

2007 Pennsylvania State University Combined Research and Extension Annual Report

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I. Report Overview

1. Executive Summary

Penn State's Agricultural Experiment Station and Cooperative Extension Service operate in concert within the College of Agricultural Sciences to address present and future needs in agriculture. Our driving force is the recognition that agriculture functions as a system – we now speak not just of the food and fiber system but rather the food, fiber, feed, and fuel system, reflecting the increasing complexity of decisions in agriculture. Our planned programs – food and agricultural biosecurity, agricultural systems, families, youth, and communities, natural resources and environment, and pest management – reflect our College's strategic priorities (<http://www.cas.psu.edu/docs/StrategicPlanning/StrategicPlan05.pdf>) and are, thus, directly integrated into day-to-day operations and resource allocations within the College.

Research and extension are integrated largely through joint appointments in the College of Agricultural Sciences. Of 758 administrators, faculty, and staff at University Park, 259 have a combination of research and extension funds supporting their positions. Faculty work as part of teams with county-based educators to identify and address problem areas, building on the multidisciplinary expertise of team members. Our approach to AES projects reflects this thinking; we are encouraging fewer single-scientist AES projects while supporting more multi-faculty projects that capitalize on the synergies of these collaborations. More faculty and educators are formally committing extension FTEs to USDA-approved multistate activities, furthering the integration of functions.

Our goal in PA AES and CES is to simultaneously provide leadership to the agricultural and natural resources communities and to be responsive to the needs of those stakeholders. We achieve this by combining world-class fundamental research with delivery of very practical products and programs to clientele with real-world questions. Our stakeholder input is comprehensive and continuous. CES provides day-to-day connections with stakeholders; the joint research-extension appointments of our faculty and their participation in issue teams with educators allow these real-time interests to focus our research and extension programs. We also have semi-annual opportunities for the private sector's agricultural leadership (<http://agcouncil.cas.psu.edu/>) to provide input; this stakeholder group generally takes a broader, longer-term view of the needs for research and extension. Finally, our scientists are internationally recognized experts in their disciplines and understand the fundamental science opportunities in those disciplines. Thus, we act as leaders on behalf of PA and US agriculture.

It is critical to continue to identify and serve previously under-served audiences. Different research and extension approaches are necessary to identify and fill gaps and to present this information in a manner that leads to adoption of our science-based solutions. We have recognized that female operators and decision-makers in agriculture would benefit from programs focused on their expressed needs. Our Women's Agriculture Network (<http://wagn.cas.psu.edu/>) was developed to fill this need, and we have been successful in facilitating a variety of educational programs based upon sound science conducted by our researchers. While we have a long history of nutrition education programs serving urban audiences, our extension/research synergy is now dealing with a variety of other problems that can be addressed by pest management research information. In partnership with Philadelphia city agencies (<http://paipm.cas.psu.edu/563.htm>), we are addressing integrated pest management solutions for cockroach infestations in residences, which have a direct effect on children's health and school attendance. We have created a Metro Center in Pittsburgh, which will lead to research and extension opportunities for an audience that was not previously directly benefiting from our expertise. New investments of research and extension funding in immigrant issues will allow us to focus on the rapidly expanding Hispanic population in PA.

Our commitment to addressing agricultural issues in a system fashion is reflected in the activity of our Environmental and Natural Resources Institute (ENRI) (<http://enri.cas.psu.edu/>), which was created three years ago to ensure that we are dealing with the environmental consequences of agricultural and natural resources topics in a comprehensive manner. ENRI now sponsors two centers, the Biomass Energy Center (BEC) (<http://www.bioenergy.psu.edu/>) and the Agricultural and Environment Science and Policy Center (AESPC). The BEC serves as a broad-based point of integration for AES and CES investments in biomass energy with investments in place from other sectors of Penn State University. The BEC addresses technical issues in current and future technologies, but it also is consolidating the economic and sociological implications of biofuels, the conversion of food/feed streams to fuel streams, and land use decisions (i.e., conservation vs. production). It further is helping to identify issues in energy efficiency and conservation – near-term topics that are of great importance in current CES programming. The AESPC is focusing on nutrient management and water quality issues in PA and the mid-Atlantic region. PA AES and CES have played a key role in developing and implementing N- and P-based nutrient management regulations in PA over the years, but the challenges of identifying new science to solve the nutrient problems have not diminished. Of equal importance, science-based solutions must be integrated into sustainable programs that can be implemented by agricultural producers. PA CES plays a key role here, working directly with

farmers to identify the economic implications of new technical programs and influencing regulatory agencies in the implementation strategies of regulations. AESPC has reached out to key leadership among our stakeholders to identify a state-wide strategy for solving the PA and Chesapeake Bay nutrient management crisis.

Hatch and Smith-Lever investments in PA provide us with the flexibility to respond rapidly to unanticipated problems. Colony collapse disorder (CCD) is an excellent example of our ability to respond rapidly based upon the federal investment in agricultural research and extension (<http://aginfo.psu.edu/psa/08WinSpr/bees.html>). CCD was identified as an emerging threat to pollination, and thereby to our food supply, in late 2007. At that time, we had several individuals working on various aspects of apiculture, but obviously none had experience with nor an answer to CCD. A team supported by AES and CES funding assembled quickly and, in collaboration with USDA-ARS, industry, state agencies, and other land grant universities, identified a series of hypotheses to explain the catastrophic losses caused by CCD. A variety of funding sources were interested in providing financial support (and subsequently have done so), but it was truly through the federal investment in agricultural research and extension that this team was able to respond quickly to begin to test these hypotheses and provide guidance to beekeepers and agricultural producers. Among the key potential causes of CCD, PA scientists designed experiments on the role of environmental pesticides, colony management practices by commercial beekeepers, and diseases. Several actionable results have already emerged from these studies and have been communicated to stakeholders. Experiments demonstrated that sterilization of used beekeeping equipment resulted in lowered incidence of CCD symptoms in beekeeping operations. This suggested a role for an infectious agent, and the positive impact of using new or sterilized equipment was disseminated to the beekeeping community. Pesticide analyses revealed the presence of a wide variety of environmental pesticides (insecticides, miticides, herbicides, and fungicides) in pollen collected by honey bees. Significantly, concerns that elevated use of neonicotinoid insecticides was responsible for CCD were not supported by experimental investigation. While the presence of pesticides in honey bee colonies remains a concern and has implications for the long-term health of pollinators, this research result was distributed to beekeepers and agricultural producers. This knowledge had direct impacts in the past year on contracts for pollination services throughout the US; beekeepers had been reluctant to enter into contracts with producers relying on neonicotinoids, and the research from this project helped inform parties involved in these transactions of the relative levels of risk that might be incurred. Research on pathogen loads revealed – as with the pesticide study – a variety of fungi, bacteria, viruses, and protozoans resident in most honey bee colonies. Most of these pathogens were not preferentially associated with CCD colonies, but a virus – Israeli acute paralysis virus (IAPV) – previously unrecognized in North America was present in CCD colonies but not in healthy colonies. Experiments have not yet established IAPV as a causal agent of CCD, but the identification of the virus has had implications for federal government policies on importation of honey bees from overseas sources. Other funding sources – USDA-CSREES, USDA-ARS, state departments of agriculture, private industry, and individuals – have stepped up with support, but it is important to reiterate that Hatch and Smith-Lever funds were the investment that allowed an immediate response to the crisis while other donors assembled their funding portfolios.

