2010 Delaware State University and University of Delaware Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Delaware agriculture increasingly operates in a global economy and we face ongoing challenges in our efforts to contribute to ensuring food security for a growing world population, develop innovative means to improve profitability and productivity, protect environmental quality and heal damaged ecosystems. Emerging issues must also be addressed, including climate change, farmland losses to development, food safety, and social issues for families and youth such as reversing the growing epidemic of childhood obesity. Our plan of work includes the following 7 programs intended to provide research-based solutions to the complex, global challenges facing Delaware today. It is important to note that divisions between these programmatic efforts are artificial. Our research and extension efforts are most commonly conducted by multi-disciplinary teams working across programs, in collaboration with colleagues in other disciplines. We also regularly plan and work with stakeholders in other University departments, other governmental agencies, foundations, community groups, universities, and political or policy-making positions.
(1) Global Food Security and Hunger: Delaware agriculture is fully integrated into the global economy and driven by the need to produce a safe and secure food supply for a growing world population. Longstanding components of agriculture in Delaware are animal production,, grain crops and vegetables, aquaculture, soil management and watershed protection, and agricultural and natural resource economics. Animal-based agriculture is one of the largest and most profitable enterprises in Delaware with poultry ($750 million annually) accounting for 76% of the total economic value of agriculture in the state. Livestock industries ($28M income from dairy, beef cattle, swine) are important and aquaculture has emerged as a new sector, in freshwaters and coastal areas with shellfish. For poultry, diagnosis and control of infectious avian diseases is a high research priority, while for all of animal agriculture, research and extension programs focus on key issues such nutrient management and water quality, air quality, food safety, labor, animal welfare, and community relations. Grain crops, vegetable crops for processing and fresh markets, and a growing horticultural industry dominate Delaware agriculture. Most cropland is used for corn, soybean, and small grains, mainly for animal feed,; but interest grows in producing energy crops (barley, soybeans). Crop management depends more than ever on fundamental research on plant genomes and using genomic information to solve production problems. We address advances in field-scale crop management and farm marketing skills to ensure that farmers and the "green industry" remain profitable. Basic studies on plant adaptation to the environment and biotic and abiotic stress are priorities, as are studies on soil microbe-plant relationships and plant/soil interfacial reactions key to plant nutrient use and plant adaptation to contaminated soils. Environmentally sound management of soil resources requires that we address a range of issues impacting air, soil, surface and ground water quality such as efficient use of nutrients in animal and crop production; fate, mobility, speciation, and bioavailability of metals and organic chemicals in soil and water environments; efficient use of ground water for irrigation; safe use of pesticides and herbicides;, and emission of gases and particulates from soils and wastes that can affect air quality, climate change, and human and ecosystem health. We conduct basic research to increase our fundamental understanding of soil processes and applied research and extension programs to develop and implement management strategies that sustain agriculture and other land uses while protecting the quality of our air, soil, and water. Integrating economics with basic and applied research is a key aspect of this planned program. Our economics research foci are international trade and policy, with an emphasis on energy economics and economic development, and natural resource economics, particularly as this relates to land use change, such as conversion of farmland and forests to developed

land uses and formulation of sound policies to preserve agricultural land for future generations; (2) Biotechnology and Biotechnology-Based Agribusinesses: The University of Delaware, in conjunction with the state and private industry, has devoted nearly 25 years to developing research capacity and expertise in basic and applied biotechnology. Areas of existing strength are avian virology, physiology, and genomics and plant molecular biology and plant breeding. In our avian programs, biotechnology is used at the basic level to improve poultry health and immune competence and to understand fundamental mechanisms of avian diseases. At the applied level, biotechnology efforts focus on improving diagnostic testing methods, developing vaccines and other disease control methodologies, surveying for emerging avian disease causing agents, and developing disease resistant breeds of chickens. For plants, basic biotechnology efforts include understanding gene regulation in plants, particularly those associated with RNA turnover or small RNA-mediated gene regulation. Other efforts include understanding disease resistance and signal transduction pathways in plants, understanding nitrogen fixation via the application of molecular and proteomics approaches, and understanding, at the molecular and atomic levels, plant-soil interfacial relations important to nutrient and heavy metal uptake. Key elements of this program include: expanding fundamental, cross-disciplinary research in the avian and plant/soil research areas; applying basic biotechnology research to the development of diagnostic methodologies for plants and animals; investigating new opportunities to apply biotechnology knowledge, such as alternate, bio-based energy sources that make economic sense for Delaware; producing pharmaceuticals, vaccines, nutriceuticals and other products from plants; and a new, high priority - developing biotechnology-based agribusinesses by financial planning, risk management analysis, and evaluation of the marketability and consumer acceptance of biotechnology based products; (3) Natural Systems, Biodiversity, and Wildlife Ecology: Maintaining and restoring renewable natural resources and the vital services provided by healthy ecosystems in Delaware after 400 years of urban and agricultural land use is our focus in this planned program. The impact of past and current land use changes, such as agricultural/forestry practices and encroachment of urban/suburban populations on native landscapes, is not fully understood but is thought to be contributing to the loss of many plant and animal species. Perturbation of ecosystems, such as by fragmentation of wildlife habitats due to development and nutrient enrichment of aquatic resources caused by greater runoff as impervious surface increases, are key areas where the interface between terrestrial and aquatic ecosystems is in need of more research and extension programming. New technologies in agricultural production that include control of insects, weeds, filamentous algae, and plant pathogens are needed to ensure sustainability of agriculture in Delaware while restoring and maintaining biodiversity and natural ecosystems located on farms. Finding ways to replace and sustain biodiversity in suburban landscapes, which today comprise 54% of Delaware, is another priority and is vital to future efforts to sustain natural resources in the face of increasingly rapid land use change from agriculture to more developed land uses; (4) Family and Youth Development: The rapid economic and social changes occurring in Delaware today place high demands on families and communities. These problems are not only confined to rural areas where development and urbanization of farmland are changing the nature of communities and the opportunities for youth, but also are found in our towns and cities. Strong families are the basic building unit for our future citizens, yet those charged with this important responsibility often do not have the time, money, or skills to carry out their family roles in a positive, productive manner. Preparing citizens to take prominent roles in shaping their future and the future of their communities is the fundamental goal of this planned program. Cooperative Extension activities are the major component of this program and focus on: helping Delaware youth develop the leadership and life skills needed to become productive, independent, contributors to our society; increasing the educational opportunities in science, engineering, and technology for youth; providing guidance and training in areas important to financial security of families and to family well-being across the generations; and safe community programs on drug and alcohol prevention and safety training for vehicles, bicycles, pedestrians, farm families, and businesses; (5) Food Safety: The American food system provides consumers with an abundant supply of convenient, economical, high-quality, nutritious, and safe food products. However, foodborne illness still occur in the U.S. Outbreaks of foodborne illness due to microbial contamination continue to be a major but preventable public health problem. While advances in understanding and controlling foodborne pathogens have been significant, new pathogens, new food products, increases in

imported foods, and increasing anti-microbial resistance present new challenges to the nation's food safety programs. Further, despite the fact that Americans have access to an abundant, nutritious, affordable food Our research programs focus on understanding foodborne pathogens and reducing the occurrence of these microbes during pre- and post-harvest by intervention strategies (e.g., high pressure, ultraviolet light, antimicrobial packaging). Extension activities center on food safety education of food handlers and youth; emerging food safety and nutrition issues; and the public education about how to respond to outbreaks of foodborne diseases; (6) Childhood Obesity: This program revolves around development of healthy eating and physical activity patterns. These programs will be delivered by family and consumer science educators, youth agents, paraprofessionals, and trained volunteers. Special emphasis will be placed on minority, low-income and educationally disadvantaged individuals since nationwide data indicate these individuals have a disproportionate share of diet-related diseases, including being overweight. Although many diseases occur more frequently with advancing age, dietary practices in young people significantly affect the occurrence and onset of these diseases. Extension activities center on selecting foods from My Pyramid, meal planning, and food preparation to lose or maintain weight and increasing physical activity; (7) Climate Change: Climate change will create major challenges for Delaware's agriculture and natural resource areas, due to a transition to a warmer climate, characterized by hotter summers and warmer winters, greater annual rainfall, and more extreme weather events. Predicted problems include prolonged droughts, disruptions of key farming operations such as planting and harvesting due to heavy spring and fall rains, higher incidences and more diversity in the types of animal and plant pests (insects, diseases), greater potential for water quality degradation as nutrients move more rapidly and more often to waters via leaching and runoff, and losses of biodiversity in forests, wetlands, and other areas as plants now native to Delaware become stressed and more susceptible to invasions by alien plants and gradually replaced by those more suited to a warmer climate. Sea level rise will lead to problems with salt water intrusion into ground waters used for irrigation, inundation of wetlands and other low-lying natural areas, and intensified flooding, particularly problematic for cropland near the coast that is only productive because of an extensive network of drainage ditches. Our research and extension focus in this planned program will be: (i) improving fundamental understanding of why and how a changing climate affects animal and plant physiological processes related to health and productivity, the transformations of carbon, nutrients, organic chemicals, and toxins in soils, and biodiversity of plants and wildlife in natural ecosystems; (ii) developing cost-effective management strategies to help animal and crop producers and natural resource managers respond to weather extremes, greater pressures from insects and diseases, and sea level rise; and (iii) contributing to the development of climate change policies (e.g., carbon trading) that provide farmers and others with resources needed to adopt practices to mitigate climate change problems.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	52.6	9.9	106.6	13.0
Actual	59.1	8.4	120.6	18.3

II. Merit Review Process

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

- Internal University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel

- Expert Peer Review
- Other (Northeast Cooperative Extension Directors)

2. Brief Explanation

Merit review for Delaware Cooperative Extension consists of five levels of peer and stakeholder review. Extension professionals submit county plans that have been reviewed by their peers within the county and by county stakeholder advisory groups. These stakeholder groups provide input on critical needs and issues within their communities, which is used to develop the county plans. After county plans are complete, stakeholders review them for inclusion of the previously identified needs and issues, as well as, program delivery and evaluation methodologies. Each of these plans includes specific objectives that are examined for relevance, usefulness, and potential impact of the programs. This feedback is used to refine county plans and develop future plans. The second level of review is by college-wide issue teams that are cross-functional and multi-disciplinary. From this review, county plans are combined into a college-wide plan. The third level of review is both within and outside the university community. Copies of the plan are submitted to university administrators and related agency personnel who function as both present and future partners. These individuals are invited to comment on the objectives identified, areas of collaboration, and potential impacts. University administrators are also asked to comment on ways in which we might work across colleges and schools to increase our outreach efforts. A fourth level is with statewide stakeholder groups, including advisory groups, commodity organizations, volunteers, research partners, and state and local funding agencies. These groups are asked to provide feedback regarding objectives, potential impacts, and how it meets their specific needs. The final level is the Northeast Extension directors, who have agreed to share all state plans among each other. This peer review helps states advise each other on opportunities to strengthen individual state plans and ways that we can collaborate across state lines.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey specifically with non-traditional groups
- Survey of selected individuals from the general public
- Other (Permanent advisory committees for extension programs and researc)

Brief explanation.

In the State of Delaware, the University of Delaware and Delaware State University use a multi-faceted approach to secure stakeholder input. We believe in direct contact with people and actively solicit input from a wide variety of clientele, users and stakeholders. College administrators, faculty working on research funded by state and federal agencies or industry, and Cooperative Extension staff regularly request input on the relevance of our research and extension priorities to state and regional problems. Numerous formal opportunities for input also exist and include, but are

not limited to, the following: extension overall advisory committees, extension issue-based advisory committees, strengthening families statewide advisory committee, 4-H volunteers, 4-H Foundation, LINKS, agriculture commodity groups, environmental interests, the green industry, agribusinesses, agriculture associations (i.e., Farm Bureau, Grange, Pork Producers Association, Delmarva Poultry Industry, Soybean Board, Sheep Producers Association, etc.), Master Gardeners, Master Food Educators, and Master Financial Planners. We meet with these groups on a regular basis and request their input on our programs and encourage their involvement in all of our planning efforts.

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments

Brief explanation.

Stakeholders are identified by a combined effort of college administrators, research and teaching faculty, and cooperative extension staff. We are very familiar with our traditional agricultural stakeholders and have established a number of advisory committees, at the county and state levels, to provide input on our research and extension programs. Similarly, we have long-standing contacts and good relations with many individuals, organizations, and agencies involved in the natural resource and environmental matters important to our research and extension programs. We work hard to ensure that these committees represent the range of agricultural production systems present in the state, the interests of those concerned about natural resources and the environment, and the social and economic issues related to communities, families, and youth development. We also take proactive steps to ensure that our advisory committees encompass the increasing diversity (age, gender, background, ethnic group) of our stakeholders. When new issues come forth, or a need for re-organization and re-direction of an existing program arises, we often establish focus groups composed of a mix of individuals internal and external to our universities to help guide our planning and to ensure that all interested parties are contacted for input. As appropriate, we also will use surveys and open listening sessions to solicit input from the public.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Meeting with invited selected individuals from the general public
- Other (Meetings with permanent advisory committees)

Brief explanation.

We hold a variety of regular meetings across the state, which include a diverse mix of clientele, users, and stakeholders. These meetings include such things as: Agriculture Visiting Committee, State Chamber of Commerce, Kids County Advisory Council, Delaware Public Policy

Institute Task Force, Friends of Agriculture Breakfast series, Council of Farm Organizations, USDA Food and Agricultural Council, State Agriculture Technical Committee, and user groups like 4-H regular and day camp parents. Students enrolled in our colleges, faculty, professionals and salaried staff, are all encouraged to provide input on program priorities. We have conducted random surveys of users and non-users of the programs and activities on a variety of issues including land use and economic development. Other tools that we use to get input include visioning processes and focus groups. For the Plan of Work, specific stakeholder input was obtained via a committee assembled by the Delaware Secretary of Agriculture to participate in the develop of a statewide plan for agricultural research. This committee consisted of leaders in agriculture as well as faculty and administrators from the University of Delaware and Delaware State University. All of these efforts have been focused on both building commitment and getting input from stakeholders such as government agencies, industry partners, and regulatory agencies. Our programs have expanded and input continues to increase. We are recognized as a source of not only useful but also reliable information. We will continue to seek input in a variety of ways. These methods will chang

3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- To Set Priorities

Brief explanation.

We value all input from our stakeholders and use it to guide a number of our applied research and extension programs. It is particularly valuable in our efforts to make sure that any new and emerging agricultural, environmental, and social issues are identified early and that programs are developed to address them effectively. We carefully consider stakeholder input in our periodic reviews of extension programs to ensure that our goals are up-to-date and that we have the appropriately trained staff in place to meet these goals. We also use stakeholder input to identify areas where research is perceived to be needed. In some cases, where an adequate research base is already available, we respond through an increased extension effort to communicate research findings to end-users. However, if stakeholders identify areas where new or expanded research is needed, we use their input to strengthen our requests for research support from funding agencies and to identify partners that can collaborate in research projects.

Brief Explanation of what you learned from your Stakeholders

Key Stakeholder Input Items for CSREES Attention: What did you learn from your Stakeholders? While our stakeholders have many and diverse interests and concerns, the following continue to be areas of high immediate importance to them and for the state of Delaware and USDA-CSREES:

1. Energy- as it dramatically affects both the costs of producing poultry and livestock, agricultural crops and the future of nature and management of cropping systems, the impact of energy, and the economic volatility associated with energy supply, on agriculture remains a high priority area today. How will the poultry industry, poultry growers, and crop farmers adapt to the competing demands from food and energy markets for their products in a manner that sustains profitability and protects the environment?
2. Land use change and farmland preservation- as the economic pressure to convert farmland to suburban and urban uses grows ever-greater, how will we sustain our agricultural land base to produce food, energy, fiber, and other products? How will the ecological and environmental benefits

associated with agriculture be provided if crop land is converted to development? The importance of this to Delaware was recently highlighted by two commitments by the Governor - first, to provide $10 million to restore budget cuts to Delaware's nationally recognized farmland preservation program; and second to establish a Delaware Young Farmers Program, offering $3 million of the $10 million for low- or no-interest loans to qualifying farmers ages 18-40 to buy farmland on the condition that they permanently preserve the land for agriculture.

