

2008 Pennsylvania State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Penn State's Agricultural Experiment Station and Cooperative Extension Service operate in concert within the College of Agricultural Sciences to address present and future needs in agriculture. Operational decisions by the Directors of AES and CES are integrated into College decision-making. In 2008, we completed a new strategic plan for the College (http://strategicplanning.cas.psu.edu/2008_2013/PDFs/CAS_2008-2013_Strategic_Plan.pdf), and this plan for the 2008-2013 time period contains five strategic initiatives: entrepreneurship, energy, water, pest prediction and response, and food, diet, and health. These new initiatives are highly congruent with the planned programs found in our joint plan of work and upon which we report in this document.

Research and extension are integrated largely through joint appointments in the College of Agricultural Sciences. Of 744 administrators, faculty, and staff at University Park, 264 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. Penn State Cooperative Extension initiated a reframing exercise in 2008 to capitalize on this multidisciplinary approach. That initiative will be in place in calendar year 2009 and will focus attention on a limited number of key science-driven stakeholder issues to bring our full resources to bear on these critical subjects. Our efforts to reduce the number of AES projects to encourage interdisciplinarity continue to be successful. We have continued to connect with other expertise across the Penn State campus to ensure that AES and CES resources are leveraged to the maximum possible extent with scholarship resident outside our College.

In 2008, the Marcellus shale natural gas deposits became one of the most significant events in rural Pennsylvania in recent memory. Unprecedented interest in gas exploration led to a gold rush of sorts as the private sector descended upon the mountains of Pennsylvania to lock in leases that would facilitate gas extraction. Pennsylvania Cooperative Extension responded immediately to this event, developing and presenting a variety of educational programs to landowners, state regulatory agencies, and local municipal officials. We have developed a comprehensive educational program (summarized at <http://naturalgas.extension.psu.edu/>) that is now widely used as a reference point across the region. Well over 10,000 Pennsylvania residents have attended our educational programs, and, partly through this education, lease values have increased nearly ten-fold. This money is flowing into rural communities in Pennsylvania, and we have engaged AES researchers to evaluate the impacts on local economies, how some of this money might be captured for local infrastructure enhancement, and how state policies might be shaped to encourage local investment of this new-found wealth (which will continue past the near-term in the form of royalties on extracted gas should the deposits produce as anticipated). In addition to economic and sociological questions, there are a number of researchable topics around environmental issues in Marcellus shale extractions. The gas is removed from these deposits by a technique known as "hydrofracing," which involves injecting large quantities of water into the gas wells and then pumping that water back out to initiate the flow of gas. Both the injection of water (source of water) and the removal of the water (treatment needs prior to disposal) are critical environmental issues. There are also questions about the impact of roads into undeveloped landscapes and the likelihood of invasive species spread and wildlife disruption, threats to farmland, and implications for timber extraction that must be addressed by our AES scientists. In addition to these issues that are core to our AES and CES operations, there are also technical issues around the extraction technologies themselves and the distribution of extracted gas. To assist in these matters, CES educators are partnering with experts in our College of Earth and Mineral Sciences in another example of cross-campus interdisciplinary interaction. Our resource materials, based on the best science available, are very thorough and have been cited by a variety of stakeholders as critical to decision-making at many levels.

Two explanatory notes are necessary regarding the report that follows. These queries were raised in USDA-CSREES responses to our FY2007 Annual Report of Accomplishments. First, PA CES does not currently have a mechanism in place for capturing youth contact data. The direct and indirect contact grids throughout the report have been completed only with data we currently collect. Discussions are ongoing on how to capture and report these data for subsequent reports but will not be in place

until FY 2010 at the earliest. Second, PA CES captures data on contacts (direct and indirect) and participants. We consider participants to be the number of individuals who attend our programs that we offer. Our contact numbers are derived from the number of people each of our extension educators and/or faculty have contacted via face-to-face meetings, emails, telephone conversations, videoteleconference, Adobe Connect sessions, etc. For instance, if three extension educators talk to a group of 10 farmers at a meeting, this event would reflect 30 contacts but only 10 participants. We have revised our 2010 Plan of Work to capture "number of people enrolled or registered in program" rather than participants.

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>). The latter also contains links to podcasts, blogs, and news releases conveyed by other media regarding AES and CES programs.

Total Actual Amount of professional FTEs/SYs for this State

Year:2008	Extension		Research	
	1862	1890	1862	1890
Plan	319.3	0.0	644.2	0.0
Actual	271.1	0.0	298.5	0.0

II. Merit Review Process

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

- Internal University Panel
- External University Panel
- External Non-University Panel
- Combined External and Internal University 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
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals

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. Also part of the Ag Council membership are such organizations as the Chesapeake Bay Foundation and the County Commissioners Association of Pennsylvania – we seek input for all sectors representing the interest of Pennsylvania citizens. 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. For example the following groups provide valuable feedback – Pennsylvania Nutrition Education Network, the Intergenerational Initiatives Advisory Group, the StrongWomen program leaders, the PROSPER program collaborators, and the PA Office of Financial Education. Penn State has a well-developed organizational structure for interacting with industry; our Industrial Research Office serves as a liaison to specific industrial partners. Also in our stakeholder base are state and federal partners; we have regularly scheduled meetings with agencies such as the Pennsylvania Department of Agriculture, the Pennsylvania Department of Environmental Protection, 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. County advisory committee members are selected to represent program areas, emerging issues, geographic areas, and population diversity. These groups help extension educators with program design and implementation, which may include identifying resources to support the programs, tailoring the content to specific audience needs, and marketing the programs to targeted audiences and communities.

In the establishment of 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. Penn State Agricultural Council meetings are publicly announced, and our broad representation is constantly reassessed to ensure that new and traditionally underserved audiences are included.