PA AES and CES continue to support faculty positions that leverage expertise found across the Penn State campus through co-funded faculty positions supported by a series of Penn State Institutes – the Huck Institute of the Life Sciences (<http://www.lsc.psu.edu/>), the Penn State Institutes of Energy and the Environment (<http://www.environment.psu.edu/>), the Social Sciences Research Institute (<http://www.ssri.psu.edu/>), and the Materials Research Institute (<http://www.mri.psu.edu/>). These institutes foster a culture of interdisciplinary collaboration, and PA AES and CES participation allows us to ensure that agricultural issues are addressed by the wider Penn State community. In the past year, we have co-funded faculty in animal health, animal and microbe genomics, biomass energy, infectious diseases, animal behavior and welfare, and pest management, and we have open co-funded searches in demography of immigrant families, energy economics, and synthetic biology (for enhanced energy production).

In this annual report, we provide snapshots of some of our successful programs. Further information on PA AES and CES programs and successes are available through our semi-annual publication “Penn State Agriculture” (<http://aginfo.psu.edu/psa/default.html>) and through our regular news release system (<http://www.cas.psu.edu/NewsInfo.htm>).

Total Actual Amount of professional FTEs/SYs for this State

Year:2007	Extension		Research	
	1862	1890	1862	1890
Plan	319.3	0.0	644.2	0.0
Actual	274.6	0.0	278.9	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 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 (<http://www.extension.psu.edu/internal/FocusPOW.pdf>). After the needs assessment and program identification process was completed, each of the identified programmatic issues was assigned to an integrated, multidisciplinary Issue Team 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. Regional and state administrators and academic unit leaders serve 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 Issue Team to guide the programming efforts of field-based educators and faculty members with extension appointments, and they 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 county 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.

Through the evaluation process that is part of the logic model, feedback from stakeholders provide 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 cooperative extension 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 College of Agricultural Sciences Planning and Reporting system (CASPAR). This tool, which is built on components of the logic model, is 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 personnel in each county confer with their local 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 over 95 member organizations and groups representing the agricultural industry across Pennsylvania. In addition, we meet multiple times per year with stakeholder groups including, but not limited to, the Pennsylvania Farm Bureau, PennAg Industries, State Horticultural Association of Pennsylvania, Pennsylvania Agronomic Education Society, Pennsylvania Association for Sustainable Agriculture, Pennsylvania Council of Cooperative Extension Associations, the Pennsylvania Christmas Tree Growers Association, and the Pennsylvania Floral Industry Association. Through direct faculty and extension educator contacts, we have regular contact with the private sector to assess their specific needs. 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, 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, regional, and state advisory committees continue their role in providing valuable information on extension programming needs. 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.

In the establishment of Advisory committees, our policy is that these committees need to represent the demographics of the commodity, community, or workforce. The same is true in the establishment of internal and external focus groups.

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
- Survey of the general public
- Meeting 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
- Other (Focus Groups)

Brief Explanation

To collect stakeholder input, educators or faculty met with advisory committees, individuals, or solicit input at educational meetings. 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 were summarized.

3. A statement of how the input was 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.

Brief Explanation of what you learned from your Stakeholders

Stakeholders provide the grassroots view of what is important in their community. We learned that County Commissioners see taxes, workforce, community and economic develop, infrastructure and agriculture sustainability, and farm preservation as their top priority issues. We learned that 4-H, agronomy, agriculture programs and services, food and nutrition, and family are the most popular extension programs. Many in private sector agricultural leadership in PA are extremely interested in renewable energy, specifically advice on production decisions, new technologies to take advantage of renewable energy opportunities, and energy efficiency in the home, farm, and business. A growing voice for specialty crop production and local market alternatives is causing us to focus on these topics, both from a research and extension perspective. We continue to be a preferred source of information for the integration of agricultural production and environmental protection. Farmers need cost-effective solutions that minimize environmental impact, and citizens and local officials are seeking input into regulatory decisions that guide land use policies.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
9626031	0	10153831	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	9169401	0	6897914	0
Actual Matching	17338737	0	24943604	0
Actual All Other	16800645	0	28852582	0
Total Actual Expended	43308783	0	60694100	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years				
Carryover	201030	0	55936	0

V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Agricultural and Food Biosecurity
2	Agricultural Systems
3	Families, Youth, and Communities
4	Natural Resources and Environment
5	Pest Management

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural and Food Biosecurity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		10%	
212	Pathogens and Nematodes Affecting Plants	10%		18%	
213	Weeds Affecting Plants	10%		0%	
216	Integrated Pest Management Systems	10%		0%	
311	Animal Diseases	10%		13%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxir	0%		10%	
501	New and Improved Food Processing Technologies	10%		10%	
504	Home and Commercial Food Service	10%		0%	
712	Protect Food from Contamination by Pathogenic Microorgani	10%		17%	
722	Zoonotic Diseases and Parasites Affecting Humans	10%		12%	
723	Hazards to Human Health and Safety	10%		10%	
Total		100%		100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	8.7	0.0	186.2	0.0
Actual	16.0	0.0	68.3	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
533096	0	876934	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1008050	0	4322563	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
976766	0	8843116	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Zoonotic disease agents are a key threat not only to livestock production but also to human health. Added concerns of intentional spread of pathogens has increased the intensity of research on these agents in recent years, but our ability to understand these continually evolving infectious diseases reflects an ongoing commitment to study the nature of disease from all perspectives. AES scientists have partnered with colleagues in the Penn State Center for Infectious Disease Dynamics to examine a variety of disease organisms. Work on bacteria in the genus *Bordetella* (whooping cough, kennel cough, etc.) is revealing what genes are involved in virulence and in host specificity and could lead to development of more effective vaccines. Research on parainfluenza virus type 5, a nonpathogenic respiratory infectious agent, has revealed a method for inducing immunity to various pathogenic viruses in mice. This discovery may have implications for vaccines in livestock species and, eventually, humans. PA AES scientists are leading an international consortium to study Johne's disease in ruminants, a disease that affects nearly one quarter of all US dairy herds and causes substantial economic losses to farmers worldwide. The knowledge management and decision support framework developed by AES scientists to address the introduction of Asian soybean rust (Pest Information Platform for Extension and Education - PIPE (<http://www.ipmpipe.org/>)) has been adopted by multiple USDA agencies as the basis for developing responses to a multitude of existing and emerging pest issues. The PIPE system has the flexibility to permit response to the inadvertent or intentional introduction of high consequence organisms. Continued efforts to develop improved diagnostics for causative agents of food-borne illnesses are relevant for evaluation of threats to the food supply. Research by AES scientists provided the first empirical data on levels of pathogen prevalence in PA meat and poultry processing facilities, and this research, which was shared with industry and USDA-FSIS, led to training sessions and instructional materials (<http://www.foodsafety.psu.edu/movies/carcass.html>).

Complementing our research effort, Cooperative Extension educators and faculty have made a difference in our state by providing programs on the need for rabies vaccination of farm pets, preparedness for natural and man-made disasters, West Nile virus management, Hazard Analysis Critical Control Point (HACCP), Serv-Safe, proper food preparation techniques, safe food preparation techniques, and wild game meat handling. Extension educators and faculty have also provided significant training on farm safety and health. Between 1995 and 2002 at least 289 Pennsylvania farm operators, family members including children, hired farm workers, volunteer helpers, and visitors lost their lives in farm related injury incidents. In addition, approximately 5,000 farm work injuries occur each year. Many of these deaths and long-term disabilities are avoidable with proper understanding of dangers, and training to avoid these dangers, provided by extension faculty and educators.

