

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

Status: Accepted

Date Accepted: 09/09/2013

## 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. Agriculture in Delaware remains strong today, despite these challenges, and has weathered the recent economic downturn well. The state has 490,000 acres of cropland (25% irrigated) that provide the grain crops needed for a thriving poultry industry, an innovative and profitable vegetable production industry, and a "green industry" that supports horticultural and natural resource interests of its citizens. Our plan of work has been designed to support the efforts of Delaware agriculture to remain competitive, to meet its environmental challenges, sustain the state's natural resources and support our rural and urban families and communities. We focus on the following eight 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 production and processing activities accounting for over \$3.2 billion dollars in industry output, 13,437 jobs, and \$911.6 million in value added, according to the 2010 report. Livestock industries (\$28M farm income from dairy, beef cattle, swine) are important with dairy production leading the way, producing \$73.3 million in industry output and providing 260 jobs, according to the UD study. 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 as 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, nutraceuticals 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 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; 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 illnesses 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. 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 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 Plate, 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.

(8) Sustainable Energy: Energy remains a primary concern of all stakeholders involved in agriculture and natural resources management. Research and extension programs related to bioenergy

will include those focused on (i) Biomass crops: genetics and basic plant biology studies, plant-microbe interactions that enhance growth and water use efficiency of biomass crops; production and agronomic management practices for current (corn, soy) and innovative new cropping systems (e.g., sweet sorghum, switchgrass, poplars); equipment changes and needs for new biomass crops, especially related to planting and harvesting; improving nutrient management BMPs mitigating potential environmental impacts of biomass energy crops and assessing their impacts on water quality relative to current cropping systems; and addressing economic, social and cultural issues related to changing from long-standing to new cropping systems; (ii) Bioenergy production systems and re-use of byproducts: evaluation of farm-scale anaerobic digestion for bioenergy production, using animal manures, cover crops (e.g., forage radishes), and other by-products; evaluation of gasification/pyrolysis technologies, especially those using poultry litter. Finding beneficial agricultural uses for the by-products of energy production such as distillers' grains; (iii) Water supply: managing regional water supplies to produce biomass energy crops, including better understanding of the impacts of climatic extremes, improving drought tolerance, increasing irrigation use efficiency, use of wastewaters, and developing cropping systems that foster efficient water use by crops; and (iv) Education and outreach: development of bioenergy and climate change curricula for youth (e.g., K-12, 4-H programs, Master Gardeners).

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

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	53.1	16.1	110.5	12.5
Actual	54.4	20.2	117.8	10.5

**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**

Scientific Peer Review of Research Programs

We adopt by reference the National Standards for Peer Review.

Merit Review of Extension Programs

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 research)

#### **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 change as the issues themselves change.

### **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**

The areas of highest immediate importance to our stakeholders have changed very little in the past year..

1. Economic uncertainty: Agriculture has remained strong economically throughout the recent US economic downturn, but concerns persist about the national and local economies and their impact on our farm communities, agribusiness, natural resource management, our water and air quality, and families and youth. For example, one of the longest operating poultry integrating companies recently went out of business, due to a range of financial problems, creating widespread concern in Delaware. Fortunately, an international poultry company (from Korea) purchased most of the local integrating company and has begun to develop and expand the business, keeping most of the employees and facilities. The 2012 US drought, coupled with national commitments to divert corn for bioenergy uses, reduced grain supplies to Delaware's poultry industry, increasing costs of production, and challenging the state's largely poultry-grain agricultural system economically. Farmers also worry about the growing economic costs associated with meeting the requirements of new environmental policies (USEPA Watershed Implementation Plans) driven by concerns about the Chesapeake Bay (e.g., TMDLs). Funds for farmland preservation were reduced due to state budget concerns and then partially restored. Farm families, as with many others today, are facing stresses and challenges related to the economy and seeking advice from research and extension

programs at UD and DSU on more cost-effective production practices and environmental "BMPs", energy saving options, and financial planning for their businesses and families.

2. Energy- has major and ongoing impacts on the costs of producing poultry and livestock, agricultural crops and the future of nature and management of cropping systems. The impact of energy use and costs on farm finances, and the economic volatility associated with energy supply, on agriculture remains a high priority area today. How will the poultry industry, poultry growers, vegetable 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? Can biofuel crops become an economically viable option for Delaware farmers in the future, given our smaller and more fragmented landscape?