3. Water and air quality- despite intensive efforts to develop agricultural management practices that protect water quality, nonpoint pollution of ground and surface waters remains a serious problem. Recent changes at the federal level, particularly the proposed TMDL for the Chesapeake Bay and the newly required (for each Bay state) Watershed Implementation Plans are creating even greater pressures for farmers and others to efficiently manage fertilizer and manure nutrients. Development is competing with agriculture for ground and surface water raising concerns about water supply in the future, a serious concern given the importance of irrigation to crop production on the sandy, drought-prone soils of Delaware. Air quality concerns are growing, particularly for animal agriculture. Global climate change offers new opportunities for farmers and foresters as interest in biological approaches to sequester carbon grow rapidly. Will an integrated approach to the water and air quality problems facing agriculture today emerge to support research and guide policies that enhance agriculture in the future?

4. Farm labor- demands and opportunities in other sectors increasingly make it difficult for farmers and other sectors of the agricultural community to hire and retain qualified labor. Many farmers are also concerned about the future of agriculture due to the major economic hurdles faced by young men and women who wish to pursue agriculture as a career. As noted above, these challenges are directly linked to the need for policies that can preserve farmland, resolve complex immigration issues, and more rapidly advance the mechanization of agriculture. How will national policies affect our ability to sustain a viable population of farmers, maintain a stable farm labor base, and increase investments in the innovative technologies needed to increase agricultural productivity in the face of all these challenges?

5. Irrigation- major droughts in 2 of the past 5 years have emphasized the need for a statewide, long-term strategy to increase the amount of irrigated acreage and be more efficient in our irrigation practices. A statewide irrigation team (PIER: Panel on Irrigation Extension and Research) has been established to integrate the efforts of the universities, state and federal agencies, the irrigation industry, crop consultants, and farmers to improve the efficiency of irrigation and fertigation (applying fertilizers via irrigation systems). This will both increase agricultural profitability and help protect water quality by increasing nutrient utilization efficiency by irrigated crops, particularly with respect to corn and nitrogen management. Extension education programs on the latest advances in irrigation technology and research on nutrient management for irrigated grain and vegetable crops are priority areas for the next decade.

6. Food safety - Seemingly constant outbreaks of food-borne illnesses and the growing demand for "local" foods due to their presumed greater safety and nutritional value are areas of increasing importance for Delaware's poultry and vegetable industries in particular. Research on the causes of foodborne illness is growing rapidly, from the molecular to applied scales. At the same time, growing pressures for new food processing technologies have led to increased research in areas such as non-thermal food processing. Expanding local demand for more food safety education is being met by Extension through Servsafe for professional food preparers, Dinesafe for volunteer and casual food preparers, safe canning workshops and Good Handling Practices on the farm.

7. 4-H Youth Development- Delaware 4-H continues to address high areas of need of youth, their families and communities in which they live. Examples of these programs include: a) Operation Military Kids Program that serves youth and their families from all branches of the military both active and reserve; b) daily afterschool and summer programs at five Delaware State Housing Authority complexes reaches 120 youth per day with quality afterschool programming designed to improve grades and reading skills. A sixth site will open this summer; c) Science, Technology, Engineering and Mathematics (STEM) programming continued as a major thrust. For example, the

Tech Wizards program is being implemented statewide. This is a mentoring program supported via grant funds from the Office of Juvenile Justice and Delinquency Prevention that is built around teaching technology skills to youth. 4-H has also received funding from Adobe to implement the Youth Voices project which provides a technology based method for allowing kids to have their voice heard through the use of videography..

8. Master Food Educators- Americans face many challenges related to food safety and nutrition. Complex issues associated with the role of diet in the prevention of chronic diseases such as heart disease and cancer, childhood obesity, and safe food preparation practices often require knowledge and skills that consumers lack. In an effort to expand the delivery of high-quality, cutting edge programs in this area, Extension's family and consumer science (FCS) educators launched the Master Food Educators program. This program involves an intensive 30 hour course in nutrition and food safety designed to provide volunteers with the tools for assisting staff in the delivery of basic programs. For example, Eleven Master Foods Educators graduated from training in the winter of 2011 and have already started volunteering with the existing group at events such as Eat Smart for a Healthy Heart, employee food safety event at DuPont and Dow.

9. Nutrition - Because of the downturn in the economy the Expanded Food and Nutrition Education Program continues to grow, providing nutrition education to those individuals from low resource communities statewide. Childhood obesity and high incidences of chronic illnesses in Delaware, such as heart disease and diabetes, drive the demand for programming in this area.

10. Financial Management - A steady demand for basic money management courses for those filing bankruptcy is driven through referrals from local attorneys aware that UD Cooperative Extension provides competent education for their clients.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1291472	1162876	1460945	1192685

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	850687	0	1449591	0
Actual Matching	1783664	0	2135131	0
Actual All Other	3645282	0	8010070	0
Total Actual Expended	6279633	0	11594792	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%	20%	10%	10%
112	Watershed Protection and Management	10%	10%	5%	5%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	15%	15%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	5%	5%
205	Plant Management Systems	15%	15%	10%	10%
304	Animal Genome	0%	0%	10%	10%
305	Animal Physiological Processes	0%	0%	5%	5%
307	Animal Management Systems	15%	15%	5%	5%
311	Animal Diseases	10%	10%	15%	15%
601	Economics of Agricultural Production and Farm Management	5%	5%	5%	5%
605	Natural Resource and Environmental Economics	5%	5%	10%	10%
903	Communication, Education, and Information Delivery	20%	20%	5%	5%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	2.9	0.4	26.9	1.5
Actual	17.3	1.7	66.0	4.1

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
428949	0	1119976	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
409488	0	1242748	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1514255	0	1867877	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

For animal agriculture, research and extension programs target: (1)Poultry Health and Disease Prevention and Control - mechanisms of disease induction, host genetic resistance and immune responses in poultry with a focus on diagnostic surveillance methodology, vaccination and biocontainment; (2) Poultry Growth and Development - basic molecular and cellular mechanisms regulating poultry growth, development and meat yield;(3) Avian Genomics - development and application of avian microarrays for: disease diagnosis, resistance, and control; growth and development; and optimization of desired production traits; (4) Alternative Production Systems - alternative production systems to reduce disease, mortality, and waste production, minimize antibiotic use, integrate alternative energy into production systems and foster compatibility between animal production, environmental quality, and urban populations; (5)Nutrient Utilization in Poultry and Ruminants - increased nutrient utilization and reduced nutrient excretion via improved understanding of animal biology. For crop production, key activities are: (1) Agronomic, Vegetable and Horticultural Crop Production - improving varietal selection, disease and pest resistance, seed technology, cultural and marketing practices; (2) New Crops - financial and environmental impacts of new crops or new varieties of existing crops, (3) Integrated Pest Management - control of insect pests, weeds, and plant pathogens via biological and chemical methods; (4) Engineering Technologies - improvements in harvesting and guidance systems and expanded research and extension programs on irrigation management; implementing recent advances in remote sensing, tillage, and pesticide application; (5) Plant Breeding, Crop Genomics, Proteomics, and Bioinformatics - basic research on how plants adapt to their environments and manage stress and the nature of soil microorganism-plant symbiotic relationships and plant/soil interfacial reactions affecting crop growth and quality; (6) Pasture and Forage Management - research on pasture-based animal production systems and forage research on improving biological control systems for alfalfa. Soil science programs focus on: (1)Fate, Transport, and Reaction Mechanisms - fate, transport and reaction mechanisms of plant nutrients, wastes, and organic chemicals in soils, and their effects on soil, air and water pollution (2) Cost-Effective, In-Situ Remediation - cost-effective, in-situ methods for the remediation and speciation of contaminated soils; (3) Nutrient Management for Water and Quality - fertilizer and waste management programs to ensure economic and environmental sustainability while considering crop needs, nutrient reactions in soils, alternative fertilizer sources, and government policies. Resource and international economics activity areas include: (1) Protection and Preservation of Agricultural Land - current strategies to protect and preserve agricultural land will be evaluated and promising new approaches will be investigated; (2)International Economics and Trade: improved understanding of factors controlling export-import markets, particularly poultry.

2. Brief description of the target audience

For animal agriculture, primarily poultry integrators, growers, breeders, trade groups and allied industries; dairy and beef producers; livestock commodity groups; forage producers, equine owners,

producers and interest groups; state and federal agencies; federal research laboratories; peer scientists in the U.S. and international colleagues, K-12 teachers, and environmental and community groups. For crop and soils related research and extension programs, the audience includes existing and prospective grain crop producers, mixed (animal and crop production, e.g., dairy, horse) farms, crop commodity groups and trade associations (e.g., Delaware Herb Growers & Marketers Association, Delaware Soybean Board), the "green industry" (e.g., horticulture, nurseries, landscapers), certified crop advisors, private agricultural consultants, state (DDA, DNREC, DELDOT) and federal agencies (USDA), national laboratories (e.g., Argonne), chemical/seed/fertilizer companies, agricultural equipment companies, industries with soil contamination problems, growers, processors, marketers of plants of flavor, fragrance, and medicine, , peer scientists in the U.S. and other countries, K-12 educators, and policy-makers. For our resource economic programs the audience includes farmers, landowners, state agencies (Delaware Development Office; Land Use Planning and Preservation; Department of Agriculture; Department of Health and Human Services; Department of Natural Resources & Environmental Control; Department of Transportation; Economic Development Office), federal agencies (USDA, NRCS, USEPA), land use organizations (Conservation Districts, AFT), environmental organizations, business and community leaders, families, students, and the general public.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	54039	77451	10851	6754

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	7	44	51

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	75

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	44

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	78

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	122

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	34

Output #6

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	19

Output #7

Output Measure

- Number of Post-doctoral Research Associates

Year	Actual
2010	5

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	51

Output #9

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	19

Output #10

Output Measure

- Number of Technical Reports

Year	Actual
2010	103

Output #11

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	79

Output #12

Output Measure

- Number of Invited Presentations

Year	Actual
2010	202

Output #13

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	156

Output #14

Output Measure

- Number of Websites Established

Year	Actual
2010	17

Output #15

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	401

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased awareness of the need to produce and utilize diets for all animal species that prevent unnecessary overfeeding of nutrients, especially nitrogen and phosphorus.
2	Education programs for the livestock and equine industries on equine nutrition and health practices, fiscal management, and beneficial use of the by-products of animal agriculture.
3	Establishment of an Avian Biosciences Center to conduct research, outreach, and K-12 educational programs on avian disease and production, food safety and technology, and the environmental compatibility of poultry production.
4	Increased number of poultry producers participating in surveillance, diagnostic testing, and vaccination programs for infectious avian diseases. Implementation of statewide plans to address major outbreaks of avian diseases.
5	Sustainable production practices for the dairy and beef industries that link forage and pasture production practices with animal health, performance, and meat and milk quality.
6	Improved economic competitiveness of the poultry and allied industries relative to other poultry producing regions in the U.S. and global competitors.
7	Increased number of poultry and dairy farmers using feed management practices that increase nutrient utilization, and feeding diets with lower concentrations of nitrogen and phosphorus.
8	Increased use of air quality best management practices that prevent odor, ammonia, and particulate emissions from poultry farms.
9	Increased number of diagnostic laboratories capable of using advances in avian genomics and state-of-the art instrumentation to rapidly diagnose infectious diseases
10	Disease Prevention and Control: basic and applied research on mechanisms of poultry disease processes will translate into useable tools and strategies for improved disease surveillance, diagnosis, prevention, and control in broiler chicken production. Knowledge will be extended to commercial poultry and allied industries.
11	Genomics: increased understanding of gene function and expression and targeting of candidate genes affecting economically important traits in broiler chicken growth and production, disease resistance and immunity. Improvements in classical poultry breeding programs by use of marker assisted selection (MAS) and technology transfer.
12	Nutrition: research will lead to improved understanding of nutritional requirements for poultry and ruminants and adoption of recommended dietary strategies by practicing nutritionists and producers. Specifically, results of poultry directed research aim to minimize nutrient contamination of the environment from manure. Results from ruminant based research will lead to improved management of forages to maximize nutritional value, safe use, and minimize spoilage during storage. Nutritional effects on dairy cattle health and immune function including factors impacting white blood cell gene expression will be studied. Research will also lead to improved understanding of the molecular and cellular mechanisms associated with bovine lameness and early detection of the disease. Research will enhance collaboration between University and industry partners, will help increase the efficiency of livestock production and transfer new technology to stakeholders.
13	Environmental Compatibility: poultry industry and commercial nutritionists will adopt and implement recommendations for broiler diet modification - including such practices as reducing diet nutrient concentrations to more closely meet the animal's requirements,

	utilization of phytase and other diet additives shown to improve nutrient utilization, and incorporation of low phytate grains - in feed formulations to reduce nutrient emissions to the environment. Reduced emissions will be measured by reduced nutrient concentrations in manures and litters, reduced application of nutrients to cropland and other soils, and reduced movement of nutrients from soils to ground and surface waters. Other environmental issues related to animal agriculture include the fate and transport of trace elements (arsenic, copper, zinc) found in poultry manures; widespread national concerns about air quality associated with ammonia, hydrogen sulfide, volatile organic compounds, and fine particulates originating from poultry houses; environmental and human health impacts of endocrine disruptors (estrogen, testosterone) found in manures; the fate and transport of viruses and other pathogens during disease outbreaks and subsequent disposal of poultry mortality, and the environmental and human health effects of antibiotics used in poultry production.
14	Equine science: contribute to improved equine care, disease prevention, responsible land management, barn safety, and effective business practices using proven outreach channels for the dissemination of peer reviewed knowledge and practices to equine professionals and enthusiasts.
15	Improved statewide strategies to prevent the spread of avian diseases and dispose of the mortality resulting from disease outbreaks.
16	Cost-effective solar power technology to heat and cool poultry houses will allow farmers to reduce their reliance on natural gas, oil, and purchased electricity, increasing the energy efficiency of poultry production.
17	Increased number of farmers adopting new crop varieties and high value, niche market crops, (culinary herbs, spices and essential oils). Integrating innovations in cultural practices, biological and chemical pest management, harvesting equipment, and irrigation management into these systems, including feasibility studies of greenhouses to produce high value plants, such as those intended for pharmaceutical or nutriceutical uses.
18	Increase in the number of farmers and others (e.g., the ?Green Industry? - greenhouses, nurseries, landscapers) implementing comprehensive nutrient management and conservation plans that are profitable and protective of ground and surface water quality, build soil quality, prevent soil erosion, and protect natural resource areas.
19	Increased use of soil management programs and best management practices for agricultural, natural, suburban/urban, and disturbed or contaminated settings that incorporate latest advances in research and greater adoption of watershed scale modeling to predict changes in the functions and environmental impacts of soils in mixed-used watersheds (agriculture, suburban, urban, forests) as land use changes from agricultural to suburban and urban uses
20	Improved economic competitiveness of Delaware agriculture relative to other regions in the U.S. and global competitors with an emphasis on greater adoption of new innovations in marketing and risk management for farmers who must increasingly compete globally.
21	Increased interactions and long-range strategic planning efforts between research and extension staff and the diverse stakeholders (state and federal agencies, community groups, not-for-profit organizations, developers, farmers, etc.) involved in farmland preservation and land use conversion from agriculture to suburban and urban uses.
22	Plant Biology and Crop Production: basic research will lead to improved understanding of plant molecular biology and allow genetic manipulation of physiological processes important to increasing crop yields and quality and crop resistance to biotic and abiotic stresses. Applied research and extension programs on cultural practices, crop varieties, fertilizer and manure use, precision agriculture, and integrated pest management will increase crop yields, minimize costs, and protect environmental quality. Extension programs will guide management practices for horticultural plants for the ?Green Industry? and for homeowners, important because of the rapid conversion of farmland to urban and suburban uses.