2. Brief description of the target audience

The most significant target audience in this Planned Program consists of producers, processors, and distributors of agricultural products, first responders and emergency resource individuals/organizations, food handlers and policy makers. Extension educators translate information and products developed under this Planned Program to stakeholders.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	18000	0	0	0
2007	25265	54426	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	3

Patents listed

- Serial No.: 60/891,375; Filed: 02/23/07; Title: Use of an Avirulent *Bordetella* Mutant as a Live Vaccine Vector
- Serial No.: PCT/US2007/007711; Filed: 03/27/07; Title: Methods for Prevention or Treatment of Viral Disease
- Serial No.: 60/866,173; Filed: 11/16/06; Title: AKT Regulation for Treatment of Disease States Associated with RNA Virus Infection

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	0	205

V(F). State Defined Outputs

Output Target

Output Measure

- Number of invention disclosures

Year	Target	Actual
2007	5	4

Output Measure

- Number of participants (contacts) in programs related to agricultural and food biosecurity systems

Year	Target	Actual
2007	9800	25488

Output Measure

- Number of research projects completed on agricultural and food biosecurity

Year	Target	Actual
2007	16	9

V(G). State Defined Outcomes

1. Outcome Measures

Number of participants who were evaluated and demonstrated increased knowledge and skills related to agricultural and food biosecurity issues

2a. Outcome Type:

Change in Knowledge Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	6500	4955

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

All citizens of the United States care about the safety of their food system. It is important that the US put in place proper protections and procedures to respond rapidly in the event of a threat to our agriculture and food systems. To protect our agriculture and food systems, the President of the United States issued the Homeland Security Presidential Directive HSPD 9.

What has been done

Extension provides solutions to Food and Agriculture Safety and Security issues for individuals, families, farms, businesses, and communities. Educational interventions through best management practices, educational training and exhibits, research trials, laboratory sampling, and awareness campaigns provide a comprehensive program plan to mitigate, respond to, and/or recover from incidents that have the potential to affect the safety and security of our food and agriculture system.

Results

Program impacts include increased awareness and knowledge gained in new and emerging diseases, benefits of a herd biosecurity plan, vaccination protocols, symptoms of infectious diseases, factors leading to antibiotic resistance and the resulting threat to human health, testing options for animal diseases, quality assurance certification, and infectious disease control measures. Participants in Serv-Safe learned HACCP protocol for group food preparation. Family food preparers learned correct food purchase, cooking, and storage techniques to minimize exposure to harmful organisms. The role and responsibility of Penn State Extension in Food and Agriculture biosecurity is better understood. Intrastate and interstate agencies and producers have become better prepared to work as a team during an incident.

3. Associated Knowledge Areas

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
311	Animal Diseases
723	Hazards to Human Health and Safety
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxi
314	Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxins, and Other Hazards Affecting Animals
212	Pathogens and Nematodes Affecting Plants
504	Home and Commercial Food Service

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of participants who were evaluated in a follow up and who implement/adopt practices related to agricultural and food biosecurity issues

2a. Outcome Type:

Change in Action Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	2100	2464

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increased concern of US citizens for the safety of the food system requires that appropriate protections be assured and procedures created to address potential threats to the food and agricultural systems. The Homeland Security Presidential Directive (HSPD9) was issued to help protect the agricultural and foods systems of the US.

What has been done

Cooperative Extension provides solutions to food and agricultural safety and security issues through sharing of best management practices, educational training and exhibits, research trials, laboratory sampling, and awareness campaigns that help individuals, families, farms, businesses and communities avoid, respond to, and/or recover from events that may have potential impact on the safety and security of our food and agricultural system.

Results

Six times as many pre-purchase animal biosecurity diagnostic kits have been used by producers and veterinarians since the start of the program in 2002 (52 in 2002, 297 in 2007). The kit contains collection and shipping vials for milk, feces, and blood. The milk is sampled for mastitis pathogens, and the serum sample is examined for bovine viral diarrhea (BVD), infectious bovine rhinotracheitis (IBR), and bovine leukosis virus (BLV). The fecal samples are examined for Salmonella and Clostridium perfringens. There was a 47 percent increase in the use during the last year. The purpose is to isolate the potential for disease pathway through purchased animals coming onto the farm. Land O Lakes milk cooperative has duplicated and distributed the Penn State BioSecurity poster to their co-op members (<http://vetextension.psu.edu/biosecurity/docs/biosecuremain.jpg>). The sign identifies the farm facility as a restricted biosecurity area.

3. Associated Knowledge Areas

KA Code	Knowledge Area
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723	Hazards to Human Health and Safety
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxi
722	Zoonotic Diseases and Parasites Affecting Humans
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxins, and Other Hazards Affecting Animals

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of decision support tools adopted based upon predictive modeling research

2a. Outcome Type:

Change in Condition Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	1	0

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A key feature of decision support tools in the area of agricultural and food biosecurity is the need to develop agile systems that can be quickly adapted to unforeseen threats. Regulatory agencies responsible for risk assessment and response need a flexible platform that can be used by scientists and regulators to address emerging issues.

What has been done

Pest Information Platform for Extension and Education (PIPE), which has been adopted by five agencies of USDA (<http://www.ipmpipe.org/SC/index.cfm>) as a tool for development of a robust risk assessment and response tool, was first employed in response to Asian soybean rust introduction into North America in 2004. While support for current projects focuses on pest management solutions, there is recognition that this same tool can be effective for emerging threats.

Results

The incursion of the Asian soybean rust (ASR) pathogen into North America in 2004 demanded a rapid response tool that could consolidate known information on the pathogen and its biology and management, disseminate this information, and provide an interactive predictive tool to reduce the risk of pathogen spread. PIPE is the underlying knowledge management system for ASR, and the web presence continues to generate tens of thousands of visits per season. The case study of ASR management via PIPE demonstrates the potential for this system to undergird rapid response to an unanticipated threat agent in the future.

3. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of diagnostic tools implemented or adopted for threat identification

2a. Outcome Type:

Change in Condition Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	1	1

2c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Rapid and accurate diagnosis of a threat is key to response and recovery. Action agencies require a new suite of tools to augment existing capacity to respond to emerging threats.

What has been done

Previous chemical ecology research has documented the ability of insect antennae to respond to a wide range of unexpected chemical volatiles. Refinement to the computer algorithms that classify odorants and to the integrated anemometer on the detection device lead to improved discriminatory capacity. Several select agent chemicals are produced by *Fusarium* fungi. *Fusarium* chemotypes can be characterized by molecular methods, increasing diagnostic capacity.

Results

A sensor comprised of 4 insect antennae (a quadraprobe) has been demonstrated to detect a variety of chemical odors with high specificity and sensitivity. The quadraprobe showed promise for detection of plant volatile chemicals, chemicals associated with explosives, and various illicit drugs. Further research on the composition of odor plumes and the manner in which the insect antenna processes these plumes suggested improvements to the quadraprobe and associated software that could take further advantage of the bio-inspired design of this sensor system.

Improvements to the anemometer of the quadraprobe led to wind direction information synchronously with the sampling of each odor strand. The quadraprobe with these improvements is able to indicate the location of an odor source from a distance. A sequence database for more than 2000 *Fusarium* clinical isolates comprises most species associated with human infections; this database was used to resolve a case of contact lens keratitis.

3. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxi
314	Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxins, and Other Hazards Affecting Animals
212	Pathogens and Nematodes Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants
723	Hazards to Human Health and Safety

4. Associated Institution Types

•1862 Research

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Competing Public priorities
- Other (extramural funding)

Brief Explanation

A variety of factors influence potential outcomes in Agricultural and Food Biosecurity. This is an area where public policy and regulations have influenced research needs and the delivery of research results to stakeholders through Cooperative Extension and technology transfer. Federal agencies have expressed interest, demonstrated by funding programs, in diagnostic tools to detect a variety of pathogens and other pests. Appropriations are a driver of fundamental research underlying the development of translational products.

Local crop conditions influence the level of demand on extension faculty and educators. Local weather conditions also influence disease incidence. In 2007, we had localized droughts across Pennsylvania, which changed crop harvesting times and pest pressures while reducing issues with mosquitoes that transmit West Nile Virus and other livestock and human diseases. Changing local needs influence the types of programs requested.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Before-After (before and after program)
- Other (direct observation)

Evaluation Results

The most germane aspects of the evaluation results are shown in the results sections as number of participants increasing knowledge or implementing new practices or methods.

Key Items of Evaluation

See results sections.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural Systems

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		0%	
112	Watershed Protection and Management	5%		0%	
124	Urban Forestry	5%		0%	
131	Alternative Uses of Land	5%		0%	
132	Weather and Climate	5%		0%	
133	Pollution Prevention and Mitigation	5%		0%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
205	Plant Management Systems	10%		10%	
216	Integrated Pest Management Systems	10%		0%	
301	Reproductive Performance of Animals	5%		10%	
302	Nutrient Utilization in Animals	5%		10%	
306	Environmental Stress in Animals	5%		10%	
307	Animal Management Systems	10%		10%	
502	New and Improved Food Products	0%		10%	
601	Economics of Agricultural Production and Farm Management	10%		10%	
602	Business Management, Finance, and Taxation	10%		10%	
604	Marketing and Distribution Practices	5%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	105.5	0.0	220.9	0.0
Actual	69.8	0.0	75.5	0.0

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

Extension		Research	
Smith-Lever 3b & 3c 2329028	1890 Extension 0	Hatch 2651881	Evans-Allen 0
1862 Matching 4404039	1890 Matching 0	1862 Matching 10238876	1890 Matching 0
1862 All Other 4267364	1890 All Other 0	1862 All Other 8377391	1890 All Other 0

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

Economically and environmentally sustainable production of food, fiber, fodder, and fuel continues to demand science-based solutions. This sustainable production also requires a systems-based approach to problem solving. The complexity of Pennsylvania agriculture demands wide-ranging research and knowledge delivery, addressing livestock production, a wide variety of cropping systems, and the financial decision support systems that undergird successful production operations. Dairy is the single most important agricultural commodity in Pennsylvania. Research by PA AES scientists have evaluated nutrition of dairy calves and revealed that weaning calves at 4-6 weeks of age has no negative effects on animal health or productivity, yet saves \$1-2/day in feed costs. Dairy profit teams implemented with AES research results have helped farmers achieve up to 16 percent increases in milk production/cow, resulting in an average \$250/cow increase in profit at participating dairy farms. Economic analysis of market and revenue risks in dairy production in PA and neighboring states led to adoption of the first pilot revenue insurance product for dairy, implemented by USDA-RMA. Widespread adoption of crop varieties with herbicide resistance has made studies of herbicide resistance in weeds an important topic. A spatially explicit model of the spread of glyphosate-resistant horseweed in PA has demonstrated that production practices (i.e., herbicide tolerant crop use) do have an impact on weed management practices and the appearance of resistant weed populations. Studies on the role of cover crops and cover crop management have led to recommendations distributed through Cooperative Extension, USDA-NRCS, and PA state agencies that have resulted in increased cover crop acreage in PA. Increased cover crops and better cover crop management will also reduce weed pressure, leading to fewer problems with herbicide-resistant weed populations. Pollination systems are a central part of the agricultural system; food and forage production are critically dependent on adequate pollination. The appearance of Colony Collapse Disorder (CCD), first reported by a PA beekeeper, led to a rapid and thorough response to the crisis. PA AES scientists and PA CES educators collaborated with USDA-ARS and other university scientists to determine the extent of the problem and to identify potential causes. Israeli Acute Paralysis Virus was identified in association with CCD. Pesticide levels in hives did not explain the incidence of CCD, but elevated pesticide levels may contribute to honey bee susceptibility to other stresses, including diseases. Beekeepers were advised to avoid repeated reuse of equipment, as pathogens and pesticides were shown to accumulate in the wax.

Cooperative Extension has educational program topics in four areas that relate to Agricultural Systems: agricultural profitability and sustainability, animal production, agronomic production, and horticulture and green industry production. These include a number of topics related to crop, pest, and soil management, crop marketing and risk management, animal production, and facilities optimization.

2. Brief description of the target audience

The target audience in this Planned Program consists of producers, processors, and distributors of agricultural products and policy makers, including local government officials. Extension educators translate information and products developed under this Planned Program to stakeholders.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	204000	0	0	0
2007	114233	498084	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	11

Patents listed

Serial No.: 11/745,748; Filed: 05/08/07; Title: Process for Antimicrobial Treatment of Fresh Produce, Particularly Mushroom
 Serial No.: 11/821,512; Filed: 06/21/07; Title: Compositions and Methods for Enhancing Receptor-Mediated Cellular Internalization
 Serial No.: 11/821,513; Filed: 06/21/07; Title: Compositions and Methods for Enhancing Receptor-Mediated Cellular Internalization
 Serial No.: 11/821,514; Filed: 06/21/07; Title: Compositions and Methods for Enhancing Receptor-Mediated Cellular Internalization
 Serial No.: PCT/US2007/063984; Filed: 03/14/07; Title: Phytonutrient Compositions from Mushrooms or Filamentous Fungi and Methods of Use
 Serial No.: 11/686,033; Filed: 03/14/07; Title: Phytonutrient Compositions from Mushrooms or Filamentous Fungi and Methods of Use
 Serial No.: 60/958,023; Filed 07/02/07; Title: Novel Process for the Generation of Thermally Stable, Enzyme Resistant Starch
 Serial No.: 11/713,994; Filed: 03/05/07; Title: Regal Pelargonium Named '99-247-1'
 Serial No.: 60/913,034; Filed: 04/20/07; Title: Reversible Inhibition of Sperm Receptor Synthesis for Contraception
 Serial No.: 11/833,472; Filed: 08/02/07; Title: Reversible Inhibition of Sperm Receptor Synthesis for Contraception
 Serial No.: PCT/US2007/017316; Filed: 08/03/07; Title: Reversible Inhibition of Sperm Receptor Synthesis for Contraception

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	0	420

V(F). State Defined Outputs

Output Target

Output Measure

- Number of invention disclosures

Year	Target	Actual
2007	6	4

Output Measure

- Number of participants (contacts) in programs related to agricultural production, profitability, and sustainability

Year	Target	Actual
2007	198000	104212

Output Measure

- Number of research projects completed on agricultural systems

Year	Target	Actual
2007	41	22

V(G). State Defined Outcomes

1. Outcome Measures

Number of participants who were evaluated and demonstrated increased knowledge and skills related to improving agricultural production, profitability, and sustainability

2a. Outcome Type:

Change in Knowledge Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	25000	13225

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Pennsylvania farmers are increasingly competing in a global market. This has led to increased consolidation of cropping and livestock systems, increased agricultural inputs, and increased animal waste. Thus, farmers face not only increasing competition, but increasing environmental regulation. To maintain viable agricultural systems that are environmentally compatible, farmers need help learning about ways to reduce inputs, market more effectively, and farm in a more sustainable manner.

