (N=109), improved family cooperation and problem solving

SFP 10-14 families (N=109) who completed pre/post or retrospective surveys reported:

- 67%, improved family cooperation and problem solving
- 61%, improved parent-child relationship quality and increased positive rule enforcement.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
802	Human Development and Family Well-Being

**Outcome #8**

**1. Outcome Measures**

Studied policy implications of structural changes in food retailing

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	1

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Society as a whole should understand the consequences of nontraditional food retailers' expansion on issues such as food security (a household being able to acquire enough food to meet the needs of all its members), obesity, food access, and food deserts.

#### What has been done

Researchers analyzed how the presence of different types of stores affects, at the aggregate level, the incidence of consumption of fruits and vegetables among U.S. adults. An article has been submitted to a peer-reviewed journal and it has undergone two rounds of reviews.

#### Results

Results showed that while the presence of specialized stores (fruit and vegetables stores) can have an ameliorating effect on diets at the aggregate level, the presence of supercenters may have a worsening effect.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

### Outcome #9

#### 1. Outcome Measures

Families participating in Family Fitness program

#### 2. Associated Institution Types

- 1862 Extension

#### 3a. Outcome Type:

Change in Action Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2012	96

#### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Families need focused information about healthy foods, meal planning, ways to improve their

diets, and the benefits of physical exercise.

#### **What has been done**

For the Family Fitness program, four programs were run in three counties--Butler, Columbia, and Luzerne--reaching 12 parents and 84 children. Seven parents and 83 children completed a matched survey.

#### **Results**

Results showed that 74% improved enjoyment of family physical activity, 57% increased knowledge of Nutrition Facts labels, 43% of children decreased sugary food intake, 100% improved diet in two or more areas, 57% planned a meal together, and 67% improved family physical activity.

60% of children reported improved knowledge of food high in calcium, 60% said they would try new healthy food, and 50% said they would increase physical activity.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Appropriations changes
- Competing Programmatic Challenges
- Other (Extramural Funding)

##### **Brief Explanation**

There were many fewer Family and Consumer Sciences staff to provide and run programs this year due to layoffs and retirement. Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

All funding for PROSPER/SFP 10-14 programs is obtained through external sources. With the current economic climate, it has become more challenging to find funding to sustain programming.

#### **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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

### **Key Items of Evaluation**

The Certified Food and Wellness volunteers pilot program had 25 participants, and 100% indicated that the course met or exceeded their expectations. This program has 14 lessons online via ANGEL and a 1-day hands-on training.

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



**V(A). Planned Program (Summary)**

**Program # 9**

**1. Name of the Planned Program**

Food Safety

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
501	New and Improved Food Processing Technologies	25%		25%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	25%		25%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	25%		25%	
723	Hazards to Human Health and Safety	25%		25%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	17.0	0.0	4.0	0.0
Actual Paid Professional	16.9	0.0	7.2	0.0
Actual Volunteer	0.4	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
550951	0	191679	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1456390	0	406524	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
554541	0	308575	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Research investigated the presence of disease-causing microorganisms in poultry and beef from various sources; the development of genomics and molecular biology-based methods for tracking and controlling foodborne microorganisms in foods and the environment; and other topics.

Extension activities included the popular Cooking for Crowds workshops, attended by 1,064 people, and promoting safe food handling in festival and other special event booths; a food safety hotline; work with Master Food Preservers to promote safe canning techniques; testing and adjusting or advocating replacement of pressure canner dial gauges to ensure the safety of canned low-acid foods; and the Penn State Food Safety Certification/Serv Safe Certification (PSFSC/SSC) program. Through PSFSC/SSC, 2,137 food service workers completed 15 hours of classroom instruction and/or home study activities and passed an exam to maintain their ServSafe certification and comply with PA law. This program helped more than 1,240 food service facilities meet licensure requirements and continue operations. The TAP Online Food Safety training was also offered.

### 2. Brief description of the target audience

Agricultural producers, farmers, landowners, food scientists, academia and government researchers, general public, food safety specialists, food microbiologists, food industry personnel, architectural engineers, industrial hygienists, other scientists, nonprofit organizations, community groups, students/youth, volunteers/extension leaders

### 3. How was eXtension used?

Conducted two seminars for the Food Safety COP. Addressed a few Ask the Expert questions.