23	New Markets: advances in plant molecular biology and genomics will provide new markets for farmers and commercial-scale horticulture, such as plants for bioenergy, pharmaceutical and nutriceutical uses. New and creative marketing programs will stimulate diversification and growth in the production of value-added and niche market crops, such as culinary herbs, spices, essential oil plants, and specialty vegetables for urban and suburban markets.
24	Land Use Change: research will identify strategies needed to manage land use change in a state where preserving farmland is a major goal, but economic and social forces are resulting in steady conversion of agricultural lands to suburban and urban uses. The economic, social, and cultural impacts of land fragmentation, suburban sprawl, and the ?critical mass? of land and businesses needed to sustain agriculture in the long-term will be determined. Research knowledge and extension programs will guide long-term land use planning in cooperation with state and local agencies and governments, community groups, and other stakeholders.
25	International Economics and Trade: research will provide strategies to foster international trade and economic growth in developed and developing countries, with an emphasis on policy issues related to agricultural and energy markets and climate change, particularly those related to poultry production and bioenergy crops. Extension programs will educate agricultural producers on international marketing strategies for traditional agricultural products (e.g., poultry, grain crops) as well as new cropping systems, such as organic agriculture and genetically modified crops.
26	Educational programs for K-12 teachers and youth on: (i) advances in animal and plant molecular biology and applications of the basic animal and plant sciences to the production of animals and of plants used for food, fiber, landscaping, timber, bioenergy, and pharmaceutical and nutriceutical purposes; (ii) value of soils as a critical natural resource vital to civilization, including the many functions of soils in agricultural and natural ecosystems, the importance of soil management to environmental quality, and the role of soils in sustaining aesthetically pleasing managed landscapes in suburban and urban settings; and (iii) the relationship between land use and major societal issues, such as economic development, community and family adaptation to changing social and political conditions, and the value of sustaining ecosystems and protecting environmental quality.
27	Soils and Environment: basic research will increase understanding of physical, chemical, and biological factors influencing the fate and transport of nutrients, metals, organics, and pathogens in soils. Applied research will lead to development of nutrient management strategies and recommendations that minimize nonpoint nutrient pollution from all land uses. Remediation practices for soils contaminated by metals, organics, and nutrients will use innovative, research-based measures to prioritize risk to the environment and human health based on the speciation, mobility, and bioavailability of contaminants in soils. Mitigation approaches for polluted soils will combine soil chemistry, physics, and soil/plant molecular

Outcome #1

1. **Outcome Measures**

Increased awareness of the need to produce and utilize diets for all animal species that prevent unnecessary overfeeding of nutrients, especially nitrogen and phosphorus.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Education programs for the livestock and equine industries on equine nutrition and health practices, fiscal management, and beneficial use of the by-products of animal agriculture.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Establishment of an Avian Biosciences Center to conduct research, outreach, and K-12 educational programs on avian disease and production, food safety and technology, and the environmental compatibility of poultry production.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Increased number of poultry producers participating in surveillance, diagnostic testing, and vaccination programs for infectious avian diseases. Implementation of statewide plans to address major outbreaks of avian diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Poultry producers, poultry integrating companies, veterinarians, agricultural businesses financing the poultry industry, the public.

What has been done

Three field trials on incubation and lameness were performed with local poultry companies to understand the predisposing conditions in the development of the major poultry health issues affecting the poultry industry at Delmarva (Lameness and Respiratory Complex).

Results

Preliminary results were presented at the 45th National Meeting on Poultry Health and Processing, which took place October 4-6, 2010, in Ocean City, Maryland.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases

Outcome #5

1. Outcome Measures

Sustainable production practices for the dairy and beef industries that link forage and pasture production practices with animal health, performance, and meat and milk quality.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

305	Animal Physiological Processes
307	Animal Management Systems

Outcome #6

1. Outcome Measures

Improved economic competitiveness of the poultry and allied industries relative to other poultry producing regions in the U.S. and global competitors.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Increased number of poultry and dairy farmers using feed management practices that increase nutrient utilization, and feeding diets with lower concentrations of nitrogen and phosphorus.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #8

1. Outcome Measures

Increased use of air quality best management practices that prevent odor, ammonia, and particulate emissions from poultry farms.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #9

1. Outcome Measures

Increased number of diagnostic laboratories capable of using advances in avian genomics and state-of-the art instrumentation to rapidly diagnose infectious diseases

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Disease Prevention and Control: basic and applied research on mechanisms of poultry disease processes will translate into useable tools and strategies for improved disease surveillance, diagnosis, prevention, and control in broiler chicken production. Knowledge will be extended to commercial poultry and allied industries.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
307	Animal Management Systems
311	Animal Diseases

Outcome #11

1. Outcome Measures

Genomics: increased understanding of gene function and expression and targeting of candidate genes affecting economically important traits in broiler chicken growth and production, disease resistance and immunity. Improvements in classical poultry breeding programs by use of marker assisted selection (MAS) and technology transfer.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
305	Animal Physiological Processes
311	Animal Diseases

Outcome #12

1. Outcome Measures

Nutrition: research will lead to improved understanding of nutritional requirements for poultry and ruminants and adoption of recommended dietary strategies by practicing nutritionists and producers. Specifically, results of poultry directed research aim to minimize nutrient contamination of the environment from manure. Results from ruminant based research will lead to improved management of forages to maximize nutritional value, safe use, and minimize spoilage during storage. Nutritional effects on dairy cattle health and immune function including factors impacting white blood cell gene expression will be studied. Research will also lead to improved understanding of the molecular and cellular mechanisms associated with bovine lameness and early detection of the disease. Research will enhance collaboration between University and industry partners, will help increase the efficiency of livestock production and transfer new technology to stakeholders.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
307	Animal Management Systems

Outcome #13

1. Outcome Measures

Environmental Compatibility: poultry industry and commercial nutritionists will adopt and implement recommendations for broiler diet modification - including such practices as reducing diet nutrient concentrations to more closely meet the animal's requirements, utilization of phytase and other diet additives shown to improve nutrient utilization, and incorporation of low phytate grains - in feed formulations to reduce nutrient emissions to the environment. Reduced emissions will be measured by reduced nutrient concentrations in manures and litters, reduced application of nutrients to cropland and other soils, and reduced movement of nutrients from soils to ground and surface waters. Other environmental issues related to animal agriculture include the fate and transport of trace elements (arsenic, copper, zinc) found in poultry manures; widespread national concerns about air quality associated with ammonia, hydrogen sulfide, volatile organic compounds, and fine particulates originating from poultry houses; environmental and human health impacts of endocrine disruptors (estrogen, testosterone) found in manures; the fate and transport of viruses and other pathogens during disease outbreaks and subsequent disposal of poultry mortality, and the environmental and human health effects of antibiotics used in poultry production.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #14

1. Outcome Measures

Equine science: contribute to improved equine care, disease prevention, responsible land management, barn safety, and effective business practices using proven outreach channels for the dissemination of peer reviewed knowledge and practices to equine professionals and enthusiasts.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Equine owners, veterinarians, agricultural businesses supplying the equine industry.

What has been done
UD?s equine extension professional has developed and implemented an Equine Educational Needs Assessment Survey to help identify interests and priorities among Delaware equine owners.

Results
The data collected will be used to develop effective, science-based equine extension programs and educational resources. This individual has also worked with CANR and UD Cooperative Extension personnel to develop an Equine Blog to better serve the needs and interests of Delaware equine clientele.

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases

Outcome #15

1. Outcome Measures

Improved statewide strategies to prevent the spread of avian diseases and dispose of the mortality resulting from disease outbreaks.

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

Cost-effective solar power technology to heat and cool poultry houses will allow farmers to reduce their reliance on natural gas, oil, and purchased electricity, increasing the energy efficiency of poultry production.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #17

1. Outcome Measures

Increased number of farmers adopting new crop varieties and high value, niche market crops, (culinary herbs, spices and essential oils). Integrating innovations in cultural practices, biological and chemical pest management, harvesting equipment, and irrigation management into these systems, including feasibility studies of greenhouses to produce high value plants, such as those intended for pharmaceutical or nutriceutical uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers, extension and advisory agencies, crop consultants,and others interested in integrated crop management systems.

What has been done
In an attempt to gain greater knowledge about what information is currently available and identify research and extension needs, the Southern Region IPM Center funded an emergency-planning meeting to establish a Mid-Atlantic Slug Working Group. The 2010 group included extension, research, and NRCS personnel from Delaware, Maryland, Pennsylvania, and Virginia. This working group expanded their name to the Mid-Atlantic High Residue Cropping Systems IPM Working Group (HRIPM).

Results
In 2010, the Delaware Extension IPM Team conducted a series of projects working towards the goals set forth by the HRIPM. They included: pre-plant field sampling for slugs, post-planting slug damage, evaluation of pit-fall trapping survey for beneficial arthropods, evaluation of banding fertilizer application, evaluation of Lannate (methomyl) to control slugs in field corn, and demonstration of tillage impacts on slug densities and crop injury.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #18

1. Outcome Measures

Increase in the number of farmers and others (e.g., the ?Green Industry? - greenhouses, nurseries, landscapers) implementing comprehensive nutrient management and conservation plans that are profitable and protective of ground and surface water quality, build soil quality, prevent soil erosion, and protect natural resource areas.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #19

1. Outcome Measures

Increased use of soil management programs and best management practices for agricultural, natural, suburban/urban, and disturbed or contaminated settings that incorporate latest advances in research and greater adoption of watershed scale modeling to predict changes in the functions and environmental impacts of soils in mixed-used watersheds (agriculture, suburban, urban, forests) as land use changes from agricultural to suburban and urban uses

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural community, advisory and regulatory agencies focused on water quality and nutrient management, not-for-profit groups, the public who use ground and surface waters.

What has been done
Plant and soil scientists at UD are working to optimize crop production for farmers while minimizing the impact on the environment of the fertilizer and manure nutrients essential for crop growth.

Results
Scientists are developing a nutrient management system for corn, based on the late-season stalk nitrate test, that will result in less nitrogen leaving cornfields and entering the Chesapeake Bay while improving overall profitability to growers. The ultimate project goal is to develop a performance-based nutrient management system. The study uses 300 fields as on-farm research plots and involves the cooperation of more than 75 farmers from Kent and Sussex counties as well as areas of Maryland.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management

205	Plant Management Systems
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #20

1. Outcome Measures

Improved economic competitiveness of Delaware agriculture relative to other regions in the U.S. and global competitors with an emphasis on greater adoption of new innovations in marketing and risk management for farmers who must increasingly compete globally.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #21

1. Outcome Measures

Increased interactions and long-range strategic planning efforts between research and extension staff and the diverse stakeholders (state and federal agencies, community groups, not-for-profit organizations, developers, farmers, etc.) involved in farmland preservation and land use conversion from agriculture to suburban and urban uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #22

1. Outcome Measures

Plant Biology and Crop Production: basic research will lead to improved understanding of plant molecular biology and allow genetic manipulation of physiological processes important to increasing crop yields and quality and crop resistance to biotic and abiotic stresses. Applied research and extension programs on cultural practices, crop varieties, fertilizer and manure use, precision agriculture, and integrated pest management will increase crop yields, minimize costs, and protect environmental quality. Extension programs will guide management practices for horticultural plants for the ?Green Industry? and for homeowners, important because of the rapid conversion of farmland to urban and suburban uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Delaware soybean farmers, agricultural businesses involved in production and sales of insecticides and nematicides, those concerned about alternatives to pesticide use for insect control in soybeans.

What has been done
Soybean Integrated Pest Management (IPM) programs focused on 2 main pests in 2010: Dectes stem borer, and Soybean Cyst Nematode. The University of Delaware?s Extension IPM team took another look at the use of foliar insecticides to control adult beetles and variety evaluations as a possible management tool in 2010.

Results
Although the team did see a difference among varieties regarding the percentage of lodging loss, there was no significant difference in final yield. Research trials from other regions indicate that two well-timed foliar applications aimed at the adults can help reduce lodging losses from this insect pest. Large plots established on the University?s research farm as well as on commercial farms did not result in significant yield reductions. These studies will be repeated in 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #23

1. Outcome Measures

New Markets: advances in plant molecular biology and genomics will provide new markets for farmers and commercial-scale horticulture, such as plants for bioenergy, pharmaceutical and nutriceutical uses. New and creative marketing programs will stimulate diversification and growth in the production of value-added and niche market crops, such as culinary herbs, spices, essential oil plants, and specialty vegetables for urban and suburban markets.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #24

1. Outcome Measures

Land Use Change: research will identify strategies needed to manage land use change in a state where preserving farmland is a major goal, but economic and social forces are resulting in steady conversion of agricultural lands to suburban and urban uses. The economic, social, and cultural impacts of land fragmentation, suburban sprawl, and the ?critical mass? of land and businesses needed to sustain agriculture in the long-term will be determined. Research knowledge and extension programs will guide long-term land use planning in cooperation with state and local agencies and governments, community groups, and other stakeholders.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

112	Watershed Protection and Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #25

1. Outcome Measures

International Economics and Trade: research will provide strategies to foster international trade and economic growth in developed and developing countries, with an emphasis on policy issues related to agricultural and energy markets and climate change, particularly those related to poultry production and bioenergy crops. Extension programs will educate agricultural producers on international marketing strategies for traditional agricultural products (e.g., poultry, grain crops) as well as new cropping systems, such as organic agriculture and genetically modified crops.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers, agricultural businesses, commodity traders, banks, and other financial institutions.

What has been done
An Online Grain Marketing Primer was developed in cooperation with Farm Journal Media. Topics covered include: grain market planning; basis; cash market alternatives; hedging in futures; options on agricultural futures; new crop insurance policies for 2011; profitability ? how crop insurance helps; and online resources. The online primer is designed for farmers to use as a self-help guide in making grain marketing and crop insurance decisions.

Results
The site has grown from 317 visits and 1,459 pages viewed in September, 2010 to 2,082 visits and 3,000 pages viewed for the month of December, 2010.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #26

1. Outcome Measures

Educational programs for K-12 teachers and youth on: (i) advances in animal and plant molecular biology and applications of the basic animal and plant sciences to the production of animals and of plants used for food, fiber, landscaping, timber, bioenergy, and pharmaceutical and nutriceutical purposes; (ii) value of soils as a critical natural resource vital to civilization, including the many functions of soils in agricultural and natural ecosystems, the importance of soil management to environmental quality, and the role of soils in sustaining aesthetically pleasing managed landscapes in suburban and urban settings; and (iii) the relationship between land use and major societal issues, such as economic development, community and family adaptation to changing social and political conditions, and the value of sustaining ecosystems and protecting environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
304	Animal Genome
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #27

1. Outcome Measures

Soils and Environment: basic research will increase understanding of physical, chemical, and biological factors influencing the fate and transport of nutrients, metals, organics, and pathogens in soils. Applied research will lead to development of nutrient management strategies and recommendations that minimize nonpoint nutrient pollution from all land uses. Remediation practices for soils contaminated by metals, organics, and nutrients will use innovative, research-based measures to prioritize risk to the environment and human health based on the speciation, mobility, and bioavailability of contaminants in soils. Mitigation approaches for polluted soils will combine soil chemistry, physics, and soil/plant molecular

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Researchers at UD are studing the fate and transport of hormones and antibiotics in runoff from agricultural watersheds. The occurrence of hormones and antibiotics in the environment has received considerable attention in both the scientific and mainstream media. Synthetic and natural steroidal hormones are considered endocrine disrupting chemicals (EDCs) because they can cause physiological and reproductive disorders in aquatic and wildlife species. While the concentrations of hormones in surface waters are typically small -- parts per billion or parts per trillion levels -- they are effective enough to cause impairment, especially when aquatic and wildlife species are continuously exposed to a cocktail of such chemicals over long periods of time. The environmental contamination by pharmaceutical residues, especially antibiotics, may promote antibiotic resistance in pathogenic microorganisms and contribute to phytotoxicity.