What has been done

Research-based extension programs have been implemented to help Pennsylvania farmers learn about new integrated pest management methods, crop and soil management practices, sustainable agriculture systems, and crop marketing and risk management strategies. Educational programming is also being provided to help livestock producers improve production efficiency, build better livestock facilities, and manage livestock waste.

Results

Two hundred and fifty-seven participants indicated that they increased their knowledge about milking systems, while 106 participants indicated they learned new knowledge about site assessment and facilities. Five hundred and fifty-seven participants indicated they increased their knowledge about nutrition related to grazing management systems, while 106 indicated they increased their knowledge about containing costs associated with nutrition of their livestock. Under the area of IPM and sustainable agriculture 1,204 participants indicated that they gained knowledge. Another 1,085 individuals indicated that they gained knowledge in grain and forage crop management and harvesting practices. Across horticultural crops, 1,657 participants indicated that they increased knowledge about crop production practices and methods. Using tools such as FINPACK, a financial planning tool developed by Penn State faculty, 704 participants increased their knowledge around marketing and risk management.

3. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
302	Nutrient Utilization in Animals

604	Marketing and Distribution Practices
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
216	Integrated Pest Management Systems

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of participants who were evaluated in a follow up and who implement/adopt practices related to improving agricultural production, profitability, and sustainability

2a. Outcome Type:

Change in Action Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	3000	5959

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increased competition in global markets for PA farmers has led to increased consolidation of cropping and livestock systems, agricultural inputs, and animal waste. Increasing environmental regulations has led to PA farmers seeking ways to reduce inputs, market more effectively, and farm in a more sustainable manner.

What has been done

Research and extension programming help livestock producers improve production efficiency, build better livestock facilities, and manage livestock waste. In addition, programs have been implemented to help PA farmers to learn about new integrated pest management methods, crop and soil management practices, sustainable agriculture systems, and crop marketing and risk management strategies.

Results

Using tools such as FINPACK, 1,668 participants indicated that they had implemented or adopted business plans, market research, decision making tools, risk management practices, and/or human resource management practices. One hundred and sixty-five participants indicated that they had implemented or adopted either improved farmstead traffic and livestock flow systems, improved building design, infectious disease control systems, best management practices, and/or reproduction/genetics on their farm. The PA Dairy Tool is being used to help assess on-farm dairy production and profitability. Thirteen hundred and twenty eight participants indicated they implemented or adopted sustainable agriculture or nutrient management practices and methods on their farm. Across the vegetable, fruit, and green industries in Pennsylvania, 3,300 participants who attended extension programs indicated they implemented or adopted more sustainable techniques for crops and landscapes.

3. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
301	Reproductive Performance of Animals
604	Marketing and Distribution Practices
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
302	Nutrient Utilization in Animals
216	Integrated Pest Management Systems
133	Pollution Prevention and Mitigation

4. Associated Institution Types

- 1862 Extension
- 1862 Research

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

A variety of factors influence potential outcomes in Agricultural Systems. Competing public priorities and unpredictable natural disasters (e.g, drought, flooding) have significant impacts on both research plans and extension programming. Weather issues had a significant effect on some of our programming, especially with regard to crop production. New policies and priorities around renewable energy are changing many research and extension programs as these priorities emerge. Changing crop insurance policies were a particular challenge with regard to providing adequate extension programming. Appropriations are a driver of research underlying the development of translational products and could have impact (negative during this year in the case of several key county extension educator positions) on recruiting and retention of AES and CES personnel.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Before-After (before and after program)
- Other (direct observation)

Evaluation Results

The most germane aspects of the evaluation results are shown in the results sections as number of participants increasing knowledge or implementing new practices or methods.

Key Items of Evaluation

See results sections.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Families, Youth, and Communities

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
504	Home and Commercial Food Service	5%		0%	
607	Consumer Economics	10%		10%	
608	Community Resource Planning and Development	10%		10%	
610	Domestic Policy Analysis	5%		10%	
703	Nutrition Education and Behavior	10%		10%	
724	Healthy Lifestyle	10%		10%	
801	Individual and Family Resource Management	10%		10%	
802	Human Development and Family Well-Being	10%		10%	
803	Sociological and Technological Change Affecting Individuals,	10%		10%	
805	Community Institutions, Health, and Social Services	10%		10%	
806	Youth Development	10%		10%	
Total		100%		100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	174.4	0.0	37.8	0.0
Actual	151.1	0.0	20.3	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
5044986	0	562045	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
9539739	0	1926538	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
9243682	0	1432130	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Rural communities are a key component of the PA demographic landscape. Future plans of rural youth strongly influence the nature of the workforce available to address future labor needs, business ownership, and community structure in much of PA. Educational and occupational aspirations of Hispanic rural youth (whose parents are part of the agricultural workforce) were surveyed, and these data form the basis of programs offered by the NGO Rural Opportunities, Inc. With less than 2 percent of PA residents involved in ag production, ag literacy plays an important role in the development of policies that strongly influence the nature of PA communities. A survey of more than 1,500 PA residents revealed very little knowledge of one of the state's most significant industries, which could translate to local and statewide policy decisions that negatively influence production agriculture. Results were reported to the Center for Rural Pennsylvania, which informs state government officials about current issues in PA communities. A focus on Women in Agriculture, a historically underserved constituency in PA agriculture, led to research-based educational programs in business planning, cheese making, soil quality, integrated pest management, and dairy alternatives, among other topics. More than 80 percent of attendees reported they would change a practice on their operation from knowledge gained.

Family programs promote family strengths and help communities become positive environments for families. Parenting programs improve communication and life skills, quality child care, youth development and resiliency, and coping with stress and change. Nutrition education programs increase healthy eating behaviors and address chronic disease issues such as heart diseases, type 2 diabetes, and obesity.

2. Brief description of the target audience

Youth and families in the general public will benefit from these programs. Teachers and a variety of community and government agencies and organizations are key target audiences and partners, as they magnify the message provided through PA AES and CES activities. Extension educators translate information and products developed under this Planned Program to stakeholders.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	180000	0	220000	0
2007	342642	626649	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	2

Patents listed

Serial No.: PCT/US2007/060393; Filed: 01/11/07; Title: Soy/Whey Protein Recovery Composition
 Serial No.: 11/621,715; Filed: 01/10/07; Title: Soy/Whey Protein Recovery Composition

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	0	190

V(F). State Defined Outputs

Output Target

Output Measure

- Number of participants (contacts) in programs related to families, youth, and communities and to the nutrition and health of adults and youth

Year	Target	Actual
2007	320000	232171

Output Measure

- Number of research projects completed on families, youth, and communities

Year	Target	Actual
2007	6	14

Output Measure

- Number of invention disclosures

Year	Target	Actual
2007	{No Data Entered}	0

V(G). State Defined Outcomes

1. Outcome Measures

Number of participants who were evaluated and demonstrated increased knowledge and skills related to strengthening families, youth, communities and improving nutrition and health

2a. Outcome Type:

Change in Knowledge Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	95000	47698

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

High-quality child care provides safe places for youth to grow, learn, and receive good nutrition, and it provides environments for socialization and physical development. These factors contribute to child development and have effects into later years. Adults with limited education face economic problems and few opportunities to advance. Families with lower knowledge levels who are more dependent on society, rather than independent in society, create a larger burden on social services.