3. 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? For the past 5 years, the pace of development has slowed markedly making this less of an issue. At the same time, funds for farmland preservation have been reduced in the state budget due to economic challenges facing the state of Delaware. However, increasing signs of economic growth in the housing industry are bringing this issue to the forefront again, pointing to the need for guidance on how to balance land use change in a way that sustains agriculture.

4. 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 now adopted TMDL for the Chesapeake Bay and the newly required 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. Our stakeholders see a pressing need for an integrated approach to the water and air quality problems facing agriculture today, one that will provide reliable, consistent funding support for multi-year, multi-disciplinary research and extension programs and guide policies that enhance agriculture in the future.

5. Integrated Pest Management: Insects, weeds, and plant diseases continue to create serious problems for Delaware farmers and consumers increasingly concerned about the need for alternative control strategies other than pesticides. Delaware extension is responding to stakeholders - and learning more about their needs - through state and regional strategies and programs focused on IPM.

6. 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?

7. Irrigation- major droughts continue to plague Delaware farmers, emphasizing the need for a statewide, long-term strategy to increase the amount of irrigated acreage and be more efficient in our irrigation practices. The state has responded by launching the DRIP program ("Delaware Rural Irrigation Program") to help farmers invest in new irrigation systems. Delaware extension continues to view this as an area of increased need for an integrated research/extension program that will focus on farmers to improve the efficiency of irrigation which can 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 remain priority areas for the next decade.

8. 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. 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. Extension is now focusing a major effort on food safety of produce to help growers meet buyer demands for food safety.

9. Family and Youth Development - Delaware Extension, particularly through its outstanding 4-H program, continues to address many economic and social challenges facing families and youth today, particularly in underserved communities. Programs are wide-ranging, well-received, and supported by competitive grants, addressing issues such as family financial planning; youth leadership programs focused on preparing for careers and avoiding peer pressures that lead to substance abuse problems; education about health, exercise, nutrition, and obesity, especially for youth; after-school programs in schools at State Housing Authority complexes continue to reach hundreds of youth each day with programming designed to improve grades and reading skills particularly in STEM (Science, Technology, Engineering and Mathematics) areas; and the "Operation Military Kids Program", which continues to meet the complex challenges faced by youth and their families from all branches of the military both active and reserve. Delaware families, state and local government agencies, not-for-profit groups, and the public in general are very supportive of these efforts to support families and youth and we expect the demand for this programming to grow in the future.

#### IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1293262	1161672	1604743	1225169

2. Totalled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
<b>Actual Formula</b>	1630409	1161673	1382763	1225169
<b>Actual Matching</b>	949694	1161673	1058455	1225169
<b>Actual All Other</b>	3974416	792909	12268626	2090178
<b>Total Actual Expended</b>	6554519	3116255	14709844	4540516

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

## V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Biotechnology and Biotechnology-based Agribusiness
3	Natural Systems, Biodiversity, and Wildlife Ecology
4	Family and Youth Development
5	Food Safety
6	Childhood Obesity
7	Climate Change
8	Sustainable Energy

**V(A). Planned Program (Summary)**

**Program # 1**

**1. Name of the Planned Program**

Global Food Security and Hunger

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
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%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	16.0	4.0	63.3	1.8
Actual Paid Professional	16.6	7.7	64.7	5.1
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
890476	371563	500306	468947
1862 Matching	1890 Matching	1862 Matching	1890 Matching
138541	371563	381833	468947
1862 All Other	1890 All Other	1862 All Other	1890 All Other
746029	405000	1570485	0

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

### 1. Brief description of the Activity

For animal agriculture, research and extension programs will 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 methods, 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 areas 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, cultural, and chemical methods; (4) New Technologies - improvements in harvesting and guidance systems and expanded research and extension programs on improving the efficiency of 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 of plant nutrients, wastes, and organic chemicals in soils, and their effects on soil, air and water pollution. New soil science research areas include the application of isotope techniques to study how P cycling can be mediated by specific biota under geochemical conditions relevant to critical zone environments. Oxygen isotopes in phosphates (d18Op) will be employed to understand the mechanisms of phosphate uptake and release, sources of P in sediments, and microbial cycling of P. Isotopic signatures of specific pools of mineral bound phosphate and the degree of recalcitrance of the specific P pool to microbial activities will be used study microbial effects on P cycling and elucidate the sources of recalcitrant P phases in the soil environment; (2) Cost-Effective, In-Situ Remediation - cost-effective, in-situ methods for the remediation and speciation of contaminated soils; (3) Nutrient Management for Water, Air, and Soil 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. New research focuses on understanding the impacts of poultry production on air quality (e.g., emissions of ammonia and

particulate matter from production houses) and engineered methods and management practices to mitigate these deleterious effects. 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, K12 teachers, and environmental and community groups.. 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.