Results

Researchers are evaluating the fate, persistence, transport, and potency of animal hormones and antibiotics, including their transformation products, in an agricultural watershed receiving land-application of poultry litter. The target hormones include estrone, estradiol, estriol, and their sulfate and glucuronide conjugates. The target antibiotics studied include chlortetracycline, representing the tetracycline class of antibiotics, and sulfamethazine, representing the sulfonamide class of antibiotics. Results to date indicate the concentrations of hormones in runoff from manured soils are low and unlikely to be of environmental significance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

BIOTECHNOLOGY AND BIOTECHNOLOGY-BASED AGRIBUSINESS

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	25%	25%	25%	25%
304	Animal Genome	25%	25%	25%	25%
601	Economics of Agricultural Production and Farm Management	10%	10%	10%	10%
602	Business Management, Finance, and Taxation	10%	10%	10%	10%
603	Market Economics	10%	10%	10%	10%
604	Marketing and Distribution Practices	10%	10%	10%	10%
903	Communication, Education, and Information Delivery	10%	10%	10%	10%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.2	20.8	1.0
Actual	0.0	0.0	27.1	3.5

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	10141	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	478133	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	4193196	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and Extension programs will target avian and plant biotechnology. In the avian arena, these projects will be aimed at understanding basic mechanisms of disease etiology and control and emergence of new disease causing agents. Research will continue and expand on sequencing of the chicken genome, as well as the genome of many poultry pathogens, to help provide the tools needed to advance our understanding of poultry growth, health and disease. We plan to apply these tools to diagnosis and treatment of disease and screening for desirable production traits. We also seek to develop genome based diagnostic methods, and study the molecular basis of disease resistance and susceptibility. Some specific avian biotechnology research areas planned include: identification of genomic factors influencing pathogenesis of avian herpesviruses and mycoplasmas; evolution of virulence of Marek's Disease virus; interaction of MDV proteins with host cells; regulation of the immune response to avian pathogens; and gene expression profiles in growth-selected chickens. With regard to plant biotechnology, projects will focus on understanding basic mechanisms of gene control in plants, disease resistance, nitrogen fixation, and plant/environment interactions. Areas of particular interest for basic plant biotechnology research include: RNA turnover or small RNA-mediated gene regulation; understanding disease resistance and signal transduction pathways in plants; understanding and enhancing symbiotic nitrogen fixation via the application of molecular and proteomics approaches; developing biotechnology-based diagnostic methods for major plant diseases; and understanding processes controlling plant/soil interfacial relations at the molecular and atomic levels to enhance crop utilization of nutrients and the effectiveness of plants at remediation of soils contaminated with metals and organics. For both avian and plant biotechnology, findings will be applied as much as possible to existing issues in agriculture with the goal of integrating biotechnology research into new agribusinesses such as those producing plants better adapted to environmental and biological stress, plants used for the production of pharmaceuticals and nutriceuticals, and plant with bioenergy uses.

2. Brief description of the target audience

Farmers, landowners, state agencies (Delaware Development Office, Departments of Agriculture, Health and Human Services, Natural Resources and Environmental Control, Transportation), federal agencies (USDA, USEPA), land use organizations, environmental organizations, business and community leaders, families, students, and the general public.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	200	500	200	1000

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

Patent Applications Submitted

Year: 2010

Actual: 8

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	44	44

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	52

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	13

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual

2010	14

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	48

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	16

Output #6

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	18

Output #7

Output Measure

- Number of Post-doctoral Research Associates

Year	Actual
2010	15

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	44

Output #9

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	11

Output #10

Output Measure

- Number of Technical Reports

Year	Actual
2010	8

Output #11

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	2

Output #12

Output Measure

- Number of Invited Presentations

Year	Actual
2010	49

Output #13

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	8

Output #14

Output Measure

- Number of Websites Established

Year	Actual
2010	9

Output #15

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased awareness by all components of the poultry industry of the opportunities to use biotechnology to prevent, diagnose, and control avian infectious diseases.
2	Increased number of farmers and members of the horticultural industry aware of the opportunities to use advances in plant biotechnology to develop new businesses.
3	Educational programs for K-12 youth and teachers on basic principles and applications of biotechnology to the plant, animal, and environmental sciences.
4	Commercial evaluation in agronomic and horticultural settings of genetically modified plants developed using biotechnology research.
5	Integration of plant and animal biotechnology educational materials developed cooperatively by research and extension staff into K-12 curricula in Delaware schools.
6	Stronger, more formal links between scientists conducting biotechnology research, extension specialists familiar with biotechnology applications, and state and regional economic development agencies and private industry.
7	Avian Biotechnology: basic research will provide an improved understanding of the fundamental causes and modes of action of avian diseases and the factors that influence their potential to spread to other animal species and humans; applied research will provide innovations in surveillance and diagnostic tools that help prevent or contain disease outbreaks and vaccines that prevent or control infectious diseases.
8	Plant Biotechnology: basic research will lead to an improved understanding of the processes by which plants grow, resist or adapt to diseases and other stresses; can be used to produce bio-based products useful for human health and nutrition, and regulate the uptake of plant nutrients in agricultural soils and contaminants (e.g., heavy metals) in polluted soils; applied research will lead to plants that can produce increased yields with lower inputs, resist pest and climatic stresses, and remediate or stabilize polluted soils.
9	Biotechnology-Based Agribusinesses: research and extension programs will link results of biotechnology research to industries interested and capable of marketing advances in animal and plant biotechnology; biotechnology, financial planning, marketing, and risk management will be combined to establish agribusinesses specializing in the diagnosis and control of avian infectious diseases, production of crop varieties that have lower fertilizer requirements and that are more tolerant of climatic stress; utilization of hyper-accumulating plants that can remediate contaminated soils, and the production of high-value plant products useful for human health and nutrition.

Outcome #1

1. Outcome Measures

Increased awareness by all components of the poultry industry of the opportunities to use biotechnology to prevent, diagnose, and control avian infectious diseases.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
603	Market Economics
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Increased number of farmers and members of the horticultural industry aware of the opportunities to use advances in plant biotechnology to develop new businesses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
304	Animal Genome
602	Business Management, Finance, and Taxation
603	Market Economics
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Educational programs for K-12 youth and teachers on basic principles and applications of biotechnology to the plant, animal, and environmental sciences.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
K-12 teachers and students, university undergraduate and graduate students, and faculty engaged in experiential learning.

What has been done
Research in the area of plant biotechnology has extended to involve undergraduate research interns in metagenomics research projects during the 2010 Summer Metagenomics Institute.

Results
A diverse group of students, with varying academic backgrounds, participated in this summer-long educational and research experience. The collective work of the group is being submitted to a peer-reviewed teaching journal and should be of value to teachers interested in developing course modules for K-12 and university students on metagenomics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
304	Animal Genome
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Commercial evaluation in agronomic and horticultural settings of genetically modified plants developed using biotechnology research.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers, seed companies, plant breeders, and crop consultants.

What has been done
Plant geneticists are studying the genetic basis of resistance to multiple diseases in field corn.

Results
Using public corn resources and cross-breeding techniques to develop new populations and tracking genes with molecular markers to study inheritance, they are able to pinpoint the genes that condition resistance or susceptibility to multiple diseases. By conducting research that bridges plant molecular genetics with field corn breeding, they are developing methods to study natural variation and understand the genetic basis of plant improvement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
601	Economics of Agricultural Production and Farm Management
603	Market Economics

Outcome #5

1. Outcome Measures

Integration of plant and animal biotechnology educational materials developed cooperatively by research and extension staff into K-12 curricula in Delaware schools.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
304	Animal Genome
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Stronger, more formal links between scientists conducting biotechnology research, extension specialists familiar with biotechnology applications, and state and regional economic development agencies and private industry.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers, industries investing in crop enhancing biologicals, extension agronomists, and crop consultants.

What has been done
Plant and soil sciences researchers, working collaboratively, have applied promising results from molecular biology studies to field studies involving agronomic crops, such as corn and soybeans. In collaboration with colleagues from UD Cooperative Extension at the Georgetown Field Station and industrial collaborators, plant molecular biologists, have initiated applied field studies on the use of bioinoculants for crop growth enhancement

Results
Initial data shows that by inoculating seeds with high numbers of special strains of naturally-occurring bacteria, they can help plants overcome stresses in the field, including nitrogen limitations, drought, and pathogen pressures. In addition, yields are positively affected by this treatment. As a result, the team will continue to develop new agricultural products to help growers reduce input cost for crop production, reduce environmental damage related to agricultural practices (including well-water quality), and improve food security.

4. Associated Knowledge Areas

KA Code	Knowledge Area

201	Plant Genome, Genetics, and Genetic Mechanisms
304	Animal Genome
601	Economics of Agricultural Production and Farm Management
603	Market Economics
604	Marketing and Distribution Practices
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Avian Biotechnology: basic research will provide an improved understanding of the fundamental causes and modes of action of avian diseases and the factors that influence their potential to spread to other animal species and humans; applied research will provide innovations in surveillance and diagnostic tools that help prevent or contain disease outbreaks and vaccines that prevent or control infectious diseases.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome

Outcome #8

1. Outcome Measures

Plant Biotechnology: basic research will lead to an improved understanding of the processes by which plants grow, resist or adapt to diseases and other stresses; can be used to produce bio-based products useful for human health and nutrition, and regulate the uptake of plant nutrients in agricultural soils and contaminants (e.g., heavy metals) in polluted soils; applied research will lead to plants that can produce increased yields with lower inputs, resist pest and climatic stresses, and remediate or stabilize polluted soils.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Plant and soil scientists, ecologists, industries investing in plant breeding for agriculture, horticulture, and natural ecosystems.

What has been done
Research at UD has discovered how plants recognize their siblings. The newly developed identification system lies in the roots and the chemical cues they secrete. The finding not only sheds light on the intriguing sensing system in plants, but also may have implications for agriculture and even home gardening.

Results
In a series of experiments, young seedlings were exposed to liquid media containing the root secretions or ?exudates? from siblings, from strangers (non-siblings), or only their own exudates. The length of the longest lateral root and of the hypocotyl, the first leaf-like structure that forms on the plant, were measured. Additionally, in one experiment, the root exudates were inhibited by sodium orthovanadate, which specifically blocks root secretions without imparting adverse growth effects on roots. The exposure of plants to the root exudates of strangers induced greater lateral root formation than exposure of plants to sibling exudates. Stranger recognition was abolished upon treatment with the secretion inhibitor. More than 3,000 plants involved in the study were rotated every day for seven consecutive days and with the root patterns documented. The study found strangers planted next to each other are often shorter because so much of their energy is directed at root growth. Because siblings aren't competing against each other, their roots are

often much shallower. As sibling plants grow next to each other, their leaves often will touch and intertwine compared to strangers that grow rigidly upright and avoid touching.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

Outcome #9

1. Outcome Measures

Biotechnology-Based Agribusinesses: research and extension programs will link results of biotechnology research to industries interested and capable of marketing advances in animal and plant biotechnology; biotechnology, financial planning, marketing, and risk management will be combined to establish agribusinesses specializing in the diagnosis and control of avian infectious diseases, production of crop varieties that have lower fertilizer requirements and that are more tolerant of climatic stress; utilization of hyper-accumulating plants that can remediate contaminated soils, and the production of high-value plant products useful for human health and nutrition.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
304	Animal Genome
602	Business Management, Finance, and Taxation
603	Market Economics
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

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

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

NATURAL SYSTEMS, BIODIVERSITY, AND WILDLIFE ECOLOGY

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	10%	10%	10%	10%
123	Management and Sustainability of Forest Resources	10%	10%	10%	10%
135	Aquatic and Terrestrial Wildlife	20%	20%	20%	20%
136	Conservation of Biological Diversity	15%	15%	15%	15%
215	Biological Control of Pests Affecting Plants	15%	15%	15%	15%
216	Integrated Pest Management Systems	20%	20%	20%	20%
306	Environmental Stress in Animals	5%	5%	5%	5%
903	Communication, Education, and Information Delivery	5%	5%	5%	5%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	3.6	0.5	5.9	2.0
Actual	1.5	2.9	3.8	1.2

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
38350	0	34773	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
386050	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
105804	0	1079609	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extension programs will target: (1) Integrated Pest Management - developing and delivering integrated pest management (IPM) programs, a "systems" approach using chemical, cultural, mechanical, and biological control to increase profits to producers and protect the environment; (2) Sustainable Agriculture/Forestry - developing and promoting efficient and sustainable agricultural, forestry, and other resource conservation practices and policies that ensure sustained ecosystem function and provide food and habitat for biodiversity, including crop diversification, agroforestry, native windbreaks, cover crops, living mulches, field border systems, and conservation buffers; (3) Wildlife, Woodlands, and Aquatic Resources - understanding and mitigating the impact of agricultural practices and urbanization on biodiversity, woodlands, and aquatic resources. Focus will be on human impacts on the fundamental processes that create and maintain biodiversity, such as atmospheric nitrification of ecosystems, minimal habitat requirements, speciation, predator-prey interactions, community and ecosystem structure, and extinction processes. Approaches to develop and sustain biodiversity in agriculture, suburban landscapes, and natural habitats, will be studied. Nonpoint source nutrient pollution models will assess impacts of land use/cover change from agriculture to urban on water quality and quantity on local ponds and creeks; (4) Wetlands Ecosystems - improve understanding of wetlands restoration, protection, and preservation. Emphasis will be on seasonally saturated and non-seasonally saturated wetlands, the wildlife species that inhabit them, and the importance of sedges in wetland habitats; (5) Protection of Delaware's Native Species - research on non-indigenous invasive species, a leading cause of plant and animal extinction in Delaware, will focus on impacts of invasive species on ecosystem function and on methods of restoration after their removal; (6) Master Gardener Training - Extension programs will be developed and delivered on Wildlife Habitat Gardening, Waterwise Gardening, and use of native landscape plants in suburban gardens; (7) Human Activities and the Natural Environment - coupled environmental and socioeconomic modeling methodologies will highlight interactions between human activities (drivers), environmental impacts from those activities (stressors), potential changes to valued ecosystem components, and feedbacks experienced from the changes; (8) Wildlife Management - effects of human activity on migratory shore birds, box turtles in suburban habitat fragments, neotropical bird migrants in Delaware, Bobwhite quail in warm season grasslands, horseshoe crab ecology in the Delaware Bay, insect biomass production in suburban habitats, habitat restoration for bats and White-tailed deer populations and lead to recommendations for improved habitat management; (9) Fisheries - population status, spawning areas, and management of Atlantic sturgeon in the Delaware River.