What has been done

The Better Kid Care program provided 175,000 hours of professional development for childhood educators, parents, and businesses. Basic finance classes reached 1,160 participants who gained skills in savings, planning for emergencies, keeping good credit, and understanding tax situations. Family programs strengthened relationships and increased cooperation. Nutrition classes for families and youth addressed childhood obesity, preventing osteoporosis, and dealing with diabetes and heart disease.

Results

260 leaders helped 2,873 participants improve their health and 87 percent planned to continue strength training in the future. 250 schools participated in the High School Financial Planning Program with 118,427 booklets distributed since 2001. In 19 counties, 172 bankruptcy filers increased their knowledge about budgets, setting goals, getting a free credit report, and access to free sources of consumer information. 504 Community Bridges Project participants moved out of poverty and increased family security. 728 people learned job-readiness skills to become sustainable employees. In 14 sites, 210 children in the Family Fitness program increased their willingness to try new fruits and new vegetables, while 90 percent decreased consumption of high-sugar foods or drinks. 10,287 youth reported knowledge gain in a 4-H project area while 4,691 youth increased problem-solving skills, 4,731 increased critical thinking skills, and 3,407 increased their goal setting skills.

3. Associated Knowledge Areas

KA Code	Knowledge Area
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703	Nutrition Education and Behavior
724	Healthy Lifestyle
802	Human Development and Family Well-Being
801	Individual and Family Resource Management
806	Youth Development

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of participants who were evaluated in a follow up and who implement/adopt practices related to strengthening families, youth, communities and improving nutrition and health

2a. Outcome Type:

Change in Action Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	36000	19431

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Parents whose children participate in the 4-H Youth Development program can be assured that 4-H offers a safe environment where youth can develop skills and gain a sense of belonging with peers and adults. Strong life skills are linked to academic success and positive behavior such as giving back to the community. Nutrition education classes address chronic disease issues and impact the costs of medical care, lost wages, and related health care.

What has been done

The 4-H Youth Development program's informal learning environment helps youth develop critical life skills, fosters citizenship, and promotes leadership. Additionally, the PROSPER model offers proven evidence-based programs that teach skills and attitudes that foster improved family life and parent-child communication and provides youth with skills for planning, problem-solving, and peer resistance against problem behaviors.

Results

Over 1,190 youth participating in a study regarding life skill development in the 4-H Youth Development program showed significant increase in decision-making, critical thinking, communication, goal setting, and problem solving skills compared to youth starting program. Over 5,520 youth that participated in community service contributed over 9,800 hours of time. Since 2001, PROSPER has impacted more than 5,500 6th and 7th graders and 3,000 families in seven schools in PA. After 18 months, marijuana and inhalant use were significantly lower compared to non-PROSPER participants. The youth said that their parents were using more consistent and less harsh discipline with improved family time. For every dollar the community spends on prevention programs, they are potentially saving \$9.60. Attendance at the PROSPER family program averages 17 percent of all the eligible sixth grade families in communities compared to 1-6 percent who attended similar programs in other communities.

3. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development

4. Associated Institution Types

- 1862 Extension
- 1862 Research

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration,new cultural groupings,etc.)
- Other (extramural funding)

Brief Explanation

A variety of factors influence potential outcomes in Families, Youth, and Communities. This is an area where public policy and regulations can influence the research needs and the delivery of research results to stakeholders through Cooperative Extension. Population changes are of particular importance in both priority setting for research and extension and for availability of funding to conduct that work. Appropriations could have impact (positive or negative) on recruiting and retention of AES and CES personnel.

Increasing costs of food and fuel, as well as the number of home loans in default, are increasing the need for programs on financial management, nutrition, etc. Families are feeling a great economic pinch. This not only affects the financial stability of the home, but can also influence the functionality of the family unit. The changing economy is causing an increased demand for family, youth, and community programming, which in turn demands a research base to underlie this programming. Overlying these issues are the shifting demographics of the Pennsylvania population. We are seeing increased immigration into the state to support our agricultural industries. This creates an increase in non-English programming needs and also contributes to social issues in nearby communities. Our ability to address these issues is influenced by the competing public priorities in the rural and urban areas.

V(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- After Only (post program)
- Before-After (before and after program)
- Comparisons between program participants (individuals,group,organizations) and non-participants
- Other (direct observation and contact)

Evaluation Results

The most germane aspects of the evaluation results are shown in the results sections as number of participants increasing knowledge or implementing new practices or methods.

Key Items of Evaluation

See results sections.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Natural Resources and Environment

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	5%		10%	
102	Soil, Plant, Water, Nutrient Relationships	10%		10%	
112	Watershed Protection and Management	10%		10%	
123	Management and Sustainability of Forest Resources	10%		10%	
124	Urban Forestry	5%		0%	
131	Alternative Uses of Land	10%		10%	
133	Pollution Prevention and Mitigation	10%		10%	
134	Outdoor Recreation	5%		0%	
135	Aquatic and Terrestrial Wildlife	5%		10%	
403	Waste Disposal, Recycling, and Reuse	10%		10%	
511	New and Improved Non-Food Products and Processes	10%		10%	
605	Natural Resource and Environmental Economics	10%		10%	
Total		100%		100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	20.9	0.0	123.8	0.0
Actual	19.9	0.0	59.0	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
663102	0	1333636	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1253883	0	4926110	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1214969	0	5174377	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Production of agricultural and forest products in an environmentally sustainable manner continues to be a priority of PA AES and CES programs. Research on cover crops to improve soil health under PA conditions have yielded recommendations that are being implemented by PA CES and USDA-NRCS; nearly 500 acres of leguminous and brassica cover crops were established in Centre Co., PA, in 2007 as part of a cover crop project supported by this work. The PA Nutrient Management Act was revised to require farmers to use cover crops for winter manure application where residue cover is less than 25 percent. Studies in no-till cropping systems also supported advice to the Chicago Climate Exchange on ratios of C sequestration in no-till vs. conventional crop production. A widely available test for N content was demonstrated to provide erroneous nitrogen fertilizer recommendations in 37 percent of cases. A new chlorophyll meter N test was validated and has been adopted to guide fertilizer decisions in PA corn production. PA government adopted a phosphorous index based upon research from PA AES projects in previous years; this index has been modified based on new research on P loss in runoff from agricultural fields. Land use decisions have become critical in PA. A study of failing on-lot septic systems resulted in SepticMap, an on-line septic management and tracking system for use by PA municipalities. This system was also used to examine the land base available for residential development in 24 PA counties, and results suggest that some regions may need to rely more heavily on higher-cost systems for marginal soils. Continued participation in the National Atmospheric Deposition Program provides data that elucidate long-term trends in precipitation chemistry. While acidity and sulfate and nitrate concentrations all declined, PA continues to exceed records from nearly every other long-term monitoring site in this program. These data are critical for assessment of the 1990 Clean Air Act amendments and for evaluation of atmospheric deposition as a non-point nitrogen source important in Chesapeake Bay eutrophication. An Agricultural and Environment Science and Policy Center was established to lead outreach efforts across the state on nutrient management and the application of science to environmental decision making. Renewable energy has changed the complexion of our consideration of natural resources (and agricultural systems in general) in recent years. The Biomass Energy Center is an initiative that has coordinated research and extension efforts for the state, providing needed research to fill data gaps for agricultural producers trying to balance food and fuel production.

Cooperative Extension has a broad base of educational programs designed to address the breadth of natural resource and environment issues in the state such as: environmental stewardship of land and water resources, sustaining forest systems, agronomic production, horticulture and green industry production, and managing wildlife and fisheries.