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

1. Methods for collecting Stakeholder Input

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

Brief Explanation

To collect stakeholder input, educators or faculty met with advisory committees, individuals, or solicit input at educational meetings. During and after extension educational programs, program participants request additional programs, updates, or make suggestions on new topics where an educational program would be helpful to them. This input may be verbal only or collected in meeting survey instruments. To collect more detailed information from traditional and non-traditional stakeholders, sophisticated survey instruments or focus group meetings are implemented and the data collected were summarized. The request of information from county extension offices through telephone calls is also a measure regarding needs of clientele. If similar information is requested repeatedly, that is a sign that an issue is of concern to the public.

3. A statement of how the input 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. Stakeholder feedback also indicates where volunteers and donors would be interested in assisting with the program.

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 development, 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. More recently we learned that issues related to natural gas (Marcellus Shale) exploration and extraction were on many stakeholders' minds. 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, environmental protection and emergency preparedness. Farmers need cost-effective solutions that minimize environmental impact, and citizens and local officials are seeking input into regulatory decisions that guide land and water use policies. Practical research-based information is in high demand for food safety, nutrition, consumer issues, and for preparing the workforce for child care, food service, and human service agencies. Strategies for effectively working with diverse audiences including youth are a topic in high demand. Families seek involvement in the 4-H Youth Development program because they know it offers an opportunity for youth to learn leadership, citizenship and lifeskills.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
9335822	0	6302678	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	9177607	0	6848226	0
Actual Matching	18143443	0	29672187	0
Actual All Other	19005268	0	30842253	0
Total Actual Expended	46326318	0	67362666	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years				
Carryover	657661	0	3309602	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

Program #1**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	7%		10%	
212	Pathogens and Nematodes Affecting Plants	16%		13%	
311	Animal Diseases	13%		13%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	10%		10%	
404	Instrumentation and Control Systems	5%		5%	
501	New and Improved Food Processing Technologies	10%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	17%		17%	
722	Zoonotic Diseases and Parasites Affecting Humans	12%		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: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	8.7	0.0	186.2	0.0
Actual	14.0	0.0	68.0	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
473431	0	949597	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
935939	0	4439602	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
980396	0	8896593	0

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

Food safety was a recurring theme throughout 2008, and efforts to examine the food chain from farm to fork have been a priority. Work was initiated that examines on-farm factors influencing downstream safety of the food system, including characterization of various food-borne pathogens at different locations in the food production/processing/distribution system. This research will permit risk assessment of contamination at different locations within the food system, leading to methods for risk mitigation. Part of the ability to trace pathogens in the food supply depends upon development of robust diagnostic methods. New tools emerge from advances in laboratory techniques and from better understanding of the biology of the systems themselves. Progress on the Pest Information Platform for Extension and Education (PIPE), described as an Asian Soybean Rust tool in our 2007 report, has allowed us to greatly extend the capacity of this decision support tool. These results are reported under the Planned Program on Pest Management, where significant progress in implementation has been made, but the continued development of this tool has implications for biosecurity – a decision support tool must be highly adaptable to be useful with emerging threats. Continued collaborations of AES scientists in the campus-wide Penn State Center for Infectious Disease Dynamics (<http://www.cidd.psu.edu>) also contribute to this planned project. We have made progress in methods for rapid vaccine development and have contributed to a variety of analyses of the dissemination of disease agents.

Combining research and education, a key outcome in 2008 was the development of a Good Agricultural Practices (GAP) audit for the mushroom industry (<http://foodsafety.cas.psu.edu/mush/MshrmFrmFdSfty.pdf>). This tool was developed proactively in cooperation with the mushroom industry in Pennsylvania to address the growing demand among retailers and consumers for accountability in food production practices. Penn State Cooperative Extension is working with producers in the industry to implement the GAP audit process. The tool is currently being translated into Spanish for further penetration into the industry.

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), ServSafe®, 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. The farm related fatality rate has declined between 1980–1984 and 2000–2004. All analyses that follow are based on the 135 deaths during the 2000–2004 period: the 27 deaths in 2000, 34 deaths in 2001, 20 deaths in 2002, 30 deaths in 2003, and 24 deaths in 2004. Overall, the average death rate per 10,000 farms declined over the 25-year period. Importantly, the rate of fatalities per 10,000 farms has also declined significantly, suggesting a positive impact on efforts to reduce unintentional injury and death on Pennsylvania farms. Farm and agricultural injury deaths in Pennsylvania have fallen from a mean of 7.6 per 10,000 farms in 1990–1994, to 4.6 per 10,000 farms in 2000–2004—a 39 percent improvement. 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
2008	14198	19886	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	6

Patents listed

Serial No.: 61/047,268; Filed: 04/23/08; Title: Methods and Compositions for Improving the Nutritional Content of Mushrooms and Fungi

Serial No.: 12/036,808; Filed: 02/25/08; Title: Use of an Avirulent Bordetella Mutant as a Live Vaccine Vector

Serial No.: PCT/US2008/054902; Filed: 02/25/08; Title: Use of an Avirulent Bordetella Mutant as a Live Vaccine Vector

Serial No.: 61/022,684; Filed: 01/22/08; Title: AKT Regulation for Treatment of Disease States Associated with RNA Virus Infection

Serial No.: 61/077,252; Filed: 07/01/08; Title: Methods and Compositions Comprising Small Molecules which Target Viral Transcription

Serial No.: 61/058,350; Filed: 06/03/08; Title: Compositions and Methods for Eliciting a Protective Immune Response to Bordetella