2. Brief description of the target audience

Farm owners and operators, aquaculture producers, recreational fisheries, seafood consumers, water quality managers, agribusiness and private consultants, horticultural professionals, city land use planners

and other policy-makers, home gardeners, childcare providers, environmental educators.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	11205	8974	1222	1052

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

Patent Applications Submitted

Year: 2010
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	2	11	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	36

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	21

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	15

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	40

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	17

Output #6

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	5

Output #7

Output Measure

- Number of Post-doctoral Research Associates

Year	Actual
2010	1

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	13

Output #9

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	0

Output #10

Output Measure

- Number of Technical Reports

Year	Actual
2010	10

Output #11

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	11

Output #12

Output Measure

- Number of Invited Presentations

Year	Actual
2010	194

Output #13

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	86

Output #14

Output Measure

- Number of Websites Established

Year	Actual
2010	6

Output #15

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	219

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased number of farmers and other producers aware of the principles of integrated pest management and familiar with the practices and technologies needed for a systems-based approach to prevent and control problems with insects, weeds, and plant pathogens.
2	Educational programs for K-12 youth and teachers on ecosystems and natural resources that emphasize the importance of sustaining biodiversity for natural and managed land uses.
3	Establish a Center for Managed Ecosystems to conduct research and outreach programs on restoring and enhancing biodiversity and wildlife habitat in suburbanized landscapes.
4	Increased number of farmers and other land managers adopting integrated approaches to pest management for insects, weeds, alien invasive plants, and plant pathogens in agricultural and natural ecosystems.
5	Increased participation by all stakeholders in educational programs on responsible environmental management of natural resources, nutrients, and pesticides.
6	Increases in the amount of agricultural and suburban land where wildlife habitat has been restored or enhanced.
7	Integrated Pest Management: basic and applied research will increase the effectiveness of a systems-based approach to prevent or control pests (insects, weeds, plant pathogens) that threaten agricultural productivity and damage natural, urban, and suburban landscapes. Extension programs will promote adoption of IPM by farmers and other land managers.
8	Ecosystem restoration: fundamental research on ecosystem processes will provide evidence of the full range of ecological, water quality, and economic benefits associated with sustaining and enhancing natural ecosystems such as wetlands, forests, riparian corridors, and tidal marshes, and lead to greater restoration and expansion of areas important for wildlife habitat and biodiversity.
9	Wildlife habitat and management: research will assess the impacts of human activity on wildlife habitats and develop management practices that can protect threatened or endangered species and lead to policies that protect and enhance wildlife populations.
10	Protection of native species: research and extension programs will quantify the ecological and economic benefits of protecting indigenous plant species and restricting the spread of invasive plants and animals.

Outcome #1

1. Outcome Measures

Increased number of farmers and other producers aware of the principles of integrated pest management and familiar with the practices and technologies needed for a systems-based approach to prevent and control problems with insects, weeds, and plant pathogens.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Horticultural green industry, homeowners, industries investing in crop protection against insects and diseases, and urban extension agents.

What has been done
During 2010, UD extension entomologists provided guidance and advice to greenhouse managers that they have adopted, using biological control to manage insect pests.

Results
The team developed a web blog that has had over 1000 visitors during the past year; 19 image requests were submitted to UD and with over 4,817 individuals having viewed the photos. Homeowner education efforts were well received and many homeowners stated they would be more willing to tolerate insects feeding on their plants in the landscape.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Educational programs for K-12 youth and teachers on ecosystems and natural resources that emphasize the importance of sustaining biodiversity for natural and managed land uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
K-12 teachers, local and regional groups concerned about apiology and bee ecology/management, extension agents, crop consultants, and the public.

What has been done
A new apiology faculty member has given 25 talks to date to all different groups interested in the ecology and management of bees. The Mid-Atlantic Apiculture and Research and Extension Consortium (MAAREC) site is also now being hosted by UD and is one of the largest resources for beekeepers online.

Results
The MAAREC website touches thousands of interested beekeepers and citizen scientists. The apiary at UD has been renovated and a new apiary is being established this year at the Carvel Research and Education Center in Georgetown, DE. A research paper has been accepted to Insect Sociaux and is scheduled to be published in the summer of 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Establish a Center for Managed Ecosystems to conduct research and outreach programs on restoring and enhancing biodiversity and wildlife habitat in suburbanized landscapes.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Increased number of farmers and other land managers adopting integrated approaches to pest management for insects, weeds, alien invasive plants, and plant pathogens in agricultural and natural ecosystems.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
216	Integrated Pest Management Systems
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased participation by all stakeholders in educational programs on responsible environmental management of natural resources, nutrients, and pesticides.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Increases in the amount of agricultural and suburban land where wildlife habitat has been restored or enhanced.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Integrated Pest Management: basic and applied research will increase the effectiveness of a systems-based approach to prevent or control pests (insects, weeds, plant pathogens) that threaten agricultural productivity and damage natural, urban, and suburban landscapes. Extension programs will promote adoption of IPM by farmers and other land managers.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Natural resource managers, other land owners concerned about invasive plants, extension agents, industries investing in weed control research and product development for non-agricultural settings, and urban or forestry extension agents.

What has been done
Entomology and wildlife ecology faculty members study the vital relationship between insects and plants. Current projects investigate mile-a-minute weed (Persicaria perfoliata), an invasive alien plant native to Asia. Because the plant is not native to the United States, it has few natural predators and competes with native plants for space, nutrients and water.

Results
After several years of research, UD?s Chinese collaborators found an insect that would feed and reproduce only on mile-a-minute weed, Rhinocominus latipes, known as the mile-a-minute weevil and native to eastern Asia. Researchers have brought the project to local schools to teach them about biological control of weeds. They partnered with five 5th grade classes in Radnor Township, Pa., to help students study the effect of the weevils firsthand. The experiment recently moved to a 7th grade classroom, where students released the weevils into a site that contains mile-a-minute weed and monitored the results, she said.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Ecosystem restoration: fundamental research on ecosystem processes will provide evidence of the full range of ecological, water quality, and economic benefits associated with sustaining and enhancing natural ecosystems such as wetlands, forests, riparian corridors, and tidal marshes, and lead to greater restoration and expansion of areas important for wildlife habitat and biodiversity.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Natural resource managers, wildlife conservation agencies, wildlife biologists, not-for-profit groups concerned about wildlife habitat, and the public.

What has been done
With populations of bobwhite quail declining drastically across the country, wildlife research at UD is focusing on saving grasslands and edge habitats. Both are disappearing due to suburban development and increased efficiency in farming, Bobwhite quail, a historically favored game bird, was recently named by the Audubon Society as the number one bird in decline in North America. Although the Delmarva area has rarely been a target of quail research, the reported quail population per square mile was once one of the highest in the country, yet today is now one of the lowest.

Results
A basic ecology study of bobwhite quail in southern New Jersey was conducted. Working with the New Jersey Division of Fish and Wildlife, reserachers tracked the birds using radio collars to study their habitat, survival rates and daily life during both breeding and non-breeding seasons.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
216	Integrated Pest Management Systems
903	Communication, Education, and Information Delivery

Outcome #9

1. Outcome Measures

Wildlife habitat and management: research will assess the impacts of human activity on wildlife habitats and develop management practices that can protect threatened or endangered species and lead to policies that protect and enhance wildlife populations.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Natural resource managers, wildlife conservation agencies, urban land managers interested in natural areas, foresters, and the public.

What has been done
UD is collaborating with the U.S. Forest Service to continue work on a project that focuses on assessing the conditions of urban forests and explores ways in which to improve those conditions. The project is known as Forest Fragments in Managed Ecosystems, or FRAME, and it has its origins in a study titled ?Wildlife Ecology and Urban Impact? conducted 45 years ago at UD by scientists in the Department of Entomology and Wildlife Ecology and the Forest Service. The 1965 research became the longest running study on the demographics of the wood thrush, a neotropical migratory bird.

Results

The first two years of the FRAME study, underway now, are dedicated to gathering the pre-data, showing the present condition of the soil. The research team then plans to lime the forest patches to see if we can increase their quality, which will raise the pH and release the calcium, thereby improving biodiversity. They plan to treat 10 sites with lime and leave another 10 sites untreated in order to compare differences in soil quality. The team believes that changing the pH is going to change a lot to these forest fragments.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
903	Communication, Education, and Information Delivery

Outcome #10

1. Outcome Measures

Protection of native species: research and extension programs will quantify the ecological and economic benefits of protecting indigenous plant species and restricting the spread of invasive plants and animals.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

FAMILY AND YOUTH DEVELOPMENT

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	25%	25%	25%	25%
802	Human Development and Family Well-Being	25%	25%	25%	25%
806	Youth Development	40%	40%	40%	40%
903	Communication, Education, and Information Delivery	10%	10%	10%	10%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	17.4	3.4	0.0	1.5
Actual	12.2	1.2	0.0	3.9

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
295504	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
808543	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1271180	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extension programs will target: (1) Volunteer Leadership Development programs will be delivered on public policy education; volunteer leadership development (e.g., 4-H adult and teen volunteers and camp counselors, master gardeners, master food educators; T.R.Y. (Teens reaching youth), middle management volunteers (volunteers managing volunteers); and extension advisory committees; (2) Family Well-Being Across the Lifespan Educational Programming, including Just in Time Parenting (Great Beginnings and the Brown Bag program for parents of young children) and Families Matter! (for parents of school-age children), interactive web sites, newsletter series, workshops, worksite seminars and classes focusing on positive parenting and care giving, family stress management, child development, healthy relationships and marriage education, savvy decision-making, anger management and conflict resolution, healthy communication, intergenerational well-being, teamwork, leadership, and community involvement skills; 3) Safe Communities - programs will include drug and alcohol prevention education, bicycle safety education, pedestrian safety education, farm safety, and car seat safety; (4) Family Economic Well-Being and Consumer Decision Making educational programs will be developed and delivered focusing on strategies for effective consumer decision making, financial planning, financial management counselor training, basic budgeting, credit management, and retirement planning; (5) 4-H Youth Development programs will focus on life skills development, positive life choices, leadership development, citizenship/community involvement, and career exploration with emphasis on science, engineering and technology knowledge. Appropriate settings including clubs, camps, school enrichment and after school will use the latest technology to deliver the sustained opportunities.

2. Brief description of the target audience

Youth ages 5-19, 4-H members, 4-H volunteers, new 4-H volunteers, Master Gardeners, Community Leaders, at-risk youth and families, court appointed and incarcerated youth and adults, parents of children (from birth through school-age), families with members in the second ½ of the lifespan, youth agency professionals, key decision-makers, human service professionals, child care/after school providers, family day home providers, social clubs, church groups, private and public school youth and teachers, after school 4-H clubs and school age child care programs.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	11940	5841	27990	20444

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	1	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	35

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	20

Output #3

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	9

Output #4

Output Measure

- Number of Invited Presentations

Year	Actual
2010	40

Output #5

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	78

Output #6

Output Measure

- Number of Websites Established

Year	Actual
2010	2

Output #7

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	283

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Leadership development programs for volunteers interested in improving the quality of life for youth, families and communities.
2	Greater knowledge by Delaware youth of the importance of academic performance, social skills, and job preparedeness to their future careers.
3	Educational programming for K-12 teachers and youth emphasizing the development of positive life skills related to parenting, family financial planning, and safe communities.
4	Number of youth adopting behaviors that reduce their risk of using alcohol, tobacco and related substances.
5	Number of youth participating in extension programs who demonstrate improved academic, social, and job preparedness skills.
6	Number of parents/families participating in extension programming who demonstrate positive parenting skills.
7	Number of youth and adults adopting increased leadership, communication, conflict management and decision-making skills
8	Number of program participants adopting skills for balancing work and family and stress management that promote healthy, well-functioning individuals and families
9	Number of youth and adults adopting bike, pedestrian and traffic safety rules and regulations.
10	Dollars saved through volunteer interventions.
11	Number of families who adopt best practices in financial management, retirement planning and consumer decision-making.
12	Number of adults adopting best practices in child development, business development, educational program development in child care settings.
13	Number of youth who have increased science, engineering, and technology skills.
14	Number of youth with greater involvement in citizenship and community service programs.
15	An enhanced capacity for families and youth to improve their quality of life because of increased skills in parenting and family relationships, academic preparedness, career development, family financial planning, leadership and volunteerism, and citizenship and community involvement.

Outcome #1

1. Outcome Measures

Leadership development programs for volunteers interested in improving the quality of life for youth, families and communities.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Military families and their relaties, US Armed Services, K-12 teachers, community groups, state and federal agencies concerned about the impact of parental separation due to military service on families.

What has been done
Operation Military Kids (OMK) reaches children of service members throughout the state of Delaware to provide them with support and programmatic activities associated with the stress of military service, particularly family separation due to service.

Results
685 Hero Packs were filled and distributed to military youth, and a Mobile Tech Lab was used at 85 events. A Military Youth Camp Grant reached 699 military youth and 386 adults and 73 other OMK Youth program events were offered reaching 4,827 youth. 75 individuals were trained in the 4-H Army Babysitter Curriculum and 48 Face To Face OMK Briefings were given by state team partners, reaching 2,478 individuals in DE. OMK Displays were placed at over 18 events. 50 Ready, Set, Go! Trainings were given in DE, reaching 1,646 individuals. 303 youth were served at DAFB Youth Center and 55 youth in our off base club. The 4-H Drug Prevention Carnival had over 342 in attendance, and the Month of the Military Child Activities served over 800 youth.

4. Associated Knowledge Areas

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

903 Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Greater knowledge by Delaware youth of the importance of academic performance, social skills, and job preparedeness to their future careers.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Educational programming for K-12 teachers and youth emphasizing the development of positive life skills related to parenting, family financial planning, and safe communities.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Number of youth adopting behaviors that reduce their risk of using alcohol, tobacco and related substances.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of youth participating in extension programs who demonstrate improved academic, social, and job preparedness skills.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Number of parents/families participating in extension programming who demonstrate positive parenting skills.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Number of youth and adults adopting increased leadership, communication, conflict management and decision-making skills

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

Number of program participants adopting skills for balancing work and family and stress management that promote healthy, well-functioning individuals and families

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
903	Communication, Education, and Information Delivery

Outcome #9

1. Outcome Measures

Number of youth and adults adopting bike, pedestrian and traffic safety rules and regulations.

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Dollars saved through volunteer interventions.

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Number of families who adopt best practices in financial management, retirement planning and consumer decision-making.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
903	Communication, Education, and Information Delivery

Outcome #12

1. Outcome Measures

Number of adults adopting best practices in child development, business development, educational program development in child care settings.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

903 Communication, Education, and Information Delivery

Outcome #13

1. Outcome Measures

Number of youth who have increased science, engineering, and technology skills.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

Number of youth with greater involvement in citizenship and community service programs.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

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

Outcome #15

1. Outcome Measures

An enhanced capacity for families and youth to improve their quality of life because of increased skills in parenting and family relationships, academic preparedness, career development, family financial planning, leadership and volunteerism, and citizenship and community involvement.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Delaware families, K-12 teachers, state and federal agencies concerned about youth development and community involvement, and the public.

What has been done
The Engaging Youth Serving Community project funded by USDA through National 4-H Council has been very successful. Five communities were funded and youth-adult teams were trained to conduct forums using the National Issues Forum Model.