2. Brief description of the target audience

The target audience in this planned program consists of agricultural producers, private forest landowners, wood products producers, and natural resource managers. Non-governmental organizations, local, state, and federal government agencies, and policy makers will also benefit from activities in this planned program. Extension educators translate information and products developed under this planned program to stakeholders.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	54000	0	0	0
2007	33349	436026	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	1

Patents listed

Serial No.:60/939,726; Filed: 05/23/07; Title: Lignin Modification

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	0	316

V(F). State Defined Outputs

Output Target

Output Measure

- Number of invention disclosures

Year	Target	Actual
2007	1	0

Output Measure

- Number of participants (contacts) in programs related to watershed management and forest management

Year	Target	Actual
2007	50000	48256

Output Measure

- Number of research projects completed on natural resources and environmental issues

Year	Target	Actual
2007	21	14

V(G). State Defined Outcomes

1. Outcome Measures

Number of participants who were evaluated and demonstrated increased knowledge and skills related to enhancing water quality and sustainability of private forest lands

2a. Outcome Type:

Change in Knowledge Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	4000	6190

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Over 500 watershed organizations have formed around the state in response to local water resources and land-use issues, but most are in desperate need of education and training on best management practices related to watersheds.

What has been done

Research-based educational programs for these groups have been implemented, along with programs for the general public. One program, the Master Naturalist, is designed to establish a pool of knowledgeable individuals that can extend extension's expertise.

Results

Two hundred and eighty five participants at pond management programs indicated that they increased their knowledge about water. After water conservation programs, five participants demonstrated an increased knowledge about water. Five hundred and fourteen participants in private water supplier and Master Owner Network programs indicated an increase in knowledge about water. Two hundred and twenty-one participants indicated that they had increased their knowledge about water after watershed management educational programs.

3. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
112	Watershed Protection and Management

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of participants who were evaluated in a follow up and who implement/adopt practices related to enhancing water quality and sustainability of private forest lands

2a. Outcome Type:

Change in Action Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	2000	2111

2c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Sixty percent of the land area of PA is forests and contributes watershed to both the Chesapeake Bay and Mississippi watersheds. PA water resources are extremely challenged due to mining and other abuses. More than 50 percent of the over one million water supplies in PA fail to meet at least one drinking water standard. The water resources originating in Pennsylvania forests affect not only PA citizens, but other states as well.

What has been done

Research knowledge on watershed protection and preservation of local drinking water sources has been translated into best practices that have been delivered through Cooperative Extension programming to a wide variety of local watershed organizations (over 500) throughout PA. The Master Naturalist is a program designed to establish a pool of knowledgeable individuals that can extend the expertise offered by CE.

Results

Three hundred forty-eight participants indicated that they implemented a recommended action or Best Management Practice related to water quality after attending pond management programs. Five participants implemented recommended action or Best Management Practice related to water quality. After private water suppliers and Master Owner Network programs, 529 participants indicated that they implemented recommended action or Best Management Practice. One hundred and sixty-five participants implemented a recommended action or Best Management Practice after watershed management educational programs.

3. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
123	Management and Sustainability of Forest Resources

4. Associated Institution Types

- 1862 Extension
- 1862 Research

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation

A variety of factors influence potential outcomes in Natural Resources and Environment. This is an area where public policy and regulations can influence the research needs and the delivery of research results to stakeholders through Cooperative Extension. Focus on renewable energy has a profound impact on identification of priorities and action on those priorities. Unexpected natural climate variation continues to influence priority identification. Changing demographics and land use decisions are key drivers for natural resource management. Runoff from rain events can influence water quality in ponds and percolation into private wells. Changing criteria to protect major waterways and watersheds in Pennsylvania change the degree of program demand and where programs are offered. Appropriations could have impact (positive or negative) on recruiting and retention of AES and CES personnel.

V(l). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Before-After (before and after program)
- Other (direct observation)

Evaluation Results

The most germane aspects of the evaluation results are shown in the results sections as number of participants increasing knowledge or implementing new practices or methods.

Key Items of Evaluation

See results sections.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Pest Management

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
124	Urban Forestry	5%		0%	
132	Weather and Climate	5%		0%	
211	Insects, Mites, and Other Arthropods Affecting Plants	15%		20%	
212	Pathogens and Nematodes Affecting Plants	15%		20%	
213	Weeds Affecting Plants	15%		10%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	15%		0%	
215	Biological Control of Pests Affecting Plants	10%		10%	
216	Integrated Pest Management Systems	20%		40%	
Total		100%		100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	9.9	0.0	75.5	0.0
Actual	17.9	0.0	55.7	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
599189	0	1473418	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1133026	0	3529517	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1097864	0	5025568	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Science-based solutions for pest management require constant research on the biology of pests, the cropping systems, alternative solutions, and consumer attitudes about their food supply. PA AES and CES support a robust portfolio of research and outreach programs to address improved pest management options. Implementation and adoption of an area-wide pheromone mating disruption program as a major control tactic for tree fruit pest management has substantially reduced fruit injury attributable to the codling moth and oriental fruit moth complex. Fruit injury in all orchards in our experimental project was approximately 70 percent lower than injury levels documented in 2006. Based upon grower and pheromone supply companies, in excess of 2,500 ha of tree fruits used pheromone mating disruption technology in 2007 (546 ha are official participants in our experiments; the remaining orchards have been switched to this program voluntarily by growers at their expense). A majority of growers report 50-70 percent reduction in synthetic organic pesticide use in their orchards compared to previous years. This program, where research is conducted directly with cooperation from growers, is an excellent example of the seamless connection between research and extension in the PSU system. Transition of apple orchards, grape vineyards, agronomic crop acreage, and horticultural high tunnels to organic have led faculty and extension educators to examine a variety of alternative pest management strategies. Many of these research and outreach programs have equal value in organic and conventional production systems, sharing the goal of effective pest management while reducing our environmental footprint, increasing worker and consumer safety, and discovering economically sustainable pest management solutions.

Effective implementation of Integrated Pest Management (IPM) systems requires growers to understanding pest biology, timing of pest activities, scouting/monitoring procedures, economic thresholds, and selection of appropriate management technologies. Extension programs have been implemented in multiple commodities (i.e. field crops, tree fruits, vegetables, mushrooms, grapes, livestock, etc.) to help growers understand and adopt these technologies and new technologies as they become available. Penn State is unique in its focus on the development of web-based pest prediction models and decision support tools. To support our extension faculty and educators in delivering their programs, numerous insect and weed phenology models and disease forecast models have been developed and implemented. A decision support tool, BET (Bt Economic Analysis model), <http://www.btet.psu.edu/>, is available for growers to assess the economic value of Bt corn on their farm. These models support newsletters and educational programs. In addition, these models can be accessed directly by growers, agricultural input dealers, crop consultants, and personnel in government agencies that assist farmers.

2. Brief description of the target audience

The primary target audiences of this Planned Program consist of agricultural producers, crop consultants, state agencies, and policy makers. Extension educators translate information and products developed under this Planned Program to stakeholders.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	24000	0	0	0
2007	30936	517493	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	0	245

V(F). State Defined Outputs

Output Target

Output Measure

- Number of invention disclosures

Year	Target	Actual
2007	0	0

Output Measure

- Number of research projects completed on pest management

Year	Target	Actual
2007	16	11

Output Measure

- Number of participants (contacts) in programs related to pest management

Year	Target	Actual
2007	21000	26672

V(G). State Defined Outcomes

1. Outcome Measures

Number of participants who were evaluated and demonstrated increased knowledge and skills related to managing pests in safer, more effective ways

2a. Outcome Type:

Change in Knowledge Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	16000	2351

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Managing agricultural pests is one of the most difficult aspects of crop production because their time of occurrence is dependent on large scale weather patterns and microclimates. Successful implementation of pest management practices is dependent on predicting when these key events occur so scouting/monitoring and management practices can be timed effectively. Farmers and the businesses and agencies that serve them need good prediction tools.