**3. How was eXtension used?**

In 2012, UD kicked off its eXtension Institutional Team, comprised of 8 leaders across all planned programs. Those team members set goals for the following:

- Incorporating eXtension into grants;
- Connecting the UD Extension website with eXtension.org;
- Establishing an Ask an Expert widget for Delaware;
- Encouraging the use of eXtension's Learn feature;
- Encouraging a positive culture regarding eXtension;
- Maintaining an accurate list of institutional members in the eXtension people database; and
- Encouraging participation in Communities of practice.

For Planned Program #1, UD's Dr. Carissa Wickens, assistant professor of animal sciences and Extension equine specialist, is an active member of MyHorseUniversity and the cross programs (HorseQuest) with eXtension. She serves as an equine expert for the equine Ask an Expert community and provides resources to the horse pages.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	36867	174310	13040	175

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	5	45	50

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

Year	Actual
2012	65

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

Year	Actual
2012	35

**Output #3**

**Output Measure**

- Number of Research Projects Completed

Year	Actual
2012	86

**Output #4**

**Output Measure**

- Number of Undergraduate Researchers

Year	Actual
2012	92

**Output #5**

**Output Measure**

- Number of M.S. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	32

**Output #6**

**Output Measure**

- Number of Ph.D. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	19

**Output #7**

**Output Measure**

- Number of Post-Doctoral Research Associates

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

**Output #8**

**Output Measure**

- Number of Refereed Journal Articles

<b>Year</b>	<b>Actual</b>
2012	50

**Output #9**

**Output Measure**

- Number of Books and Book Chapters

<b>Year</b>	<b>Actual</b>
2012	6

**Output #10**

**Output Measure**

- Number of Technical Reports

<b>Year</b>	<b>Actual</b>
2012	260

**Output #11**

**Output Measure**

- Number of Extension Bulletins and Factsheets

<b>Year</b>	<b>Actual</b>
2012	79

**Output #12**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	146

**Output #13**

**Output Measure**

- Number of Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	125

**Output #14**

**Output Measure**

- Number of Websites Established

<b>Year</b>	<b>Actual</b>
2012	13

**Output #15**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	216

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

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

O. No.	OUTCOME NAME
1	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 and an increase in the number of diagnostic laboratories using advances in avian genomics to rapidly diagnose infectious diseases.
2	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.
3	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.
4	Increased use of air quality best management practices that prevent odor, ammonia, and particulate emissions from poultry farms.
5	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.
6	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 nutraceutical uses.
7	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.
8	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.
9	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.
10	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.
11	Disease Prevention and Control: basic and applied research on mechanisms of poultry disease 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.
12	Animal 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.
13	Animal Nutrition: research will lead to improved understanding of nutritional requirements for poultry and ruminants and adoption of recommended dietary strategies by practicing

	<p>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</p>
14	<p>Environmental Compatibility of Animal Agriculture: In addition to addressing nutrient related problems, research and extension programs will develop long-term strategies and management practices for other environmental issues related to animal agriculture such as the fate and transport of trace elements; concerns about air quality 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; fate and transport of viruses and other pathogens during disease outbreaks and subsequent disposal of poultry mortality, and potential environmental and human health effects of antibiotics.</p>
15	<p>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.</p>
16	<p>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 nutraceutical 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.</p>
17	<p>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</p>
18	<p>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.</p>
19	<p>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 nutraceutical 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</p>

	sustaining ecosystems and protecting environmental quality.
20	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 biology to enhance removal or in-situ degradation or stabilization of pollutants in soils.

**Outcome #1**

**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 and an increase in the number of diagnostic laboratories using advances in avian genomics to rapidly diagnose infectious diseases.