Results
Longitudinal data were collected. Over 90% of participants learned how to identify community issues. Over 90% of community leaders developed more positive attitudes about youth. Over 95% of participants demonstrated an increased commitment to the adult community. Over 95% of the youth and adult leaders were able to apply leadership skills learned in the project to other local situations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	15%	15%	15%	15%
502	New and Improved Food Products	10%	10%	10%	10%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	60%	60%	60%	60%
903	Communication, Education, and Information Delivery	15%	15%	15%	15%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	7.8	3.6	3.9	2.0
Actual	1.1	0.9	3.9	0.9

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	3215	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
16665	0	290347	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research efforts involve using high pressure processing to reduce bacteria, viruses, protozoan oocysts, and bacterial endospores; inactivation of pathogenicbacterial specieswith high pressure and mild heat; using various antimicrobial films to control bacteria, such as Listeria monocytogenes;physiological and genetic analysis ofpressure-resistant Listeria monocytogenes; testing of activity of antimicrobial films against native and inoculated bacteria on foods and surfaces; effects and mechanisms of non-thermal processes (ozone, UV, oxidative chemicals, iron, and/or high pressure processing) on protozoa, human pathogenic viruses, and bacteriophage, and increase understanding of basic biochemistry of these microorganisms. Extension efforts include conducting Keep Food Safe, ServSafe®, Don't Give Kids a Tummy Ache, Food Safety for Entrepreneurs, Keep'em Down on the Farm, Chances and Choices, Operation Risk, Microbial Contamination, Don't Bug Me!,; training volunteers including Master Food Educators, 4-H leaders, agency personnel, and teacher about food safety so that they can educate families, community groups, and institutions (e.g., childcare centers, schools); developing and delivering programs on Kids Cooking (1890 EFNEP), Food Safety for Youth, and Eat Smart, Play Hard; developing web-based information and fact sheets; distributing information to media; developing a marketing campaign to expand program participation; developing a marketing strategy with state and local government partners, faith-based groups, parents, social workers, childcare providers, low income housing managers, and corporate wellness centers to collectively deal with low income and socially disadvantaged individuals.

2. Brief description of the target audience

Restaurant workers, volunteer food handlers, delicatessen workers, day care providers, institutional foodservice workers, school foodservice personnel, caterers/private chefs, food entrepreneurs, retail food owners/managers, food producers, youth ages 5 to 18, parents and caregivers of children from birth to 18, limited-resource individuals and families, 4-H leaders and clubs, Boys and Girls clubs, teachers and other school personnel, youth in low-income schools, policy makers, and media.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3290	46855	7450	7900

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	1	20	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	33

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	14

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	9

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	20

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	21

Output #6

Output Measure

- Number of Post-doctoral Research Associates

Year	Actual
2010	2

Output #7

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	21

Output #8

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	4

Output #9

Output Measure

- Number of Technical Reports

Year	Actual
2010	11

Output #10

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	4

Output #11

Output Measure

- Number of Invited Presentations

Year	Actual
2010	18

Output #12

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	47

Output #13

Output Measure

- Number of Websites Established

Year	Actual
2010	1

Output #14

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	262

Output #15

Output Measure

- Number of Newsletters Distributed

Year	Actual
2010	2222

Output #16

Output Measure

- Number of New Program Partners

  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased number of farmers, processors, food handlers, and families who are aware of food safety and nutrition issues that can lead to illness and long-term health problems and of the practices and technologies needed to ensure a safe and healthy food supply.
2	Educational programs for K-12 youth and teachers on food safety and nutrition that will help reduce the likelihood of food-borne illness, develop good nutritional and dietary habits, avoid obesity, and prevent chronic illnesses related to poor nutrition.
3	Increased number of farmers and food processors adopting research-based advances in food science technology that will prevent the incidence and spread of foodborne illnesses.
4	Safe, new food products that are preserved using innovative technologies designed to maintain food quality and nutrient content.
5	Increased number of program participants improving in one or more safe handling practices.
6	Increased number of participating youth increasing understanding of safe food handling procedures.
7	Increased number of program participants improving one or more nutrition practices.
8	Increased number of program participants improving one or more food resource management practices.
9	Increased number of program participants increasing or maintaining appropriate physical activity level.
10	Food science and technology: basic and applied research will lead to optimization of intervention strategies incorporating high hydrostatic pressure processing, ultraviolet light, ozone treatment, active packaging and low-temperature storage to eliminate or significantly reduce the source of foodborne disease in food products. Applied food science research and extension programs in these areas will increase awareness to food producers and consumers of the most effective strategies for food product safety.
11	Food safety: research and extension programs will lead to enhanced safety and wholesomeness of foods as a result of improved understanding of the mechanisms whereby food pathogens exist, enter, survive, propagate and actuate disease syndromes in individuals who consume contaminated products. Gene-based methods to rapidly and accurately identify food-borne pathogens will increase the safety of food products.

Outcome #1

1. Outcome Measures

Increased number of farmers, processors, food handlers, and families who are aware of food safety and nutrition issues that can lead to illness and long-term health problems and of the practices and technologies needed to ensure a safe and healthy food supply.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food Service industry personnel and their employers

What has been done
Educational programs targeted at food safety training for food service personnel.

Results
Eighty-eight clients employed in the food service industry took the Servsafe certification course. Of those who took the course, 83 were successful in passing the certification exam.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Educational programs for K-12 youth and teachers on food safety and nutrition that will help reduce the likelihood of food-borne illness, develop good nutritional and dietary habits, avoid obesity, and prevent chronic illnesses related to poor nutrition.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public, families, youth, food service personnel, and K-12 teachers.

What has been done
With recent outbreaks involving common foods such as eggs, peanut butter, spinach, and tomatoes, UD food science experts developed traditional and interactive materials about foodborne illness outbreaks that could be integrated into high school curriculums to teach students the science of this current ?hot? topic.

Results
Nineteen middle school, high school and college-level teachers attended a conference hosted UD to introduce the educational materials. The teachers came from backgrounds of biology, chemistry, microbiology, family and consumer sciences, applied physical sciences and mathematics. There are aspects of the program that are a perfect fit for biology and chemistry teachers, but there are also aspects that are appropriate for consumer sciences and more traditional agricultural courses. Materials available for the teachers include a presentation on food microbiology, outbreak investigation case studies and interactive web-based games. The web activities can be used by one player or groups of students in the classroom.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Increased number of farmers and food processors adopting research-based advances in food science technology that will prevent the incidence and spread of foodborne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Safe, new food products that are preserved using innovative technologies designed to maintain food quality and nutrient content.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased number of program participants improving in one or more safe handling practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public, food service industry, state and federal agencies concerned about foodborne illness, and the public.

What has been done
A Master Food Educators (MFE) program, modeled after the nationally successful Master Gardeners program, has been established and volunteers trained by Cooperative Extension.

Results
These dedicated MFE volunteers gave over 240 volunteer hours of their time back to UD extension. Volunteers conducted workshops in the community such as Eating Local or The Good, Bad and Ugly on Eating Fats, staffed educational displays at Ag Day, Day on the Farm and school health fairs, and conducted food preparation demonstrations at Dining with Diabetes and Eat Smart for a Healthy Heart programs conducted by the FCS agents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Increased number of participating youth increasing understanding of safe food handling procedures.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #7

1. **Outcome Measures**

Increased number of program participants improving one or more nutrition practices.

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Increased number of program participants improving one or more food resource management practices.

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

Increased number of program participants increasing or maintaining appropriate physical activity level.

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

Food science and technology: basic and applied research will lead to optimization of intervention strategies incorporating high hydrostatic pressure processing, ultraviolet light, ozone treatment, active packaging and low-temperature storage to eliminate or significantly reduce the source of foodborne disease in food products. Applied food science research and extension programs in these areas will increase awareness to food producers and consumers of the most effective strategies for food product safety.

2. **Associated Institution Types**

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual

2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
US food production and distriubtion industry, state and federal agencies concerned about foodborne illness, the public.

What has been done
Food safety research at UD is extensive and ranges from factors affecting pathogen survival in fresh and processed foods and innovative processing techniques that ensure a safe food supply.

Results
Research at UD examines pathogen transmission in the environment?from the gut of a chicken, into the soil, into a plant, through processing to the consumer. Food scientists at UD are evaluating survival on plants for pre-harvest safety and post-harvest are evaluating herbal-oils that could be used to kill the bacteria before the fresh tomatoes reach the consumer. In addition to research in the area of environmental transmission, UD scientists are working with high pressure processing techniques and mild heat treatments to enhance the safety and packaging components of our food supply and completely kill pathogenic bacteria on sprouting seeds with minimal negative impact on the seeds in a non-chemical fashion. High pressure processing research at UD is also studied to kill pathogenic bacteria and viruses often linked with human illness from raw oyster consumption. Scientists at UD are also enhancing the safety of compost applied to crops ensuring inactivation of bacteria and viruses. Scientists are working with to understand how spores of related species like Bacillus anthracis and Bacillus cereus survive food processing treatments. Research has also investigated how cyclospora interact with raspberries and not others and how the organism may be inactivated by non-thermal technologies.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

Food safety: research and extension programs will lead to enhanced safety and wholesomeness of foods as a result of improved understanding of the mechanisms whereby food pathogens exist, enter, survive, propagate and actuate disease syndromes in individuals who consume contaminated products. Gene-based methods to rapidly and accurately identify food-borne pathogens will increase the safety of food products.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Childhood Obesity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	10%	10%	10%	10%
703	Nutrition Education and Behavior	20%	20%	20%	20%
704	Nutrition and Hunger in the Population	60%	60%	60%	60%
903	Communication, Education, and Information Delivery	10%	10%	10%	10%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	16.8	0.6	0.0	3.3

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
3491	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
50477	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
541528	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension efforts include, but are not limited to, conducting Healthy Habits, Healthy Start - a 6 hour program on healthy eating and physical activity for child care workers, Family Meals Workshops - a series of three, three-hour programs for families with young children, FoodSkills - an eight part workshop for low-income adults without children; Expanded Food and Nutrition Education Program - a series of eight lessons for low-income adults with children; Expanded Food and Nutrition Education Program for low-income youth; training volunteers including Master Food Educators, 4-H leaders, agency personnel, and teachers; providing Just In Time parenting newsletters; incorporating physical activity and healthy foods/snacks in all 4-H camps and after-school programs; providing special educational programs at the 4-H Military Program; and conducting favorite foods contests and CATCH programs for youth.

2. Brief description of the target audience

Day care workers, parents, low-income adults and youth, 4-H youth, Master Food Educators, 4-H leaders, teachers

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5331	5652	4889	6424

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	1	0	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	7

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	4

Output #3

Output Measure

- Number of research projects completed

Year	Actual
2010	1

Output #4

Output Measure

- Number of undergraduate researchers

Year	Actual
2010	1

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	2

Output #6

Output Measure

- Number of refereed journal articles

Year	Actual
2010	1

Output #7

Output Measure

- Number of extension bulletins and factsheets

Year	Actual
2010	92

Output #8

Output Measure

- Number of invited presentations

Year	Actual
2010	5

Output #9

Output Measure

- Number of volunteered presentations

Year	Actual
2010	9

Output #10

Output Measure

- Number of websites established

Year	Actual
2010	1

Output #11

Output Measure

- Number of workshops conducted

Year	Actual
2010	217

Output #12

Output Measure

- Number of Ph.D. students

Year	Actual
2010	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Statewide educational programs for K-12 youth and teachers focused on nutrition, healthy diets and obesity causing factors that will help reduce the likelihood of food-borne illness, develop good nutritional and dietary habits, avoid obesity, and prevent chronic illnesses related to poor nutrition.
2	Targeted educational programs on understanding the causes of obesity and the means to reduce obesity for low-income communities, youth through after-school programs and childcare workers.
3	Increased number of program participants improving one or more nutrition practices.
4	Increased number of program participants who improve the frequency and quality of family meals.
5	Increased number of program participants engaged in greater levels of physical activity.
6	Reducing obesity in Delaware by extension programs that modify individual, family, and community behavior in a manner that promotes healthy lifestyles, physical activity on a regular basis, the consumption of healthy foods in appropriate quantities, and increasing family meals.
7	Greater understanding, particularly in low-income communities and by youth, of the health risks associated with obesity and the options available to prevent or correct obesity problems.

Outcome #1

1. Outcome Measures

Statewide educational programs for K-12 youth and teachers focused on nutrition, healthy diets and obesity causing factors that will help reduce the likelihood of food-borne illness, develop good nutritional and dietary habits, avoid obesity, and prevent chronic illnesses related to poor nutrition.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Familes, state and federal agencies, the public and others concerned about nutrition in childcare settings.

What has been done
Conducted the Healthy Habits Healthy Start statewide 6-hour training program focused on nutrition education for childcare providers.

Results
One hundred and nine childcare providers participated in the Healthy Habits Healthy Start statewide 6-hour training. Training came as a result of a partnership with the DE Department of Public Health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Targeted educational programs on understanding the causes of obesity and the means to reduce obesity for low-income communities, youth through after-school programs and childcare workers.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Increased number of program participants improving one or more nutrition practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Delaware racing industry, jockeys and their families, others concerned about the health and dietary habits of this group.

What has been done
UD food and nutrition specialists partnered with Delaware Jockey's Health and Welfare Benefit Board and the Delaware Thoroughbred Horsemen's Association to help them develop a nutritional education program for Delaware's jockey colony.

Results
Jockeys participated in training sessions that explained how they can meet strict weight requirements needed to participate in races and not impede the speed of their mounts. These stringent weight limits often lead jockeys to participate in unhealthy behaviors, many of them develop eating disorders such as purging after eating to prevent weight gain. Extension programs are helping Delaware jockeys to improve their eating habits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Increased number of program participants who improve the frequency and quality of family meals.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Families, state and federal agencies, not-for-profit groups, and others who are interested in improving the quality and frequency of family meals.

What has been done
UD extension has conducted a series of workshops for family meal providers. This innovative initiative gives low-resource parents the tools they need to prepare healthy and cost-effective meals at home.

Results
The program is offered at two state of Delaware Housing Authority locations in Kent County. Children who eat regular meals with their families are more likely to consume more dairy products and increase fruit and vegetable consumption. Beyond the nutritional benefits, research has shown that children and teens who eat meals with their families are less likely to drink alcohol, smoke cigarettes, or use marijuana and other drugs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased number of program participants engaged in greater levels of physical activity.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Reducing obesity in Delaware by extension programs that modify individual, family, and community behavior in a manner that promotes healthy lifestyles, physical activity on a regular basis, the consumption of healthy foods in appropriate quantities, and increasing family meals.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual

2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Greater understanding, particularly in low-income communities and by youth, of the health risks associated with obesity and the options available to prevent or correct obesity problems.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Climate Change

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	15%	15%	15%	15%
111	Conservation and Efficient Use of Water	10%	10%	10%	10%
132	Weather and Climate	10%	10%	10%	10%
136	Conservation of Biological Diversity	10%	10%	10%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	5%	5%	5%	5%
205	Plant Management Systems	10%	10%	10%	10%
305	Animal Physiological Processes	5%	5%	5%	5%
307	Animal Management Systems	10%	10%	10%	10%
311	Animal Diseases	10%	10%	10%	10%
601	Economics of Agricultural Production and Farm Management	5%	5%	5%	5%
605	Natural Resource and Environmental Economics	5%	5%	5%	5%
903	Communication, Education, and Information Delivery	5%	5%	5%	5%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	10.2	1.2	19.8	1.5

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
84393	0	281486	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
129106	0	414250	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
195850	0	579041	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and extensions programs will focus on: (1) Animal agriculture: understanding impacts of climate change on animal physiological processes, health, and disease, particularly for poultry and dairy; developing management practices to rapidly diagnose, prevent, and mitigate (e.g., new vaccines) effects of avian diseases on poultry health and productivity, including current disease problems and new ones that may appear and proliferate under new climatic conditions; developing new systems and technologies to reduce effects of environmental stress on animal health and productivity; (2) Agronomic crops: basic research on how environmental stresses associated with climate change (e.g., heat, moisture stress) affect crop physiology and productivity; plant genetics and breeding studies to develop cultivars of major crops better adapted to a changing climate, in terms of water use efficiency and resistance to insects and disease; applied research and extension programs on irrigation management and water use efficiency for periods of prolonged drought and restricted water use and for groundwaters that may become more saline from salt water intrusion; integrated pest management to diagnose and control insects, weeds, and diseases (current and newly emerging) during longer growing seasons and under warmer and wetter growing conditions; nutrient cycling and management, particularly for manures and other byproducts where decomposition and nutrient release rates and timings are affected by warmer, wetter climates; basic and applied research on factors controlling C sequestration and new agronomic management practices that help mitigate greenhouse gas emissions by sequestering C in soils; (3) Natural Ecosystems: characterizing effects of climate change on biodiversity of plants and wildlife exposed to greater pressure from droughts, insects, disease, and invasive species; studying how climate change affects natural ecosystems and insects critical to crop production (e.g., pollination, honeybees); investigate value of marshes, wetlands, and forests to sequester C; increase C storage by encouraging tree planting and sustainable forestry management, (4) Resource economics: develop creative new economic policies to profitably link agriculture and forestry with those sectors generating significant quantities of greenhouse gases (e.g., energy, transportation) in cooperative efforts to mitigate greenhouse gas emissions; improve understanding of the relationship of climate change to agricultural and environmental policy development, including farmland preservation, conservation reserve programs; study impacts of climate change on groundwater aquifers, integrate climate change into the Chesapeake Bay water quality model; contribute to policies and educational programs on recycling, develop environmentally-friendly bio-based fuels from local feed stocks, and assist in analysis of Delaware's greenhouse gas inventories from energy use (mobile sources, utilities, residential, industrial, transportation, commercial, natural gas distribution, waste management, agriculture, land use, etc.).