What has been done

Penn State research and extension faculty have developed numerous insect, weed, and disease prediction models to provide information on the timing of key pest events to help target the period for scouting/monitoring and implementation of management strategies, such as biological control or pesticides. In addition, decision support tools, such as the Bt Economic Tool (BTET), have been developed to help farmers understand the economics of using the technology on their farm.

Results

Four hundred and three field crop producers indicated an increased understanding of how to use predictive models in their pest management systems to improve sustainability. Forty-three field crop producers indicated they had increased their knowledge about scouting methods and 1,034 indicated that they increased their knowledge on selection of management tactics. In tree fruits, 747 growers indicated increased knowledge about integrated pest management.

3. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants
212	Pathogens and Nematodes Affecting Plants
132	Weather and Climate

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of decision support tools adopted based upon predictive modeling research

2a. Outcome Type:

Change in Condition Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	1	1

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Modeling tools are often idiosyncratic - they provide useful information for a well-studied system, but require long development periods and lack flexibility to adapt to new needs. Agriculture requires an agile tool that can consolidate known information about a novel threat to guide decisions in the short term and filling of knowledge gaps in the longer term. Regulatory agencies need these tools to support decisions, as do agricultural producers to explain management options.

What has been done

This led to the development of the Pest Information Platform for Extension and Education (PIPE - <http://www.ipmpipe.org/>), which has been adopted by five agencies of USDA as a tool for regional or national pest management. In 2007, USDA-CSREES solicited white papers to expand this tool beyond the Asian Soybean Rust starting point to embrace a variety of different pest management solutions. We are extending the use of the PIPE framework for PA crop management challenges.

Results

PIPE is credited with providing decision support about Asian Soybean Rust incidence that has led to millions of acres of US soybean production remaining untreated with one or more fungicide applications. PIPE is a robust system that can be adapted to deal with other pest management challenges. In FY 2007, AES scientists continued to work with small business partner ZedX, Inc., to validate an existing system (BLITECAST) (http://www.ppath.cas.psu.edu/EXTENSION/VEGDIS/Vegetable_Pathology_Home.htm) of early and late blight forecasting for Pennsylvania vegetable growers. BLITECAST alone has provided significant cost savings to PA vegetable growers in terms of reduced chemical input and increased profitability. The goal of the validation that has occurred during this past year is to incorporate BLITECAST into an PIPE-based system and to add a variety of additional pathogen, insect, and weed species and to expand the crop portfolio covered in this diagnostic network (illustrated in a recent issue of Penn State Agriculture)(<http://www.aginfo.psu.edu/psa/07WinSpr/Pests.html>).

3. Associated Knowledge Areas

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

212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of diagnostic tools implemented or adopted for pest identification

2a. Outcome Type:

Change in Condition Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	1	3

2c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Pest identification is the starting point for effective pest management. In many cases, tools to assess the presence of a pest are lacking and accurate diagnosis of which pest has been detected is also critical. Agricultural producers cannot implement responsible pest management without this information, and researchers, extension educators, and regulatory agencies are also dependent upon this information.

What has been done

Work on the chemical ecology of the small hive beetle, an invasive honey bee pest, has resulted in a new attractant to monitor this species. Grapevine decline leads to as much as \$700,000 in annual losses to PA wine grape growers. New molecular methods permit accurate diagnosis of two key pathogens implicated in this syndrome. A molecular diagnostic approach to Phytophthora has been developed and implemented in PA Department of Agriculture nursery surveys.

Results

The identification that volatiles produced by a yeast on pollen in honey bee hives serve as an attractant to the invasive small hive beetle led to development of a trap to capture beetles in the hive. This trap has led to a project examining why these beetles (native to Africa) are not serious pests of African-origin honey bees. This could lead to methods to reduce the impact on European-origin honey bees. Pathogens involved in grapevine decline are slow growing and therefore hard to culture and prone to misidentification. Molecular diagnostic tools have been developed for Petri disease and tomato ringspot virus and are being used to screen wine grape acreage and new planting materials, an initial step toward a clean vine program for wine grape nursery stock in the eastern US. Phytophthora is a major pathogen group in nursery settings. A molecular database characterizing over 150 isolates is now being used as a risk assessment tool for new isolates as they appear in PA nurseries.

3. Associated Knowledge Areas

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

4. Associated Institution Types

- 1862 Extension
- 1862 Research

1. Outcome Measures

Number of participants who were evaluated in a follow up and who implement/adopt practices related to managing pests in safer, more effective ways

2a. Outcome Type:

Change in Action Outcome Measure

2b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	1083

2c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Agricultural pest pressure is dependent on large scale weather patterns and microclimates and is therefore a difficult aspect of crop production to manage. Prediction of when these events occur will allow for more timely scouting/monitoring and management practices that could lead to successful implementation of pest management practices. Good prediction tools are needed by farmers and the business and agencies that serve them.

What has been done

Information on the timing of key pest events that will allow for targeting the appropriate period for scouting/monitoring and implementing management strategies, such as biological control of pests, has been provided by prediction models for insects, weeds, and diseases developed by Penn State research and extension faculty. Decision support tools have been developed to help farmers understand the economics of using the technology on their farm (i.e. Bt Economic Tool (BTET)).

Results

Web-based, spatially explicit phenology models that provide up to ten day forecasts at a spatial resolution of 10 Km² for timing of ten insect pests of field crops, tree fruit, and vegetables are currently available to all producers in Pennsylvania. In addition, similar phenology models are available for eight weed species. These models are updated on a daily basis and provide a real-time, high-resolution view of the pest situation across the state. Seven disease models for pathogens of fruit trees, grapes, potatoes, and tomatoes are also used to provide daily information on conditions conducive to disease development. Although we have no specific measurement of how many individuals use these models for in-season pest decision making, the vegetable growers of the state indicate that the early and late blight forecast systems is saving them several million dollars annually in reduced fungicide applications and lost crop yield.

3. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
213	Weeds Affecting Plants
132	Weather and Climate

4. Associated Institution Types

- 1862 Extension
- 1862 Research

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
- Populations changes (immigration, new cultural groupings, etc.)
- Other (extramural funding)

Brief Explanation

A variety of factors influence potential outcomes in Pest Management. Public policy and regulations can influence the research needs and the delivery of research results to stakeholders through Cooperative Extension and technology transfer. Natural disasters (e.g., drought and floods) impact research work and occasionally dictate Cooperative Extension programming priorities. With the changing economics of field crop production, due to world supply and demand and the biofuels industry, the economics of pest management have shifted dramatically in the last year - increasing the demand for pest management extension programs and the research base that supports those programs. Appropriations are a driver of research underlying the development of translational products and could have impact (negative during this year in the case of several key county extension educator positions) on recruiting and retention of AES and CES personnel and ability to maintain current information delivery systems (e.g., websites and other information dissemination tools).

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Before-After (before and after program)
- Other (direct observation)

Evaluation Results

The most germane aspects of the evaluation results are shown in the results sections as number of participants increasing knowledge or implementing new practices or methods.

Key Items of Evaluation

See results sections.