Not Reporting on this Outcome Measure

**Outcome #2**

**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.

Not Reporting on this Outcome Measure

**Outcome #3**

**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.

Not Reporting on this Outcome Measure

**Outcome #4**

**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
- 1890 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

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

**Issue (Who cares and Why)**

The Delmarva Poultry Industry has requested the support of Delaware Extension for ventilation, health and litter management for growers and flock supervisors.

**What has been done**

Multiple educational workshops were hosted by UD. The UD Poultry Team consisting of Dr. Dan Bautista, Steve Collier from the Lasher Lab staff and Bill Brown, poultry extension agent, with technical support from Dr. Hong Li of the Department of Animal and Food Sciences, produced a series of hot and cold weather ventilation seminars. Many of these sessions were approved by the Delaware Nutrient Management Program, Sydney Riggi, for continuing education credits. These seminars were used in flock supervisor and grower trainings in the spring, fall and early winter and impacted 100's of industry personnel the majority of which were contract growers.

**Results**

One company has seen a 20% improvement in ventilation audits. Two companies have changed timing of total cleanout practices. Hygrometers are used in 70% of grow out houses for one integrator. New Housing building programs now require actuated ceiling vents to take better advantage of attic heat and to improve litter and bird quality. One company is utilizing ammonia guns and tubes on 100 % of contract farms. One company is using air mixing tape to better evaluate minimum ventilation. All companies are utilizing the "static Pressure test" to identify problem housing. One company paid to have training DVD's produced of our training sessions. Many growers received continuing education credits for nutrient management compliance.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
112	Watershed Protection and Management
307	Animal Management Systems
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

**Outcome #5**

**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.

Not Reporting on this Outcome Measure

**Outcome #6**

**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 nutraceutical uses.

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

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

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

**Issue (Who cares and Why)**

Minority producers seek guidance to increase marketing options for locally grown fresh fruits and vegetables, and increase the quantity of value added products.

**What has been done**

DSU Cooperative Extension worked in collaboration with partners to assist producer who are eager to increase their income by making value added products. Thus Producers benefits from a GAP/GHP best management classes conducted by University of Delaware. A value added workshop was planned and implemented in collaboration Delaware Center for enterprise development. Workshops were enhanced a bus tour, site visits, farm visits, group meetings and one on one mentoring. Participants and producer received information through newsletters, e-

mails and phone calls. A hands on approach was used to implement these workshops. The SERVSAFE program was conducted by Delaware Center for Enterprise Development. Finally, at all events participants, expand their knowledge on additional resources available through Delaware Department of Agriculture, USDA, and FDA. Thus they increase their knowledge on requirement for licenses, permits and other pre-requisites required to produce and sell value added products.

**Results**

A total of 40 participants mainly comprising of minority producers increase their knowledge and technical know-how to product value added products. Four producers are presently producing value added products such as specialty hot sauces and zucchini breads. Three of these farmers are minority producers. The produce is sold at farmers markets, at farm gate and retail establishments. The products are marketed locally and regionally in Philadelphia and New York City. Thus producers were able to increase the quantity of value added product to available markets.

**4. Associated Knowledge Areas**

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

**Outcome #7**

**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**

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

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

**Issue (Who cares and Why)**

Agriculture is one of the most important industries in Delaware, especially in Kent County. Growers, crop consultants, and agricultural industry folks all work together to produce a variety of crops including corn, soybeans, winter wheat, barley, fresh market and processing vegetables. This group represents the main clientele of the University of Delaware Agricultural Extension in Kent C

### **What has been done**

In order to increase the knowledge of sound agriculture production practices, the Kent County Crop Master's sessions were held in 2012. A total of four sessions were held in winter of 2012. The first session, 2012 Weed, Insect, and Disease Management Update, was held Wednesday, February 8, 2012 from 6pm-9pm. The session included a review of new and re-emerging crop pests (insects, diseases, weeds) in vegetable and grain crops. The second session, Maximizing Irrigated Corn Yields, was held on Wednesday, February 22, 2012 from 6pm-9pm. In this session, keys steps for producing a profitable, high yielding corn crop were presented. Relevant topics included corn growth, current herbicide programs, insect and disease management, irrigation, fertility, and agronomic practices to maximize yield. The third session, Get to Know your Soils, was held February 29 from 6pm-9pm. This session educated participants on the basics soil management for row crop production. Topics included an overview of Kent County soils, assessing soil properties, nutrient cycling, soil fertility, nutrient applications, improving vegetable soil health through the addition of organic matter, use of cover crops, and writing soil health plans. The last session, Tools for Irrigation Management, was held Tuesday, March 6, 2012 from 9am-11am. Around 25% of Delaware's agriculture land is irrigated and the number of acres is rising. Topics include practices to determine soil moisture, timing of irrigation using soil moisture sensors, relationship of water use and crop growth stages, nutrient applications (fertigation), tracking irrigation events, and data from University of Delaware research projects. Overall, the session met the goal of increasing the knowledge level of clientele