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	15	128	
2008	0	0	179

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of invention disclosures

Year	Target	Actual
2008	5	4

Output #2

Output Measure

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

Year	Target	Actual
2008	9800	10978

Output #3

Output Measure

- Number of research projects completed on agricultural and food biosecurity

Year	Target	Actual
2008	16	11

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

O No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills related to agricultural and food biosecurity issues
2	Number of participants who were evaluated in a follow up and who implement/adopt practices related to agricultural and food biosecurity issues
3	Number of decision support tools adopted based upon predictive modeling research
4	Number of diagnostic tools implemented or adopted for threat identification

Outcome #1**1. Outcome Measures**

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	6500	5036

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

Consumers are becoming more aware of the fragile nature of the food and agriculture system. Numerous food and agriculture safety and security incidents have resulted in a more knowledgeable, yet more cautious, public. Spinach, tomatoes, peppers, chili peppers, processed beef, dairy products, peanut butter, animal and plant disease outbreaks, and other food and ag incidents have illustrated the need to provide educational intervention across the food production system.

What has been done

Extension faculty and staff have provided food and agriculture biosecurity education to producers, processors, restaurants, retailers, and the general public. Quality assurance programming for agriculture commodity producers provides awareness and knowledge to enhance the safety of ag products. HACCP training for food processors helps identify areas in need of improvement. ServSafe(r) training provides restaurant personnel with knowledge necessary to make decisions for safe food preparation. Food safety and nutrition education helps consumers understand how to minimize and eliminate risks associated with food purchase, storage, and preparation, and how to understand food recalls.

Results

Producers: Increased knowledge and awareness occurs as the result of educational programs for producers in the following subject areas: quality assurance training, implementation of best management practices at the production level, IPM and acceptable pest management practices, nutrient management and water quality, disaster and risk management, business planning, genome and variety selection for pest resistance, sustainable ag components, farm vulnerability and biosecurity risk assessment, plant and animal health, strategic antibiotic use, and new and emerging plant and animal diseases.

Processors: Increased knowledge and awareness occurs as the result of educational programs for processors in the following subject areas: HACCP, quality control across the processing system, pathogen control processing, HACCP for schools, and ServSafe(r).

Public: Increased awareness as a result of educational programs in the following subject areas: food systems issues such as food spoilage, food recall, food storage, home food processing, zoonotic diseases, West Nile Virus education, food preparation, and diet health and nutrition.

Inter- and intra-agency: Extension programs have helped with the facilitation and integration of biosecurity education and collaboration with local, state, and federal agencies and organizations with responsibility around food and agriculture safety and security.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
501	New and Improved Food Processing Technologies
723	Hazards to Human Health and Safety
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #2**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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	2100	333

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

The safety and security of our food system is dependent upon the continuous monitoring of all aspects of the food system from producer to consumer. Knowledge needs to be implemented to assure the safety and security of the food and agriculture sector. The adoption of science-based research by stakeholders is critical for successful Extension programming. We must remain vigilant about our food and agriculture system. Our public expects a continuous supply of safe food.

What has been done

Extension educators provide educational information to a diverse group of stakeholders in the area of Food and Agriculture Biosecurity. Education occurs through one-on-one and group informational meetings, through conferences and workshops, through distribution of fact sheets and informational articles, and through radio, television, newspaper, and web-based delivery. Interaction with advisory groups and responding to emerging issues with educational programming meets local needs for a diverse group of stakeholders.

Results

Producers: As the result of Extension programs, producers have adopted and implemented various management practices including: risk management plans, business plans, implementation of infectious animal disease control measures, improved genetics and varieties for environmental enhancement and pest resistance, nutrient management plans, on-farm composting, vulnerability assessments and action plans for improved biosecurity, adoption of best management practices for quality assurance, food products recall plans, farm emergency plans, and improved farm safety procedures.

Processors: As a result of extension programs, processors have implemented enhanced quality control procedures as identified through HACCP and risk and vulnerability assessment, planned implementation in the event of a food safety recall or incident, installed improved processing equipment to minimize/reduce potential contamination, adopted improved receiving, storage, and staging of ag commodities and food products, and adopted more stringent tolerance levels of potential contaminants.

Public: Adoption of accepted recommendations for purchase, transport, storage, preparation, and serving of all foods and improved confidence in the food recall system awareness is evident through direct observation of clientele.

Inter- and intra-agency: Extension programs have allowed for facilitation and participation in state and regional food systems tabletop exercises, facilitation and expertise with other state and federal agencies for development and delivery of improved federal guidelines for FEMA Target Capabilities List (TCL) for the local, state, and federal response to a significant animal disease outbreak, and improved interaction and communications within and between local, state, and federal agencies with responsibilities for food and agriculture emergency responsibilities.

4. Associated Knowledge Areas

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

Outcome #3**1. Outcome Measures**

Number of decision support tools adopted based upon predictive modeling research

Not reporting on this Outcome for this Annual Report

Outcome #4**1. Outcome Measures**

Number of diagnostic tools implemented or adopted for threat identification

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	1

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

Listeria monocytogenes is an important causative agent for foodborne illnesses. Current methods for characterizing the particular strains and clones of this microbe do not fully diagnose the origin of particular outbreaks.

What has been done

Methods to characterize Listeria monocytogenes strains have been developed using multi-virulence-locus sequence typing (MVLST), a new approach that examines the DNA sequence of particular genes implicated in microbe virulence. The sequence data are a more powerful and informative approach than previous tools that involve looking at restriction enzyme cut sites in the microbe chromosomes. These tools have been incorporated into a PCR-based assay, and historical reference data have been generated using type collections and vouchers from past disease outbreaks.