2. Brief description of the target audience

For animal agriculture, primarily poultry integrators, growers, breeders, trade groups and allied industries; dairy and beef producers; livestock commodity groups; forage producers, equine owners,

producers and interest groups; for crop and soils related research and extension programs, the audience includes existing and prospective grain crop producers, mixed (animal and crop production, e.g., dairy, horse) farms, crop commodity groups and trade associations, the "green industry" (e.g., horticulture, nurseries, landscapers), and certified crop advisors; for natural resource and ecology programs, private and not-for-profit organizations managing forests, wetlands, marshes, and other natural resource areas; state and federal agencies responsible for wildlife, forestry management, and coastal ecosystems; for our resource economic programs the audience includes farmers, landowners, policy-makers and state and federal agencies directly related to climate change policy (Delaware Development Office; Land Use Planning and Preservation; Department of Agriculture; Department of Health and Human Services; Department of Natural Resources & Environmental Control; Department of Transportation; Economic Development Office, USDA, NRCS, USEPA). For all programs, Delaware State Government and local legislators, homeowner associations, educators, community leaders, utility managers, retail stores distributing Energy Star products, fleet managers, building industry, Delaware Clean State Program members, Delaware Farm Bureau leaders, federal-state-local agriculture businesses, state and federal agencies; federal research laboratories; peer scientists in the U.S. and international colleagues, K-12 teachers, and environmental and community groups.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	10552	15688	2253	223

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

Patent Applications Submitted

Year: 2010

Actual: 4

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	4	50	54

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	74

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	32

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	45

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	75

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	39

Output #6

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	24

Output #7

Output Measure

- Number of Post-doctorate Research Associates

Year	Actual
2010	9

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	54

Output #9

Output Measure

- Number of Book and Book Chapters

Year	Actual
2010	6

Output #10

Output Measure

- Number of Technical Reports

Year	Actual
2010	24

Output #11

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	22

Output #12

Output Measure

- Number of Invited Presentations

Year	Actual
2010	71

Output #13

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	70

Output #14

Output Measure

- Number of Websites Established

Year	Actual
2010	11

Output #15

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	128

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Educational programs for the poultry, livestock and equine industries on likely effects of climate change on animal health, productivity, the incidence of disease, greater energy costs due to warmer temperatures, and their management options to prevent new problems.
2	Greater awareness by farmers, the ?Green Industry?, other producers, and land managers of the types and possible magnitude of climate change impacts on crop production, with an emphasis on drought and irrigation management, increased incidences and diversity of pest pressures from insects, disease, and weeds, and nutrient cycling and transport for different crop rotations and tillage systems.
3	Outreach programs and demonstration projects on underlying principles and soil management programs now available to enhance carbon sequestration by agriculture, forestry, and other natural ecosystems (e.g., marshes, wetlands).
4	Educational programs for K-12 teachers, policy-makers, and the public on climate change and its potential effects on agriculture, natural ecosystems, and current and proposed approaches and new policies that could mitigate problems associated with climate change.
5	Increased number of poultry and livestock producers adopting management practices specifically designed to mitigate disease and animal health problems associated with climate change, particularly those related to year-round warmer conditions and weather extremes.
6	Increased number of crop producers adopting management practices specifically designed to mitigate plant growth problems associated with climate change, particularly those related to drought, pest pressures, and nutrient use.
7	Development of systematic strategies and plans to address climate change impacts on natural resource areas, particularly those related to plant species change, loss of biodiversity, wildlife ecology, and invasive plants.
8	Increased number of farmers, natural resource managers, and others aware of and participating in programs related to mitigating greenhouse gas emissions through programs such as carbon credits and carbon trading.
9	Greater scientific understanding of the fundamental mechanisms by which climate change affects plant and animal physiological processes, soil biological and chemical processes, and ecosystem health, with particular emphasis on challenges due to plant and animal diseases, water use efficiency, and biodiversity.
10	Successful adoption of research-based management practices and economic policies that sustain animal agriculture, ensure crop productivity, protect or restore natural resource areas negatively impacted by climate change, and reduce greenhouse gas emissions.

Outcome #1

1. Outcome Measures

Educational programs for the poultry, livestock and equine industries on likely effects of climate change on animal health, productivity, the incidence of disease, greater energy costs due to warmer temperatures, and their management options to prevent new problems.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Greater awareness by farmers, the ?Green Industry?, other producers, and land managers of the types and possible magnitude of climate change impacts on crop production, with an emphasis on drought and irrigation management, increased incidences and diversity of pest pressures from insects, disease, and weeds, and nutrient cycling and transport for different crop rotations and tillage systems.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Outreach programs and demonstration projects on underlying principles and soil management programs now available to enhance carbon sequestration by agriculture, forestry, and other natural ecosystems (e.g., marshes, wetlands).

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate
205	Plant Management Systems
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Educational programs for K-12 teachers, policy-makers, and the public on climate change and its potential effects on agriculture, natural ecosystems, and current and proposed approaches and new policies that could mitigate problems associated with climate change.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual

2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
205	Plant Management Systems
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased number of poultry and livestock producers adopting management practices specifically designed to mitigate disease and animal health problems associated with climate change, particularly those related to year-round warmer conditions and weather extremes.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Increased number of crop producers adopting management practices specifically designed to mitigate plant growth problems associated with climate change, particularly those related to drought, pest pressures, and nutrient use.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate

203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Development of systematic strategies and plans to address climate change impacts on natural resource areas, particularly those related to plant species change, loss of biodiversity, wildlife ecology, and invasive plants.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Natural resource managers, environmental groups, state and federal agenices interested in climate change research, water quality, and education programs.

What has been done
The University of Delaware, in collaboration with Stroud Water Research Center in Avondale, Pa., has established the Christina River Basin as a new ?Critical Zone Observatory? for researching questions relating to climate change. Scientists define the ?critical zone? as the portion of the planet from the treetops to the groundwater that sustains terrestrial life. The observatory is one of only six in the United States.

Results
Using the 565-square-mile Christina River Basin as their laboratory, the scientific team will be working to determine how, and how rapidly, soil erosion and sediment transported through rivers impact the exchange of carbon between the land and the atmosphere, and affect climate.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Increased number of farmers, natural resource managers, and others aware of and participating in programs related to mitigating greenhouse gas emissions through programs such as carbon credits and carbon trading.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

Outcome #9

1. Outcome Measures

Greater scientific understanding of the fundamental mechanisms by which climate change affects plant and animal physiological processes, soil biological and chemical processes, and ecosystem health, with particular emphasis on challenges due to plant and animal diseases, water use efficiency, and biodiversity.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate
136	Conservation of Biological Diversity
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases

Outcome #10

1. Outcome Measures

Successful adoption of research-based management practices and economic policies that sustain animal agriculture, ensure crop productivity, protect or restore natural resource areas negatively impacted by climate change, and reduce greenhouse gas emissions.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate
136	Conservation of Biological Diversity
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

PLANT BIOLOGY AND CROP PRODUCTION 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
201	Plant Genome, Genetics, and Genetic Mechanisms	10%	0%	0%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%	0%	0%	0%
205	Plant Management Systems	10%	0%	0%	0%
206	Basic Plant Biology	10%	0%	0%	0%
212	Pathogens and Nematodes Affecting Plants	10%	0%	0%	0%
213	Weeds Affecting Plants	10%	0%	0%	0%
216	Integrated Pest Management Systems	10%	0%	0%	0%
402	Engineering Systems and Equipment	10%	0%	0%	0%
601	Economics of Agricultural Production and Farm Management	10%	0%	0%	0%
903	Communication, Education, and Information Delivery	10%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	12.9	1.4	23.0	3.0
Actual	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

NOTE: ALL ACTIVITY PREVIOUSLY ASSOCIATED WITH THIS PLANNED PROGRAM IS NOW BEING REPORTED IN THE FOLLOWING PLANNED PROGRAMS.
PLANNED PROGRAM 1: GLOBAL FOOD SECURITY AND HUNGER
PLANNED PROGRAM 7: CLIMATE CHANGE

PLEASE DISREGARD ALL INFORMATION CONTAINED IN THE "PLANT BIOLOGY AND CROP PRODUCTION SYSTEMS" PLANNED PROGRAM.

2. Brief description of the target audience

Existing and prospective crop producers, mixed (animal and crop production, e.g., dairy, horse) farms, trade associations (e.g., Delaware Herb Growers & Marketers Association), the "green industry" (e.g., horticulture, nurseries, landscapers), certified crop advisors, private agricultural consultants, state (DDA, DNREC, DELDOT) and federal agencies (USDA), national laboratories (e.g., Argonne), chemical/seed/fertilizer companies, agricultural equipment companies, peer scientists, growers, processors, marketers of plants of flavor, fragrance, and medicine in Delaware, educators, policy-makers, the U.S., and international countries.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010
Actual: {No Data

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	5	29	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	0

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	0

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	0

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	0

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	0

Output #6

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	0

Output #7

Output Measure

- Number of Post-doctoral Research Associates

Year	Actual
2010	0

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	0

Output #9

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	0

Output #10

Output Measure

- Number of Technical Reports

Year	Actual
2010	0

Output #11

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	0

Output #12

Output Measure

- Number of Invited Presentations

Year	Actual
2010	0

Output #13

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	0

Output #14

Output Measure

- Number of Websites Established

Year	Actual
2010	0

Output #15

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased number of farmers, other producers, and land managers aware of latest advances in cultural management practices, crop varieties, irrigation technologies, and integrated pest management strategies for agronomic, vegetable, and horticultural crop production.
2	Targeted educational programs for farmers focused on cultural practices, marketing, and environmental aspects of new, high value cropping systems for niche markets, such as culinary herbs and essential oil plants, greenhouse grown pharmaceutical and nutriceutical plants, and plants grown as renewable bioenergy sources.
3	Educational programs for K-12 teachers and youth on advances in plant molecular biology and applications of the basic plant sciences to the production of plants used for food, fiber, landscaping, timber, bioenergy, and pharmaceutical and nutriceutical purposes.
4	Increased adoption of new innovations in marketing and risk management for farmers and other producers of plants and plant-based products.
5	Increased number of farmers adopting new crop varieties and integrating innovations in cultural practices, biological and chemical pest management, harvesting equipment, and irrigation management into their production systems.
6	Increase in the number of farmers implementing comprehensive nutrient management plans that are profitable and protective of ground and surface water quality.
7	Increased adoption of recommended practices for plant production, management, and environmental protection by the "Green Industry" (greenhouses, nurseries, landscapers).
8	Increased amount of land used to produce high value, niche market crops, such as culinary herbs, spices and essential oils.
9	Expansion in amount of land and increased adoption of best management practices for pasture and forage production systems for the beef, goat, and equine industries.
10	Commercial scale feasibility studies of greenhouses to produce high value plants that have been genetically modified, such as those intended for pharmaceutical or nutriceutical uses.
11	Plant Biology: basic research will lead to improved understanding of plant molecular biology and allow genetic manipulation of physiological processes important to increasing crop yields and quality and crop resistance to biotic and abiotic stresses.
12	Agronomic and Vegetable Crops: applied research and extension programs on cultural practices, crop varieties, fertilizer and manure use, precision agriculture, and integrated pest management will increase crop yields, minimize costs, and protect environmental quality.
13	Horticultural Systems: Extension programs will provide guidance on management practices for horticultural plants produced and installed by the "Green Industry" and for homeowners, important because of the rapid conversion of farmland to urban and suburban uses.
14	New Markets: advances in plant molecular biology and genomics will provide new markets for farmers and commercial-scale horticulture, such as plants for bioenergy, pharmaceutical and nutriceutical uses. New and creative marketing programs will stimulate diversification and growth in the production of value-added and niche market crops, such as culinary herbs, spices, essential oil plants, and specialty vegetables for urban and suburban markets.

Outcome #1

1. Outcome Measures

Increased number of farmers, other producers, and land managers aware of latest advances in cultural management practices, crop varieties, irrigation technologies, and integrated pest management strategies for agronomic, vegetable, and horticultural crop production.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Targeted educational programs for farmers focused on cultural practices, marketing, and environmental aspects of new, high value cropping systems for niche markets, such as culinary herbs and essential oil plants, greenhouse grown pharmaceutical and nutriceutical plants, and plants grown as renewable bioenergy sources.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Educational programs for K-12 teachers and youth on advances in plant molecular biology and applications of the basic plant sciences to the production of plants used for food, fiber, landscaping, timber, bioenergy, and pharmaceutical and nutriceutical purposes.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Increased adoption of new innovations in marketing and risk management for farmers and other producers of plants and plant-based products.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased number of farmers adopting new crop varieties and integrating innovations in cultural practices, biological and chemical pest management, harvesting equipment, and irrigation management into their production systems.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
402	Engineering Systems and Equipment
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Increase in the number of farmers implementing comprehensive nutrient management plans that are profitable and protective of ground and surface water quality.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Increased adoption of recommended practices for plant production, management, and environmental protection by the "Green Industry" (greenhouses, nurseries, landscapers).