### **Results**

Evaluations were distributed to each participant at the end of each session. Participants answered by using a scale of 1 to 5 (1 meaning not at all and 5 meaning very much). Overall students ranked greater understanding of the subject matter at 4.22 out of 5, usefulness in farming operation at 4.26, and overall satisfaction at 4.38.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 #8**

**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.

Not Reporting on this Outcome Measure

**Outcome #9**

**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**

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

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

**Issue (Who cares and Why)**

Farmwomen are often tasked with managing information systems used in critical decision making processes and risk management decisions in their operations

**What has been done**

Annie's project is a national program designed to empower farmwomen to manage information systems used in critical decision making processes and to build local networks throughout the state. The target audience is farmwomen with a passion for business and involvement in the farm operation. Since 2008 Annie's Project has expanded and reached 13 sites in Maryland and Delaware educating 357 farm women. Classes are structured in eight weekly sessions for three hours at a time (24 hours of class). University Educators and Specialists along with government organizations and private industry deliver timely risk management topics. To determine if the participants had actually followed through on their intentions, a follow-up survey is conducted 18

months after the class.

### Results

Eighteen months was chosen as an appropriate time to survey the women because enough time would have elapsed to follow through with the skills and activities taught in the classes. Participants are invited via email, which included a web link for the survey. The surveys were anonymous and had a 48% average response rate. Participants were asked to complete ten questions regarding actions they have taken or implemented since they attended Annie's Project. Both in the end-of-class and the follow-up evaluations, changing insurance policies and reviewing property titles and lease agreements are two actions that had the least intention to implement across all eight categories. However, one-half of the people who intended to change their insurance policy followed through on the action. For reasons unknown to the project investigators, there was low intent to review property titles and lease agreements and a very small percentage who actually did that. Class members leave the program with a high intent to write business and marketing plans, use computers, check credit reports, prepare financial statement, update estate plans, and positively increase community and family relations. Writing business and marketing plans was an action that participants wanted to do (96%) and 41% actually followed through. Checking credit reports, updating estate plans, and positively increasing family communications were the actions that the greatest majority of participants engaged in. Overall, the follow-up evaluations point to the fact that the program is successful in that women leave the program with the skills and knowledge to take action. A medium-term outcome of Annie's project is to help ensure the economic viability of farming operations. Data obtained from the participants indicate that the program is successful in this regard. When asked if Annie's Project has increased their profitability 47% responded that yes it has. A range of dollar increases were then available for selection. The average Annie's project participant since 2008 has increased farm profitability between \$2,083.72 and \$3,693.67 with the average participant increasing farm profitability by \$3,027.78.

### 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 #10

#### 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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Suburban and urban communities see a decreased connection with agricultural producers and fresh, local produce. There is increased demand for information on urban and backyard gardening as those individuals look for self sufficiency and an inexpensive means to produce fresh produce.

#### What has been done

The University of Delaware Cooperative Extension's Lawn and Garden services include (ongoing) and on-site technical assistance to individuals and communities interested in growing fruits and vegetables, as well as soil testing and plant diagnostic services. We offer extensive educational programming with the help of our well-trained volunteer educators to include the Master Gardeners, Composters, and Food Educators. Programs include community presentations, home gardener and commercial grower workshops, and on-site and community demonstrations. Additionally, our demonstration and display gardens throughout the state have been designed to serve as an example of small-scale vegetable and fruit production (whether backyard, community, or small-scale commercial production) and to demonstrate good growing techniques. We have strengthened our programming and outreach efforts by working together with others, to include Nemours, the Food Bank of Delaware, the Delaware Department of Agriculture, and the Delaware Center for Horticulture.