Results

A partnership with USDA-FSIS and USDA-ARS has documented the strains of an epidemic clone of Listeria monocytogenes that is found in ready-to-eat meat processing plants in the northeast U.S. USDA-FSIS is using this information to examine their risk-based inspection programs. Further screening of microbe strains using this tool, in collaboration with FDA, is leading to a clearer understanding of the power of the MVLST approach to inform foodborne illness epidemics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
404	Instrumentation and Control Systems

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Competing Public priorities
- Competing Programmatic Challenges
- 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 2008, weather conditions varied over the season and across the state influencing disease and mosquito populations. National news of food borne illnesses, such as E. coli, raised concerns about food safety. In response to these continuing food safety issues, national and regional food chains and USDA are beginning to prepare farmers for new Good Agricultural Practices (GAP) that will be required to sell their produce to these retailers. Changing local needs influence the types of programs requested.

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

- After Only (post 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 section.

Program #2**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
112	Watershed Protection and Management	5%		0%	
123	Management and Sustainability of Forest Resources	5%		0%	
133	Pollution Prevention and Mitigation	5%		0%	
141	Air Resource Protection and Management	5%		0%	
201	Plant Genome, Genetics, and Genetic Mechanisms	10%		10%	
205	Plant Management Systems	10%		10%	
301	Reproductive Performance of Animals	10%		10%	
302	Nutrient Utilization in Animals	10%		10%	
306	Environmental Stress in Animals	5%		10%	
307	Animal Management Systems	10%		10%	
502	New and Improved Food Products	5%		10%	
601	Economics of Agricultural Production and Farm Management	5%		10%	
602	Business Management, Finance, and Taxation	5%		10%	
604	Marketing and Distribution Practices	5%		10%	
605	Natural Resource and Environmental Economics	5%		0%	
Total		100%		100%	

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	105.5	0.0	220.9	0.0
Actual	67.9	0.0	92.9	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
2298780	0	2735667	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
4544515	0	13133555	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
4760383	0	9960222	0

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

The production of food, feed, fiber, and fuel in agricultural systems is a complex, interdisciplinary endeavor. Choices of production practices have implications not only for the commodities produced but also for sustainability – both environmental and economic – of agricultural operations. Several AES-supported projects examined nutrient issues from the perspective of cropping system and effects on nutrient sequestration and availability. We have also seen a dramatic interest in bioenergy crops continuing into 2008. Our research on winter and spring canola crops in Pennsylvania systems has led to a number of educational programs for growers, discussions with a biodiesel plant to contract for local sources of canola, and the initiation of a new canola pressing business. AES-sponsored research led to commercialization steps for new barley varieties and for a suite of new high-lycopene tomato varieties. Root characteristics identified by researchers in our Horticulture department have been shown to have an important impact on phosphorus acquisition. The traits are now being incorporated into breeding programs to improve common bean varieties that represent a staple protein source in Central and South America and sub-Saharan Africa. Our tree fruit industry, especially in apples, is implementing new orchard management techniques, and AES funding for apple rootstock evaluation has led to recommendations that can be taken to the field as new orchards are planted. Collaboration between an AES scientist and USDA-ARS has led to methods to estimate heritability in economically important traits for several thousand dairy herds simultaneously. Application of this method should improve the accuracy of sire identification in these test herds, improving selection efficiency. Our work on pollinators, particularly honey bees, continued in 2008. The PA AES supported a comprehensive survey of beekeeper practices and honey bee population dynamics that has helped to establish the breadth of the colony collapse disorder (CCD) impact on pollination. In addition to continued work to characterize the impact of diseases and their mite vectors on honey bees, characterization of pesticide levels in honey bee colonies (specifically the wax) has revealed an unexpected diversity of chemical stressors. This knowledge has led to redoubled efforts to work with beekeepers on new hive health measures, which will improve pollination systems even independent of dealing with CCD.

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
2008	131494	506168	0	0

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

Year	Target
Plan:	0
2008 :	2

Patents listed

Serial No.: 61/047,268; Filed: 04/23/08; Title: Methods and Compositions for Improving the Nutritional Content of Mushrooms and Fungi

Serial No.: 61/037,542; Filed: 03/18/08; Title: High Lycopene Content Tomato Plants and Markers for Use in Breeding for Same

3. Publications (Standard General Output Measure)**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan	20	191	
2008	0	0	398

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Number of invention disclosures

Year	Target	Actual
2008	6	2

Output #2**Output Measure**

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

Year	Target	Actual
2008	198000	107607

Output #3**Output Measure**

- Number of research projects completed on agricultural systems

Year	Target	Actual
2008	41	22

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

O No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills related to improving agricultural production, profitability, and sustainability
2	Number of participants who were evaluated in a follow up and who implement/adopt practices related to improving agricultural production, profitability, and sustainability

Outcome #1**1. Outcome Measures**

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	25000	4020

3c. 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

A key impact has been on nutrient management planning and water quality. To date, certified planners trained by the Cooperative Extension nutrient management education program have written plans for over 2500 farms covering over 600,000 acres in PA. These plans direct the management of over half of the manure produced in PA to achieve both agronomic production and environmental goals. Extension staff conducted numerous workshops, meetings, and field days for producers during 2007 to support implementation of these nutrient management plans on their farms. The impact of this effort is clear. In the latest report card on the Chesapeake Bay, the Upper Bay had the highest Bay Health Index Score (59) of any region in the main stem of the Chesapeake Bay. This score is based on water quality and biotic indices for the Bay. The score is well above the average for the whole Bay (42). This region of the Bay is largely influenced by the Susquehanna River watershed, which lies mostly in PA and is thus a direct indicator of the impact of nutrient management water quality improvement efforts in Pennsylvania.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
302	Nutrient Utilization in Animals
307	Animal Management Systems
306	Environmental Stress in Animals
604	Marketing and Distribution Practices
205	Plant Management Systems
201	Plant Genome, Genetics, and Genetic Mechanisms
301	Reproductive Performance of Animals
602	Business Management, Finance, and Taxation
502	New and Improved Food Products
112	Watershed Protection and Management
141	Air Resource Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #2**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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	3000	1532

3c. 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 learn about new integrated pest management methods, crop and soil management practices, sustainable agriculture systems, and crop marketing and risk management strategies.