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. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

## V(E). Planned Program (Outputs)

### 1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	10004	2471537	3	14

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

**Patent Applications Submitted**

Year: 2012

Actual: 3

**Patents listed**

Serial No. 13/563,065; Filed 7/31/12; Title: Methods and Compositions for Improving the Nutritional Content of Mushrooms and Fungi

Serial No: 13/630,948; Filed: 9/28/12; Title: Rapid, Specific and Sensitive Immunoassays for the Detection of Highly Variable Gram Negative Bacterial Antigens

Serial No: PCT/US2012/5795 9; Filed: 9/28/12; Title: Rapid, Specific and Sensitive Immunoassays for the Detection of Highly Variable Gram Negative Bacterial Antigens

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	0	18

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Food Safety

<b>Year</b>	<b>Actual</b>
2012	9137

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Food Safety who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Food Safety who were evaluated in a follow-up and who implemented/adopted practices.
6	Presence of hygiene indicators in farmers' market, supermarket organic, and supermarket broilers
7	Presence of shiga toxin-producing E. coli in beef samples from small and very small beef processing plants
8	Number of participants in Cooking for Crowds who were evaluated in a follow-up and who implemented/adopted practices related to improving food safety
9	Adjusted or replaced pressure canner dial gauges
10	Testing and optimizing high-pressure processing, a new treatment for ground beef against 6 virulent Shiga toxin-producing E. coli

**Outcome #1**

**1. Outcome Measures**

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number of participants in all programs related to Food Safety who were evaluated and demonstrated increased knowledge and skills.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	3083

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

**Outcome #5**

**1. Outcome Measures**

Number of participants in all programs related to Food Safety who were evaluated in a follow-up and who implemented/adopted practices.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	304

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

**Outcome #6**

**1. Outcome Measures**

Presence of hygiene indicators in farmers' market, supermarket organic, and supermarket broilers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Poultry purchased from farmers' markets in Pennsylvania may be more likely to be contaminated with Salmonella spp. and Campylobacter spp. than is conventionally processed poultry sold at supermarkets.

**What has been done**

Whole broilers from farmers' markets and supermarkets were evaluated for hygiene indicators Salmonella and Campylobacter.

**Results**

28% and 90% of broilers from farmers' markets, 20% and 28% of supermarket organic, and 8% and 52% of supermarket broilers, were positive for Salmonella and Campylobacter, respectively. There is a need to develop food safety training for poultry vendors at farmers' markets to improve the safety of these products for public consumption.

**4. Associated Knowledge Areas**

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



## **Outcome #7**

### **1. Outcome Measures**

Presence of shiga toxin-producing E. coli in beef samples from small and very small beef processing plants

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	1

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Small and very small beef processors may be a source of the various shiga toxin-producing E. coli (STEC), which can cause serious illness or death.

#### **What has been done**

Researchers tested for presence of various forms of STEC from beef carcasses, hides, ground beef, and the environment in small and very small beef processing plants.

#### **Results**

STEC O157, O145, O121, O113, O111, O103, O45, and O26 were isolated from carcass swabs, hide swabs, ground beef, and environmental samples from small and very small beef processing plants using a multiplex polymerase chain reaction assay. 35.0% of carcass samples, 56.6% of environmental samples, 85.2% of hide samples, and 17.0% of ground beef samples tested positive for STEC. This information may be of interest to regulatory officials, researchers, public health personnel, and beef industry professionals interested in the presence of these pathogens in the beef supply.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

## **Outcome #8**

### **1. Outcome Measures**

Number of participants in Cooking for Crowds who were evaluated in a follow-up and who implemented/adopted practices related to improving food safety

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	127

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Many nonprofit organizations in Pennsylvania, such as fire companies, churches, schools, and civic groups, sell food at festivals and other special events for fundraising. Many times, the workers are volunteers and are not specifically trained in safe food handling techniques. This can lead to the spread of foodborne illness, much of which could be prevented with easily employed best practices.

#### **What has been done**

45 Cooking for Crowds workshops, covering personal health and hygiene, time and temperature controls, cross-contamination, and proper sanitizing procedures, were conducted with approximately 1064 individuals. These individuals represented 217 non-profit organizations; estimates showed that 180,662 customers and/or consumers attending 1,996 events could positively benefit from volunteers' increased knowledge and improved food safety practices as a result of attending the workshop. 127 participants completed a 3- to 6-month follow-up survey.

#### **Results**

When asked about food safety practices they have implemented within 3 to 6 months after the training, 66% (84 of 127) of the participants had implemented at least one new practice. 20% (26 of 127) implemented 4 or more new practices and 46% (58 of 127) implemented 1 to 3 new practices as a result of attending Cooking for Crowds. Participants also responded that they increased the frequency of food safety practices within 3 to 6 months after the training. 73% (93 of 127) had increased the frequency of at least one practice. 20% (25 of 127) increased the frequency of 4 or more practices, and 53% (68 of 127) increased the frequency of 1 to 3 new practices. Practices include checking food temperatures with a calibrated thermometer; cooking foods to the proper temperature; washing hands for 20 seconds; limiting the time food spends in the temperature danger zone; cooling foods quickly; separating raw from ready-to-eat foods during preparation, storage, and serving; and using appropriate strength sanitizer on utensils,

equipment, and food contact surfaces.