#### Results

Just one way in which we've responded to this growing need for vegetable and fruit production information and education is by developing new workshops and demonstrations. In 2009 and 2010, the New Castle County Extension offered numerous Grow your own Food workshops and demonstrations, in varying formats, and locations, in our community. The Master Gardener Home Gardener Workshop Series featured the following topics: starting vegetables from seed, growing your own food, fruit production, composting, open houses and demonstrations in our teaching gardens, edible landscapes, and more. A Back to Basics workshop series was developed and offered to help people learn skills that they could use to save money, expand their resources, and live more simply; this series featured a basic vegetable gardening workshop alongside other topics such as organic production, small-scale growing techniques, and food preservation and preparation. Special events included a Day in the Garden event planned and offered by Master Gardener and Master Food Educators in the teaching and demonstration gardens to educate the community in vegetable gardening, and vegetable preparation. In 2009 and 2010 there were more than 15 workshops that focused on the Grow your own Food theme, educating nearly 400

community members. This Grow your own Food theme continued into 2011 and 2012. Thus far, in 2011 and 2012, we have worked with and educated more than 500 community members. Additionally, in March 2012, a Community and School Garden Information Session was offered, in partnership with the Delaware Department of Agriculture, the Delaware Center for Horticulture, and Healthy Foods for Healthy Kids, for educators, community members, and gardeners starting or maintaining a community or school garden. This event attracted more than 50 participants from across the state. As a result of this session we continue to work closely with community and school gardens statewide, providing support and guidance as well as educational programming throughout the growing season. A similar community and school garden information session will be offered at the Sussex County Extension office this winter, 2013.

#### 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 #11

##### 1. Outcome Measures

Disease Prevention and Control: basic and applied research on mechanisms of poultry disease 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
- 1890 Extension
- 1862 Research
- 1890 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

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

**Issue (Who cares and Why)**

Avian disease outbreaks have the potential to collapse poultry industry markets around the world.

### **What has been done**

The University of Delaware hosted its fourth annual Emergency Poultry Disease Response (EPDR) certificate program June 18-21. The workshop, which was held on the College of Agriculture and Natural Resources (CANR) campus, was aimed at teaching both local and international participants about preparedness planning, biosecurity and assessment, and rapid response techniques and technology with regard to avian disease outbreaks. Sponsored by the U.S. Department of Agriculture Avian Influenza Coordinated Agriculture Project 2, this year's workshop included participants from all over the globe.

### **Results**

Thirteen countries were represented, including Ghana, Saudi Arabia, Nigeria, Bolivia, Mexico and Japan. U.S. Sen. Chris Coons spoke at the opening of the event, talking about the importance of having strong measures in place to curb any avian disease outbreaks and praising UD for its role in helping educate local and international audiences on the topic.

## **4. Associated Knowledge Areas**

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

## **Outcome #12**

### **1. Outcome Measures**

Animal 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.

Not Reporting on this Outcome Measure

## **Outcome #13**

### **1. Outcome Measures**

Animal 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

Not Reporting on this Outcome Measure

**Outcome #14**

**1. Outcome Measures**

Environmental Compatibility of Animal Agriculture: In addition to addressing nutrient related problems, research and extension programs will develop long-term strategies and management practices for other environmental issues related to animal agriculture such as the fate and transport of trace elements; concerns about air quality 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; fate and transport of viruses and other pathogens during disease outbreaks and subsequent disposal of poultry mortality, and potential environmental and human health effects of antibiotics.

**2. Associated Institution Types**

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

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

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

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

**Issue (Who cares and Why)**

UD supports the Delaware Nutrient Management Law, aimed at educating the state's diverse agriculture and horticulture producers on the importance of the relationship between nutrients and water quality issues.

**What has been done**

The Nutrient Management Program at the University of Delaware continues to offer Delaware Nutrient Management Certification Sessions to Delaware's citizens who need to comply with the Delaware Nutrient Management Law.