Results

The combination of no-tillage and cover crops is key to improving water quality in the Chesapeake Bay. Agronomy educators conducted a coordinated program on no-tillage, which is a critical component of sustainable crop management. Information was provided in winter crop meetings, newsletter and newspaper column articles, field demonstration plots, an online video, and field days. Over six hundred (600) individuals attended winter group meetings each year. In a follow up survey, 53% of participants indicated they would increase no-till plantings. In the fall of 2007 eleven (11) cover crop plots were planted in seven (7) counties. Fall and spring field walks were held at these plots. An online no-till video series developed has been viewed 3000 times. A no-till field day was held each year at the Southeast Research and Extension Center with 230 participants, of which 86% indicated they would adopt one or more of the improved practices. Due to the collaborative effort no-till acreage has increased significantly: the 2004 crop residue survey reported 24% no-till while the 2007 tillage survey, performed by the Ag Statistics Service, reported 50% no-till.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
306	Environmental Stress in Animals
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
602	Business Management, Finance, and Taxation
302	Nutrient Utilization in Animals
502	New and Improved Food Products
301	Reproductive Performance of Animals
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
123	Management and Sustainability of Forest Resources

112	Watershed Protection and Management
605	Natural Resource and Environmental Economics

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

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

Brief Explanation

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 section.

Program #3**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
607	Consumer Economics	10%		10%	
608	Community Resource Planning and Development	10%		10%	
610	Domestic Policy Analysis	0%		10%	
703	Nutrition Education and Behavior	10%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		0%	
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, Families and Communities	10%		10%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	5%		0%	
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: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	174.4	0.0	37.8	0.0
Actual	149.0	0.0	27.6	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
5042639	0	450927	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
9968920	0	2140531	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
10442450	0	1885057	0

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

Rural communities are a key component of the PA demographic landscape. Understanding the nature of problems and opportunities faced within those communities is a critical component of delivering solutions that matter in the lives of rural residents. AES funds supported follow-up survey work as part of a longitudinal survey of rural Pennsylvanians that began in 1946-47 with the survey of more than 2800 tenth grade students in 74 rural high schools. Six follow-up surveys have tracked a variety of variables. Nearly 900 of this cohort responded to a 2007 survey. Key findings include data on mobility and the importance of a sense of "place" in their lives, a variety of insights into intergenerational issues that can be addressed through extension educational programming, and the increasing importance of health care issues for rural residents. These research data will inform our extension programs, including how we devise educational programs for partner human service agencies and organizations, and our partnerships with other entities within Penn State to conduct further research in rural communities. Work on small farms clusters, leveraged by USDA-NRI funds, examined how networks among participants serve to stabilize or destabilize these local farm-to-market operations. Data collected in this project are changing our extension education to help cluster members establish sustainable networks.

Our continued focus on Women in Agriculture, a historically underserved constituency in PA agriculture, led to research-based educational programs in a wide variety of topics. The number of women operators in Pennsylvania has increased by nearly 20% from the 2002 to the 2007 Census of Agriculture, but the number of female principal operators has increased by an astounding 40%. This is a priority audience for our science-based programs. More than 95% percent of attendees reported they would change a practice on their operation from knowledge gained, and nearly 90% of attendees wished to take responsibility for developing and hosting an educational event at their farm or business.

Family programs promote family strengths and resiliency, and help communities become positive environments for families. Parenting programs improve communication and life skills, quality child care, youth development, and coping with stress and change. 4-H Youth Programs are designed to help children 5 to 18 develop into healthy and productive adults. Our youth programs provide educational curriculum designed to teach life skills, such as leadership and citizenship. These programs reached about 180,000 children in 2008. Evidence based programs such as PROSPER (Promoting School-community-university Partnerships to Enhance Resilience) are designed to improve the health and well-being of youth and families. Nutrition education programs increase healthy eating behaviors and address chronic disease issues such as heart disease, 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
2008	306278	622078	0	0

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

Year	Target
Plan:	0
2008 :	1

Patents listed

Serial No.: 61/077,252; Filed: 07/01/08; Title: Methods and Compositions Comprising Small Molecules which Target Viral Transcription

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	7	67	
2008	0	0	124

V(F). State Defined Outputs

Output Target

Output #1

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
2008	320000	205933

Output #2

Output Measure

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

Year	Target	Actual
2008	6	9

Output #3

Output Measure

- Number of invention disclosures

Year	Target	Actual
2008	{No Data Entered}	1

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

O No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills related to strengthening families, youth, communities and improving nutrition and health
2	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

Outcome #1**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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	95000	27177

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

Good nutrition and physical activity are vital for good health and overall well-being. Specific diseases and conditions linked to a poor diet and lack of physical activity include osteoporosis, heart disease, hypertension, obesity, and some types of cancer. Strengthening muscles and bones improves balance and flexibility, improves arthritis symptoms, and reduces the risk of unintentional falls and bone fractures in older adults. By reducing bone fractures, significant hospitalizations and health costs are saved.

What has been done

The Strong Women's program, a weight bearing physical activity and nutrition education program, consists of 8-12 classes that target all the major muscle groups. Participants are encouraged to lift an appropriate amount of weight for their ability using proper form and safety and to increase the intensity throughout the class for the most impact. Instructors provide ongoing feedback, assistance and support to participants, as well as leadership and inspiration to enhance compliance and success. Over 350 leaders have been trained during the five last years and over 5,000 participants have been in the program during that time.