#### 4. Associated Knowledge Areas

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

#### Outcome #9

##### 1. Outcome Measures

Adjusted or replaced pressure canner dial gauges

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	298

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Low-acid foods require the higher temperatures achieved in a pressure canner to kill harmful bacteria. Spoilage organisms are commonly found in the environment. Most cannot be seen without a microscope. Bacteria thrive on foods with low acidity. Bacteria can also produce spores that survive higher temperatures than the bacteria themselves. If not killed during canning, the spores can grow into bacteria that produce harmful toxins. Of special concern are the very toxic botulism bacteria, which thrive on low-acid foods in the absence of air and in the presence of moisture, such as occurs inside a jar of canned vegetables, meats, or other low-acid foods.

###### **What has been done**

Educators and/or volunteers tested 298 pressure canner dial gauges.

###### **Results**

Results showed that 179 (60%) of the gauges tested needed adjustment or replacement to ensure proper processing of low-acid foods to prevent foodborne illness.

#### 4. Associated Knowledge Areas

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

#### Outcome #10

##### 1. Outcome Measures

Testing and optimizing high-pressure processing, a new treatment for ground beef against 6 virulent Shiga toxin-producing E. coli

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

High-pressure processing (HPP) is a commercially available process that uses water under pressure to reduce pathogens while also extending the shelf life of the product. Researchers have documented the effectiveness of HPP on pathogens in a variety of muscle foods. However, very little information has addressed the effect of HPP on Shiga toxin-producing E. coli (STEC), including E. coli O145, O26, O45, O103, O111, and O121 (the "Big 6" STEC). Treatment of fresh ground beef with HPP to eliminate these STEC could provide a means to protect consumers against food-borne illness.

###### **What has been done**

80:20 or 93:7 (lean:fat) irradiated ground beef was experimentally inoculated with ~1 million colony forming units/gram of various STEC (O145, O26, O45, O103, O111, O121, and O157:H7), formed into patties (~50 grams), crust-frozen with liquid nitrogen, vacuum-packaged, stored at 4 degrees C, and subjected to HPP.

###### **Results**

Multiple, 1-minute HPP cycles were more effective in reducing STEC than single cycles for longer periods of time, so 4 cycles were used. Treatments resulted in a 99.99% reduction of STEC. The greatest reductions were found in 93:7 ground beef, so a higher fat content may allow for increased survival of STEC. Unfortunately, HPP-treated ground-beef patties in unopened vacuum

packages appeared gray in color, so a subsequent sensory experiment was conducted in which HPP was applied similarly to the above procedures.

Seventy participants compared HPP-treated and untreated ground beef for overall liking, texture, juiciness, and flavor. Consumers preferred untreated patties. When evaluated for texture and juiciness, treated products were slightly chewier and less juicy.

These results suggest some sensory attributes of ground beef may be affected negatively by HPP treatment. However, sensory evaluation was conducted on 'naked' ground-beef patties (no bun, seasoning, or condiments).

These results suggest that HPP may be a suitable intervention for reducing the 'Big 6' STEC in ground beef. However, HPP treatments may affect color and eating quality of ground beef.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

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

##### Brief Explanation

Across the state of Pennsylvania community groups and organizations depend on volunteer manpower to prepare food for a variety of events and activities. Volunteers preparing food for community activities may be experienced at preparing family meals but may not have the skills to prepare and store large quantities of foods. The Cooking for Crowds: A Volunteer's Guide to Safe Food Handling curriculum was developed specifically for nonprofit groups and volunteers. The program is designed to help them understand the food safety risks when cooking large volumes of food and how to reduce these risks so that the food prepared is safe for the public. Local nonprofit groups often have traditional fundraisers featuring local and ethnic foods. The money from these events helps support the mission of the groups throughout the year.

Retirement of some educators caused some food safety program data to go unreported. With the loss of many mentoring educators from the food safety program, we lost contact with some Master Food Preservers and may not be aware of all programming conducted.

We struggled with collecting data post-class because of the change to standardized evaluation and the use of Survey Monkey. Many of the workshops occurred late in the program year and follow-up data would not have been collected prior to the reporting

deadline.

Reduced State funding impacted both the research and extension functions of the College of Agricultural Sciences and resulted in retirements and layoffs of key faculty and staff across all areas of the College.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

A standardized survey tool for post-class and 3-6 month follow-up surveys was developed and implemented on Survey Monkey for this year for the Food Preservation extension program. The survey was designed to gather key information on knowledge and intent to change on critical practices related to home food preservation, such as recommended method to use and process for time and temperature control for safety. Although 1,329 individuals participated in food preservation workshops, only 267 survey results were entered into Survey Monkey. The 3-6 month follow-up survey gathered information on actual changes made as a result of the program attended. Fifty of these surveys were entered into survey monkey. This should be an area of focus for the coming year to ensure that next year's data more accurately and completely reflect the knowledge and action changes generated.

Many of the workshops occurred late in the program year and follow-up data would not have been collected prior to the reporting deadline. We could try to move more of the programs earlier in the year so as to allow the completion of 3- or 6-month follow-ups before the end of the reporting period. Alternatively, we could report on that data from the previous year.

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 environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time.

### **Key Items of Evaluation**

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