**Results**

During this reporting period, 76 individuals became certified by the Nutrient Management Program. The Nutrient Management Program works with 2,411 individuals who are currently certified through the Nutrient Management Program. These individuals are required to attend continuing education programs to maintain their certifications. During this reporting period, the

University of Delaware approved 126 programs to offer Delaware Nutrient Management Continuing Education Credits. These programs were offered by public and private organizations, with 45 of the 126 programs offered by the University of Delaware. The University of Delaware Programs offered 98 continuing education credits with a total attendance of 1,796. The other 83 programs, presented by public and private organizations, offered 199.25 credits to 933 attendees. The continuing education programs offered by organizations outside the University of Delaware can be valued at \$51.27 per participant for a total of value of \$47,834.91 based on the value of \$21.36 per volunteer hour. These figures only account for the period of time for instruction and they do not take into account the amount of time that is spent on preparing materials for the program.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
205	Plant Management Systems
305	Animal Physiological Processes
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 #15**

##### **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	Actual
2012	0

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

**Issue (Who cares and Why)**

In the Mid-Atlantic Region (DE, MD, VA, WV and NJ), there are currently 300 plus certified crop advisers who require continuing education.

**What has been done**

To address the continuing education needs our clientele as a whole, a collaborative group including the Universities of Delaware, Maryland, West Virginia, and Virginia Tech; NRCS in Maryland and Delaware; and the Mid-Atlantic CCA Board established our Mid-Atlantic Crop Management School in 1995. This school provides a diversity of educational programs in a 2 ½ day format with a variety a breakout sessions. Five concurrent sessions are offered addressing nutrient management, crop management, integrated pest management, soil and water management, and an alternative track on horticulture that offers a variety of credit categories (NM, CM, SWM, PM, and PD professional development). Emphasis is placed on new and advanced information with group discussion and interaction encouraged. In general, there are approximately 50 speakers and 230 + participants. School participants include agronomists, crop consultants, extension educators, farmers and farm managers, agribusiness, soil conservationists, and state department of agriculture personnel. Each year from ninety seven to one hundred percent of the school participants indicate that the school will allow them to provide better crop management information to their clientele.

**Results**

Crop school participants indicated that the economic value of the school to their clientele is \$26 per acre. Crop school participants consult on approximately 570,000 acres in the Mid-Atlantic region. Overall economic impact of the school for the Mid-Atlantic Region is estimated to be \$14,500,000.

**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 #16**

**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 nutraceutical 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	Actual
2012	0

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

**Issue (Who cares and Why)**

Most farmers do not have any experience growing in them. For high tunnels to truly be successful farmers need somewhere to turn to so they can get started actually growing in them. High Tunnels are an excellent way to add value to a growing operation. These high tunnels can keep small farmers in business if they can use them.

**What has been done**

The DSU high tunnel project actually started at a Profiting from A Few Acres Conference in 2011. At that Conference DSU specialists talked with several growers who had had received funding for high tunnels and others who had applied for one. Some of the questions were what to plant, when to plant and many others. It was apparent that there was a need for a program on using a high tunnel. Three workshops were planned and implemented involving high tunnels. The first one was held at Dennis Edwards farm up at Summit Bridge. That was aimed at preparing the tunnel and some of the crops you can grow in them. There were over twenty farmers attending this workshop. In April the High Tunnel specialist, Dr. Wm LaMont from Penn State University came to talk about growing in High Tunnels. About twenty growers attend this as well. The most successful workshop of the year was held in Georgetown at the farm of Ed Zitvogl. This was in May and there were over sixty-five participants. Participants were shown some specific crop examples. Ed had tomatoes almost ready to pick. There was also a Van tour that stopped at Ed's farm.

**Results**

The workshops offered have reached 250 people in total with 52 total on-farm visits. In 2010 DSU worked with two farmers with high tunnels. In 2011 it was three, and in 2012 that number had grown to ten. In 2011 Ed made \$0.00 from his tunnel. In 2012 he grossed \$15,000.00, Dennis made \$0.00 in 2011 from his tunnel. He grossed a little over \$4,000.00 in 2012.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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
605	Natural Resource and Environmental Economics

**Outcome #17**

**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**

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

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

**Issue (Who cares and Why)**

The Cape Henlopen Region is considered a special place. It is valued by its citizenry for its intimate coastal towns, its unique cultures, its accessibility from several large mid-Atlantic seaboard cities and ports that drive its seasonal tourism industry, its natural beauty preserved in the coastal State Parks and Prime Hook National Wildlife Refuge, and its local heritage emanating from colonial days. While many local area growth studies have been performed the Cape Region remains subject to 1) local zoning regulations that encourage fragmented development and 2) jurisdiction-specific Comprehensive Plans that inadequately define future growth areas. None of these studies has been implemented, nor have any action plans been developed based on those studies. Decisions on land use remain isolated to the jurisdiction and often cause community concern regarding the lack of cross-jurisdictional values taken into consideration in land use decisions. The question then becomes: How do we collaborate regionally to preserve the character of our valued towns and the attractiveness of our coastal area to tourism, while growing residentially and economically for future generations?