Results

Participants perceived their involvement in the program improved their general health. The majority reported that they felt physically stronger, their balance improved and many who suffered from joint pain, had less pain and were able to increase their physical activities. Of those completing the evaluation in the last year, 367 participants reported an increase in healthful food choices. Also, 632 made recommended lifestyle changes such as reading labels for nutritional content, increasing calcium and vitamin D consumption, eating more fruits, vegetables and whole grains, and adding more exercise, such as walking. In addition, 291 reported improved health indicators e.g. lab test results and BMI since beginning the program. The Senior Fitness Test, a battery of tests to assess physical fitness in older adults, is used to measure strength, endurance, flexibility, agility, and balance. Most of the participants show a moderate to significantly improved scores comparing the pre and post assessments.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
801	Individual and Family Resource Management
724	Healthy Lifestyle
607	Consumer Economics
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

Outcome #2

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	36000	15490

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

The dramatic increase in childhood overweight and obesity has profound health implications, including the increase of type 2 diabetes, high blood pressure, and breathing and heart problems. Economic and demographic factors have shifted the emphasis of health care to increasing wellness, wherein appropriate food choice and exercise patterns are of great importance. As health care becomes less available to significant portions of the population, local community access to health and wellness programs are greatly needed so that the current negative health trends are reversed.

What has been done

The Family Fitness program, run as an after-school program with evening or weekend family meetings and parental learn-at-home materials, offers to help all children (ages 8 to 12 years of age) and their parents to address diet quality and a healthy level of physical activity. Children attend 9 weekly sessions to practice making healthy food choices and increase physical activity through guided discussions and activities. Parents participate in 5 separate 1.5 hour weekly meetings to receive information, develop hands-on skills, and motivational guidance leading to improved food choices, physical activity, and family support. We have partnered with 34 elementary schools to reach participants throughout rural PA.

Results

Children's and parent's knowledge, attitude and behavioral changes for healthy eating, nutrition knowledge, family communication, and physical activity were assessed, using pre, post and 5-6 month follow-up evaluations and physical measurements. In the past two years, with 611 youth and 395 parents or care-giving adults or grandparents as participants, we saw significant improvement ($p < .05$) for children in healthy eating behaviors, increased minutes of physical activity and ease of physical activity, and less sedentary screen time. There were significant improvements for ($p < .05$) for parents and ($p < .05$) child in improvement communication and goal setting for healthy eating, increased physical activity together, planning and preparing meals together. The child physical measurements included at 6 month post program resulted in 61% meeting our goal of not increasing their Body Mass Index measurement. Their systolic blood pressure mean decreased by 6.2 significant at $p < .01$. In the last year 163 educators were trained to run programs in schools, YMCA's, and 4-H Camps.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
607	Consumer Economics
724	Healthy Lifestyle
806	Youth Development
608	Community Resource Planning and Development
801	Individual and Family Resource Management
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

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

- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges
- 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 setting priorities 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)
- Time series (multiple points before and after program)
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- 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 section.

Program #4**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	10%		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%	
131	Alternative Uses of Land	10%		10%	
133	Pollution Prevention and Mitigation	10%		10%	
135	Aquatic and Terrestrial Wildlife	5%		10%	
141	Air Resource Protection and Management	5%		5%	
403	Waste Disposal, Recycling, and Reuse	10%		10%	
511	New and Improved Non-Food Products and Processes	10%		5%	
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: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	20.9	0.0	123.8	0.0
Actual	20.8	0.0	59.9	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
705665	0	1222340	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1395047	0	5943761	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1461313	0	5127775	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. Our efforts in research and extension are diverse and extensive. We concluded studies on constructed wetlands to mitigate food processing waste (2 year study) and to mitigate domestic waste at a campground (10 year study) and passed the findings on to the Pennsylvania Department of Environmental Protection and the USDA-NRCS, both of which were involved in permitting and designing these experiments. A very significant finding was the need for regular maintenance in these "passive" systems to maintain their function. The agencies are comparing treatment data to design criteria and incorporating new design criteria into their permitting functions as appropriate. AES-supported scientists have developed baseline emission monitoring strategies for livestock, particularly poultry, operations. These methods are being used in studies to demonstrate the efficacy of layer hen diet to reduce ammonia emissions and the ability of vegetative shelterbelts to reduce odor from poultry facilities. Methods developed and validated by PA AES scientists have been incorporated into methods used in other university- and industry-sponsored studies. Work on mine soil reclamation using a mixture of composted or fresh poultry litter with paper mill sludge has demonstrated a high capacity for carbon and nitrogen sequestration, which could facilitate not only environmental quality but also the possibility of using these lands for biomass crop production. Acid deposition has many indirect effects, including negative impact on invertebrates that serve as food for migratory birds. AES-supported research on ovenbirds has shown that application of lime in habitats subject to acid deposition the increase in pH and calcium was correlated with an increase in snails, which subsequently supported higher nesting populations of ovenbirds.

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. Extension has put a high priority on educational programs to protect our air and water resources and to help reduce our dependency on petroleum based energy resources. Response to commercial exploitation of natural gas in the Marcellus shale deposits throughout a large portion of PA has focused on educational programs that have implications for rural community financial health and vitality, but also address the impacts on fresh water (extraction requires large amounts of water and discards contaminated water as a by-product) and forest fragmentation, with implications for invasive species spread and wildlife effects.