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Increased amount of land used to produce high value, niche market crops, such as culinary herbs, spices and essential oils.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #9

1. Outcome Measures

Expansion in amount of land and increased adoption of best management practices for pasture and forage production systems for the beef, goat, and equine industries.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #10

1. Outcome Measures

Commercial scale feasibility studies of greenhouses to produce high value plants that have been genetically modified, such as those intended for pharmaceutical or nutriceutical uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #11

1. Outcome Measures

Plant Biology: basic research will lead to improved understanding of plant molecular biology and allow genetic manipulation of physiological processes important to increasing crop yields and quality and crop resistance to biotic and abiotic stresses.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

Outcome #12

1. Outcome Measures

Agronomic and Vegetable Crops: applied research and extension programs on cultural practices, crop varieties, fertilizer and manure use, precision agriculture, and integrated pest management will increase crop yields, minimize costs, and protect environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management

903 Communication, Education, and Information Delivery

Outcome #13

1. Outcome Measures

Horticultural Systems: Extension programs will provide guidance on management practices for horticultural plants produced and installed by the "Green Industry" and for homeowners, important because of the rapid conversion of farmland to urban and suburban uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

Outcome #14

1. Outcome Measures

New Markets: advances in plant molecular biology and genomics will provide new markets for farmers and commercial-scale horticulture, such as plants for bioenergy, pharmaceutical and nutriceutical uses. New and creative marketing programs will stimulate diversification and growth in the production of value-added and niche market crops, such as culinary herbs, spices, essential oil plants, and specialty vegetables for urban and suburban markets.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

RURAL DEVELOPMENT AND LAND USE CHANGE

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	10%	0%	0%	0%
131	Alternative Uses of Land	10%	0%	0%	0%
605	Natural Resource and Environmental Economics	10%	0%	0%	0%
608	Community Resource Planning and Development	10%	0%	0%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%	0%	0%	0%
805	Community Institutions, Health, and Social Services	10%	0%	0%	0%
903	Communication, Education, and Information Delivery	40%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	3.3	0.2	8.2	0.0
Actual	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

NOTE: ALL ACTIVITY PREVIOUSLY ASSOCIATED WITH THIS PLANNED PROGRAM IS NOW BEING
REPORTED IN THE FOLLOWING PLANNED PROGRAMS.
PLANNED PROGRAM 1: GLOBAL FOOD SECURITY AND HUNGER

PLANNED PROGRAM 7: CLIMATE CHANGE

PLEASE DISREGARD ALL INFORMATION CONTAINED IN THE "RURAL DEVELOPOMENT AND LAND USE CHANGE" PLANNED PROGRAM.

2. Brief description of the target audience

Farmers, landowners, state agencies (Delaware Development Office; Land Use Planning and Preservation; Department of Agriculture; Department of Health and Human Services; Department of Natural Resources and Environmental Control; Department of Transportation; Economic Development Office), federal agencies (USDA, NRCS, USEPA), land use organizations (Conservation Districts, AFT), environmental organizations, business and community leaders, families, students, and the general public.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010
Actual: {No Data

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	1	5	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	0

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	0

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	0

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	0

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	0

Output #6

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	0

Output #7

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	0

Output #8

Output Measure

- Number of Technical Reports

Year	Actual
2010	0

Output #9

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	0

Output #10

Output Measure

- Number of Invited Presentations

Year	Actual
2010	0

Output #11

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	0

Output #12

Output Measure

- Number of Websites Established

Year	Actual
2010	0

Output #13

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	0

Output #14

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Rural families and communities will be provided with the knowledge and skills needed to adapt to the changing social, economic, and political conditions associated with conversion of agricultural land to suburban and urban land uses.
2	Educational programs for K-12 teachers and youth on the relationship between land use and major societal issues, such as economic development, community and family adaptation to changing social and political conditions, and the value of sustaining ecosystems and protecting environmental quality.
3	Increase in the number of rural families participating in extension education programs on preparing for academic success, identifying new career options, and family financial planning.
4	Increased training for rural families in establishing and achieving success with small businesses in rural, agricultural situations and in settings where land use change creates new economic opportunities beyond agriculture.
5	Increased number of farmers and other landowners trained in the social, political, economic, and environmental aspects of land use change and farmland preservation.
6	Increased interactions and long-range strategic planning efforts between research and extension staff and the diverse stakeholders (state and federal agencies, community groups, not-for-profit organizations, developers, farmers, etc.) involved in farmland preservation and land use conversion from agriculture to suburban and urban uses.
7	Rural Development: extension programming will provide rural families and communities with the personal, educational, social, and financial skills needed to thrive economically during a period of changing land use. These programs will sustain traditional agribusinesses that now support rural families and communities; identify new economic opportunities as land use changes; and assist rural communities and families in building the social and economic capital needed for success.
8	Land Use Change: research will identify strategies needed to manage land use change in a state where preserving farmland is a major goal, but economic and social forces are resulting in steady conversion of agricultural lands to suburban and urban uses. The economic, social, and cultural impacts of land fragmentation, suburban sprawl, and the "critical mass" of land and businesses needed to sustain agriculture in the long-term will be determined. Research knowledge and extension programs will help to guide long-term land use planning in cooperative efforts

Outcome #1

1. Outcome Measures

Rural families and communities will be provided with the knowledge and skills needed to adapt to the changing social, economic, and political conditions associated with conversion of agricultural land to suburban and urban land uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Educational programs for K-12 teachers and youth on the relationship between land use and major societal issues, such as economic development, community and family adaptation to changing social and political conditions, and the value of sustaining ecosystems and protecting environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Increase in the number of rural families participating in extension education programs on preparing for academic success, identifying new career options, and family financial planning.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Increased training for rural families in establishing and achieving success with small businesses in rural, agricultural situations and in settings where land use change creates new economic opportunities beyond agriculture.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased number of farmers and other landowners trained in the social, political, economic, and environmental aspects of land use change and farmland preservation.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Increased interactions and long-range strategic planning efforts between research and extension staff and the diverse stakeholders (state and federal agencies, community groups, not-for-profit organizations, developers, farmers, etc.) involved in farmland preservation and land use conversion from agriculture to suburban and urban uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
131	Alternative Uses of Land
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Rural Development: extension programming will provide rural families and communities with the personal, educational, social, and financial skills needed to thrive economically during a period of changing land use. These programs will sustain traditional agribusinesses that now support rural families and communities; identify new economic opportunities as land use changes; and assist rural communities and families in building the social and economic capital needed for success.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Land Use Change: research will identify strategies needed to manage land use change in a state where preserving farmland is a major goal, but economic and social forces are resulting in steady conversion of agricultural lands to suburban and urban uses. The economic, social, and cultural impacts of land fragmentation, suburban sprawl, and the "critical mass" of land and businesses needed to sustain agriculture in the long-term will be determined. Research knowledge and extension programs will help to guide long-term land use planning in cooperative efforts

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
131	Alternative Uses of Land
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

SOILS AND ENVIRONMENTAL QUALITY

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%	0%	0%	0%
102	Soil, Plant, Water, Nutrient Relationships	10%	0%	0%	0%
104	Protect Soil from Harmful Effects of Natural Elements	10%	0%	0%	0%
112	Watershed Protection and Management	10%	0%	0%	0%
133	Pollution Prevention and Mitigation	10%	0%	0%	0%
141	Air Resource Protection and Management	10%	0%	0%	0%
403	Waste Disposal, Recycling, and Reuse	10%	0%	0%	0%
903	Communication, Education, and Information Delivery	30%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	4.7	0.2	17.9	1.0
Actual	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

NOTE: ALL ACTIVITY PREVIOUSLY ASSOCIATED WITH THIS PLANNED PROGRAM IS NOW BEING REPORTED IN THE FOLLOWING PLANNED PROGRAMS.

PLANNED PROGRAM 1: GLOBAL FOOD SECURITY AND HUNGER

PLANNED PROGRAM 7: CLIMATE CHANGE

PLEASE DISREGARD ALL INFORMATION CONTAINED IN THE "SOILS AND ENVIRONMENTAL QUALITY" PLANNED PROGRAM.

2. Brief description of the target audience

Crop producers, poultry growers, state agencies (DDA, DNREC), federal agencies (USDA, USGS, EPA, NSF, DOE), environmental groups, peer scientists, industries with soil contamination problems, and commodity groups.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010

Actual: {No Data

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	4	32	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Competitive Grants Submitted

Year	Actual
2010	0

Output #2

Output Measure

- Number of Competitive Grants Awarded

Year	Actual
2010	0

Output #3

Output Measure

- Number of Research Projects Completed

Year	Actual
2010	0

Output #4

Output Measure

- Number of Undergraduate Researchers

Year	Actual
2010	0

Output #5

Output Measure

- Number of M.S. Graduate Students

Year	Actual
2010	0

Output #6

Output Measure

- Number of Ph.D. Graduate Students

Year	Actual
2010	0

Output #7

Output Measure

- Number of Post-doctoral Research Associates

Year	Actual
2010	0

Output #8

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	0

Output #9

Output Measure

- Number of Books and Book Chapters

Year	Actual
2010	0

Output #10

Output Measure

- Number of Technical Reports

Year	Actual
2010	0

Output #11

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	0

Output #12

Output Measure

- Number of Invited Presentations

Year	Actual
2010	0

Output #13

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	0

Output #14

Output Measure

- Number of Websites Established

Year	Actual
2010	0

Output #15

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Soil management programs and best management practices for soil use in agricultural, natural, suburban/urban, and disturbed or contaminated settings will incorporate latest advances in research and be disseminated via extension programming to farmers and other land managers.
2	Educational programs for K-12 teachers and youth on soils as a critical natural resource vital to civilization, including the many functions of soils in agricultural and natural ecosystems, the importance of soil management to environmental quality, and the role of soils in sustaining aesthetically pleasing managed landscapes in suburban and urban settings.
3	Increased number of farmers and other land managers adopting advances in soil management practices that will build soil quality, increase plant productivity, enhance the beneficial re-use of agricultural, municipal, and industrial by-products (manures, biosolids, residuals) in a variety of land use settings, and prevent nonpoint nutrient pollution of ground and surface waters, particularly for phosphorus and nitrogen.
4	Increased number of farmers and others using soil testing to provide site-specific guidance to increase agricultural profitability, prevent soil loss by erosion, mitigate nonpoint pollution of surface and ground waters, and more efficiently use soils and nutrients in suburban settings.
5	Increased use of watershed scale modeling to predict changes in the functions and environmental impacts of soils in mixed-used watersheds (agriculture, suburban, urban, forests) as land use changes from agricultural to suburban and urban uses.
6	Soils and Environment: basic research will provide increased understanding of the physical, chemical, and biological factors influencing the fate and transport of nutrients, metals, organics, and pathogenic organisms in soils. Applied research will lead to the development of nutrient management strategies and recommendations that minimize nonpoint nutrient pollution from all land uses. Remediation practices for soils contaminated by metals, organics, and nutrients will use innovative, research-based measures to prioritize risk to the environment and human health based on the speciation, mobility, and bioavailability of contaminants in soils. Mitigation approaches for polluted soils will combine soil chemistry, physics, and soil/plant molecular biology to enhance removal (phytoremediation) or in-situ degradation or stabilization of pollutants in soils.
7	Environmental Quality: applied research and extension programming will provide guidance on profitable, environmentally sound management of soils at all spatial scales, from the individual field to the watershed. The emphasis will be on cost-effective strategies and management practices that can prevent nonpoint nutrient pollution, soil erosion, and contaminant transport (metals, organics, pathogens) from agriculture and suburbanized landscapes.

Outcome #1

1. Outcome Measures

Soil management programs and best management practices for soil use in agricultural, natural, suburban/urban, and disturbed or contaminated settings will incorporate latest advances in research and be disseminated via extension programming to farmers and other land managers.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Educational programs for K-12 teachers and youth on soils as a critical natural resource vital to civilization, including the many functions of soils in agricultural and natural ecosystems, the importance of soil management to environmental quality, and the role of soils in sustaining aesthetically pleasing managed landscapes in suburban and urban settings.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
112	Watershed Protection and Management
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Increased number of farmers and other land managers adopting advances in soil management practices that will build soil quality, increase plant productivity, enhance the beneficial re-use of agricultural, municipal, and industrial by-products (manures, biosolids, residuals) in a variety of land use settings, and prevent nonpoint nutrient pollution of ground and surface waters, particularly for phosphorus and nitrogen.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Increased number of farmers and others using soil testing to provide site-specific guidance to increase agricultural profitability, prevent soil loss by erosion, mitigate nonpoint pollution of surface and ground waters, and more efficiently use soils and nutrients in suburban settings.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
112	Watershed Protection and Management
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased use of watershed scale modeling to predict changes in the functions and environmental impacts of soils in mixed-used watersheds (agriculture, suburban, urban, forests) as land use changes from agricultural to suburban and urban uses.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Soils and Environment: basic research will provide increased understanding of the physical, chemical, and biological factors influencing the fate and transport of nutrients, metals, organics, and pathogenic organisms in soils. Applied research will lead to the development of nutrient management strategies and recommendations that minimize nonpoint nutrient pollution from all land uses. Remediation practices for soils contaminated by metals, organics, and nutrients will use innovative, research-based measures to prioritize risk to the environment and human health based on the speciation, mobility, and bioavailability of contaminants in soils. Mitigation approaches for polluted soils will combine soil chemistry, physics, and soil/plant molecular biology to enhance removal (phytoremediation) or in-situ degradation or stabilization of pollutants in soils.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Environmental Quality: applied research and extension programming will provide guidance on profitable, environmentally sound management of soils at all spatial scales, from the individual field to the watershed. The emphasis will be on cost-effective strategies and management practices that can prevent nonpoint nutrient pollution, soil erosion, and contaminant transport (metals, organics, pathogens) from agriculture and suburbanized landscapes.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management

403	Waste Disposal, Recycling, and Reuse
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

THE SCIENCE AND PRACTICE OF AQUACULTURE

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	30%	0%	0%	0%
302	Nutrient Utilization in Animals	30%	0%	0%	0%
307	Animal Management Systems	30%	0%	0%	0%
903	Communication, Education, and Information Delivery	10%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	1.0
Actual	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

NOTE: ALL ACTIVITY PREVIOUSLY ASSOCIATED WITH THIS PLANNED PROGRAM IS NOW BEING REPORTED IN THE FOLLOWING PLANNED PROGRAMS.

PLANNED PROGRAM 1: GLOBAL FOOD SECURITY AND HUNGER

PLANNED PROGRAM 7: CLIMATE CHANGE

PLEASE DISREGARD ALL INFORMATION CONTAINED IN THE SCIENCE OF AQUACULTURE" PLANNED PROGRAM.

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2. Brief description of the target audience

As designed, this program will primarily target existing and perspective aquaculture producers, although the information generated and planned activities will also benefit educators, policy makers and consumers.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010

Actual: {No Data

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Refereed Journal Articles

Year	Actual
2010	0

Output #2

Output Measure

- Number of Extension Bulletins and Factsheets

Year	Actual
2010	0

Output #3

Output Measure

- Number of Volunteered Presentations

Year	Actual
2010	0

Output #4

Output Measure

- Number of Workshops Conducted

Year	Actual
2010	0

Output #5

Output Measure

- Number of websites established

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased knowledge by the public, the food processing and restaraunt industries, state and regional economic development agencies, and state and federal technical and advisory agencies about the potential economic benefits of expanding aquaculture production.
2	Educate K-12 teachers and youth about aquaculture's role in world food security, the fundamental scientific and technological components of aquaculture production systems, and the financial and marketing aspects of aquaculture as a business.
3	Greater adoption of improved best management practices for recreational and farm ponds to increase profitability and minimize any environmental impacts of aquaculture.
4	Increased ability of aquaculturists to manage production and financial risks.
5	A comprehensive approach to increase and sustain the role of aquaculture in Delaware's economy, including the development of research-based management practices for the production aspects and environmental compatibility of aquaculture, wider use of innovative marketing strategies, and providing ongoing training on the sound business and financial management skills needed by aquaculturists

Outcome #1

1. Outcome Measures

Increased knowledge by the public, the food processing and restaraunt industries, state and regional economic development agencies, and state and federal technical and advisory agencies about the potential economic benefits of expanding aquaculture production.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Educate K-12 teachers and youth about aquaculture's role in world food security, the fundamental scientific and technological components of aquaculture production systems, and the financial and marketing aspects of aquaculture as a business.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Greater adoption of improved best management practices for recreational and farm ponds to increase profitability and minimize any environmental impacts of aquaculture.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Increased ability of aquaculturists to manage production and financial risks.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

A comprehensive approach to increase and sustain the role of aquaculture in Delaware's economy, including the development of research-based management practices for the production aspects and environmental compatibility of aquaculture, wider use of innovative marketing strategies, and providing ongoing training on the sound business and financial management skills needed by aquaculturists

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

Evaluation Results

Key Items of Evaluation