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
2008	33076	89089	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	2

Patents listed

Serial No.: PCT/US2008/064694; Filed: 05/23/08; Title: Compositions and Methods Relating to Transgenic Plants and Cellulosic Ethanol Production

Serial No.: 12/126,569; Filed: 05/23/08; Title: Compositions and Methods Relating to Transgenic Plants and Cellulosic Ethanol Production

3. Publications (Standard General Output Measure)**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan	13	127	
2008	0	0	289

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Number of invention disclosures

Year	Target	Actual
2008	1	0

Output #2**Output Measure**

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

Year	Target	Actual
2008	50000	23618

Output #3**Output Measure**

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

Year	Target	Actual
2008	21	15

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

O No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills related to enhancing water quality and sustainability of private forest lands
2	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

Outcome #1**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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	4000	3091

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

Land use decisions with the potential for significantly impacting water quality are made at the local level in Pennsylvania. With over 2500 municipal divisions governed by volunteer, elected and appointed officials, watershed literacy is critical for equipping decision makers on sound land use and development choices that will protect water quality - aquatic resources and drinking water. K-12 and adult nonpoint source education is critical as new threats-, policies-, and management challenges continue to emerge. In addition, the lack of state regulations governing the protection of and well design standards for private water systems leaves the rural population that does not have access to public water supplies at heightened risk for exposure to water contaminants.

What has been done

Research based, nonpoint and point source educational programs target K-12 population and adult learners. The Master Well Owner Network (MWON), by design, increases the pool of knowledgeable individuals who can significantly extend extension's expertise. Programs were developed and delivered that use existing tools like Enviroscares for increasing understanding of nonpoint source pollution movement and incorporated new tools and approaches to address emerging water quality issues ranging from pharmaceutical (human and animal) contamination of aquatic resources to the increased risk to ground- and surface water associated with heightened natural gas exploration and extraction were developed and delivered.

Results

Over 3,090 participants in drinking water programs demonstrated an increase in their water knowledge. Another 2,653 individuals implemented a recommended action or best management practice (BMP) to improve water quality. Six hundred and sixty seven individuals identified that they had implemented a BMP related to water quantity. Through MWON, completion of voluntary testing of private wells statewide has resulted in the identification of private water systems not meeting drinking water standards. Owners of these systems were notified and provided guidance on action planning to reduce contaminants in their private drinking water system. Safe drinking water clinics trained 5,873 individuals on protection of their private drinking water (well) source, including increased participation in the regions of the state where Marcellus Shale-natural gas drilling is occurring or slated to begin. There were 1,262 participants in pond and lake management programs of which 70% indicated an increased knowledge about nonpoint source pollution management practices to decrease eutrophication within their lotic system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
102	Soil, Plant, Water, Nutrient Relationships
101	Appraisal of Soil Resources
605	Natural Resource and Environmental Economics

403	Waste Disposal, Recycling, and Reuse
131	Alternative Uses of Land

Outcome #2**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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	2000	2653

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

In Pennsylvania, recent research shows that there are 200,000 more private forest owners than earlier estimates by the US Forest Service (550,000). Forest owners are diverse in their goals for management of the natural resource, requiring both innovative and traditional outreach approaches. These private forests provide critical ecosystem services that benefit all Pennsylvanians. Ecosystem services provided by private forests include: carbon sequestration potential, habitat, biomass potential, and protection of high quality riparian systems (particularly first- and second order streams and wetlands). Conversion of private forests to other land uses or land covers can compromise the value and extent of the ecosystem services provided by the forests' current or improved management state.

What has been done

Forest stewardship training for private forest owners seeks to support land management goals through the provision of science-based research coupled with best management practices. Programs and tools utilized to improve forest stewardship include peer-to-peer training, web seminar series with certified forest education credits, publication of 'Forest Leaves', Forest Story Cards to facilitate dialogue with multiple audiences, cultivation and technical support for local/county woodland owners associations, outreach to youth (Junior Forest Steward Program), PA Forest Stewards Website, and income tax- and estate planning programs including succession planning.

Results

Two hundred and eighty-seven volunteers in the PA Forest Steward program provided 22 FTEs of service and interacted with 19,500 peer learners in the identification of improved forest management practices. The Junior Forest Steward Program recognized 2,181 youth - focusing on development of Pennsylvania's next generation of private forestland stewards. Also in support of youth education, the Sustainable Forestry Teachers Resources Center website posted lesson plans that were accessed by an average of 656 daily- and 171,051 annual visitors. In its first year, 200 registered users participated in the live broadcast sessions of the Pennsylvania Forests Web Seminar. Eight to ten times the number of live participants are anticipated to access the online recorded seminars in year one. Forty-seven of Pennsylvania's 67 counties host woodland owner associations with 2,400 private land owners participating.

4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse
102	Soil, Plant, Water, Nutrient Relationships
101	Appraisal of Soil Resources
131	Alternative Uses of Land
123	Management and Sustainability of Forest Resources
605	Natural Resource and Environmental Economics

133	Pollution Prevention and Mitigation
511	New and Improved Non-Food Products and Processes
135	Aquatic and Terrestrial Wildlife
112	Watershed Protection and Management

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

- Natural Disasters (drought,weather extremes,etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges
- 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. In addition, the discovery of a large natural gas reservoir (Marcellus Shale) and exploratory drilling have added to potential impact on the environment and our natural resources. 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(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- After Only (post program)
- Before-After (before and after program)
- Case Study
- Comparisons between program participants (individuals,group,organizations) and non-participants
- 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 section.

Program #5**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
205	Plant Management Systems	5%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	15%		15%	
212	Pathogens and Nematodes Affecting Plants	15%		15%	
213	Weeds Affecting Plants	10%		15%	
215	Biological Control of Pests Affecting Plants	10%		10%	
216	Integrated Pest Management Systems	30%		35%	
404	Instrumentation and Control Systems	15%		5%	
	Total	100%		100%	

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	9.9	0.0	75.5	0.0
Actual	19.4	0.0	50.2	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
657092	0	1489695	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1299022	0	4014738	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1360726	0	4972606	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. The third year of 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. In 2008, over 680 ha of commercial orchards officially participated this program, with substantial additional acreage implementing the same tactics on a voluntary basis. Fruit injury continued to decline in treatment blocks – 30% less damage than observed in 2007 (and 2007 injury had been 70% below 2006 figures). This reduction occurred despite an 88% increase in damage in the conventional insecticide-treated blocks.

Effective implementation of Integrated Pest Management (IPM) systems requires growers to understand 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 development models and disease forecast models have been developed and implemented (PA PIPE - <http://agsci.psu.edu/news/spotlight/pa-pipe>). A decision support tool, Bt Evaluation Tool (BtET), <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. The Sweetcorn Monitoring Network is a northeast regional system (has been extended beyond the Northeast) housed at Penn State to help alert and guide sweetcorn growers in the management of several key Lepidopteran insects. Twenty-nine states contribute data to PestWatch. In a 2009 survey, 73 (41% of) sweet corn producers (ca. 6,790 acres) indicated that they use the website and 46% the weekly alert that comes from the website. In addition, these models and systems can be accessed directly by growers, agricultural input dealers, crop consultants, and personnel in government agencies that assist farmers. Effort is also underway to provide educational programs on the use of cover crops and crop diversity to optimize ecologically-based weed management. Twelve field days were conducted in Maine and Pennsylvania reaching 700 individuals. A follow-up survey in 2008 indicated that 3% had transitioned to organic production, 19% were interested in transitioning, 47% were thinking about cover crops, and 41% had used cover crops to suppress weeds. In addition to these examples, hundreds of educational activities have taken place annually that address pest management across the numerous commodities in Pennsylvania.

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
2008	31348	62001	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	1

Patents listed

Serial No.: 61/037,542; Filed:03/18/08; Title: High Lycopene Content Tomato Plants and Markers for Use in Breeding for Same

3. Publications (Standard General Output Measure)**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan	12	123	
2008	0	0	256

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Number of invention disclosures

Year	Target	Actual
2008	1	4

Output #2**Output Measure**

- Number of research projects completed on pest management

Year	Target	Actual
2008	16	21

Output #3**Output Measure**

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

Year	Target	Actual
2008	21000	26472

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

O No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills related to managing pests in safer, more effective ways
2	Number of decision support tools adopted based upon predictive modeling research
3	Number of diagnostic tools implemented or adopted for pest identification
4	Number of participants who were evaluated in a follow up and who implemented/adopt practices related to managing pests in safer, more effective ways

Outcome #1**1. Outcome Measures**

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	16000	1307

3c. 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. Mis-timing of pest management activities leads to reduced effectiveness and farm profits. 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 Evaluation Tool (BtET), have been developed to help farmers understand the economics of using the technology on their farm. Research and educational programs are underway on the use of cover crops and crop diversity to optimize ecologically-based weed management. Pest management based educational programs are on-going and continue to address all aspect of on-farm management.

Results

Over 10,000 field crop growers have been provided pest management educational programs. Two thousand eighty-five field crop producers, government agency personnel, and other agricultural support industry individuals were trained in pest management practices. A subset of these were trained in the use of predictive models for pest management systems.

4. Associated Knowledge Areas

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

Outcome #2**1. Outcome Measures**

Number of decision support tools adopted based upon predictive modeling research

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	36

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

Producers make pest management decisions in response to a variety of data sets. Models serve as a tool to turn relevant data into understandable scenarios that can serve to inform management decisions.

What has been done

Models based upon geography, meteorology, and crop and pest biology have been coalesced into a single interface. We have used the PA-PIPE (<http://agsci.psu.edu/news/spotlight/pa-pipe>), a collaboration between PA AES scientists and the private sector, to deliver decision management information on temperature conditions, crop phenology, crop disease progression (9 pathogens), insect pest pressure (12 pest species), and weed phenology (8 species). In addition, this tool is used to deliver information on honey bee colony health.

Results

The PA-PIPE decision support system has been accessed through more than 40,000 page views since it went live in late July, 2008.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants
404	Instrumentation and Control Systems
205	Plant Management Systems

Outcome #3**1. Outcome Measures**

Number of diagnostic tools implemented or adopted for pest identification

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	1

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

The introduction of the emerald ash borer (EAB), a destructive invasive species with significant economic implications, requires enhanced detection systems in order to monitor the spread of this insect.

What has been done

EAB mate location is largely a visually-mediated process, with flying males identifying females by sight. Research by AES scientists has demonstrated that the presence of host tree volatiles greatly enhances the efficacy of trap capture.

Results

USDA-APHIS is redesigning EAB traps from a visual-only configuration to a trap that incorporates host-tree volatile odors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
404	Instrumentation and Control Systems

Outcome #4**1. Outcome Measures**

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	363

3c. 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 Evaluation Tool (BtET)). Twelve field days were conducted in Maine and Pennsylvania reaching 700 individuals.

Results

In a 2009 survey of PestWatch users, 73 (41% of) sweet corn producers (ca. 6,790 acres) indicated that they use the website and 46% the weekly alert that comes from the website. Twelve field days on cover crops and crop diversity for weed management were conducted in Maine and Pennsylvania reaching 700 individuals. A follow-up survey in 2008 indicated that 3% had transitioned to organic production, 19% were interested in transitioning, 47% were thinking about cover crops, and 41% had used cover crops to suppress weeds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants
205	Plant Management Systems

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

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

Brief Explanation

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. The continual shifting economics of field crop production, due to world supply and demand and the biofuels industry, also impact the economics of pest management; thus, 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 is having an 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)
- Time series (multiple points 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 section.