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

Cooperative Extension (CE) in partnership with Sea-grant Marine Advisory Service (MAS) and Institute for Public Administration (IPA) through the Sustainable Coastal Community Initiative (SCCI) developed and implemented a multi-faceted approach for regional planning. The core strategy is to engage the community in a meaningful way at the beginning of the planning process. SCCI does this through sophisticated land use modeling using Community-Viz®, developing future scenarios or stories to help the community visualize their own scenario. This methodology is particularly useful in a multi-jurisdictional process where participants may feel uncomfortable planning outside their official bounds. Supporters of regional planning understand: Growth issues move across landscapes and political boundaries- they are common to all; Conflicting uses occur between jurisdictions regarding economic, social and environmental use of the land and need resolution before growing and; Provides for cross-jurisdictional plans including predictability for development and readiness for emergency services. The process includes community members, developers, non-government and business stakeholders and requires cooperation, tradeoffs and consensus building.

#### **Results**

The SCCI process has resulted in regional plans in two jurisdictions as of 2012. The current project, the Cape Henlopen Region is the largest and most ambitious project to date covering over 40,000 acres, four towns, county and state government. The project is the summary project of over 10 years of planning in the region. A website <http://www.capehenlopenregionalplan.org/> fully explains the project and encourages public participation in community meetings or via the website. To date the project has resulted in several public meetings and media response, comments to the website indicating website use and further development of the community engagement process using Wii Table technology. The project will be completed in 2013.

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

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

## **Outcome #18**

### **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 Condition Outcome Measure

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

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

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

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

UD seeks to build international partnerships to support agricultural trade and exchange of information.

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

Three professors?Greg Shriver, Nicole Donofrio and Tom Powers--and two graduate students from the University of Delaware spent spring break in Brazil, visiting the University Federal de Lavras (UFLA) campus, strengthening the academic and cultural bonds between the two universities and taking in the sites and sounds of the South American nation. In addition, four UD College of Agriculture and Natural Resources (CANR) undergraduate students have been selected for an opportunity to develop international teaching modules in conjunction with professors and students at UFLA and UD, and to visit this University in 2013.

#### **Results**

The project is led by a faculty team from CANR and the College of Arts and Sciences (CAS) and is intended to help build longstanding academic programs and research partnerships with UFLA that will enhance the international nature of curricula in areas of common interest, such as food

security, bioenergy animal agriculture and biodiversity. The project will also aim to stimulate creative thinking in the students who participate about how to develop innovative solutions to complex global agricultural and environmental problems.

#### 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 #19

##### 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 nutraceutical 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.

Not Reporting on this Outcome Measure

#### Outcome #20

##### 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 biology to enhance removal or in-situ degradation or stabilization of pollutants in soils.

Not Reporting on this Outcome Measure

## **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)**

### **Evaluation Results**

Evaluation of the Global Food Security and Hunger planned program for FY 12 (70 research FTEs, 24 Extension FTEs) indicates continued strong efforts in basic and applied research and extension activity. Food security and agricultural productivity has long been a primary area of emphasis in the state. Delaware's agricultural systems, particularly poultry, grain, and vegetable crop production, are linked closely with exports to other countries and serve as models for the application of new knowledge, derived from basic research, to challenges in emerging and developed countries worldwide. Research grants (35 awarded) supported the efforts of 147 graduate students, post-docs, and undergraduate researchers who published 56 refereed journal articles and book chapters, made 339 invited and volunteered presentations, and conducted 216 workshops on improved efforts to contribute to the global need for a safe and secure food supply, increase agricultural profitability, become more competitive in global markets, and ensure the environmental compatibility of all forms of agriculture. Our evaluations have included annual internal administrative reviews, periodic University level Academic Program Reviews, and - for extension - surveys and other evaluations conducted with stakeholders participating in workshops and other extension programs. In general, we have received very positive feedback from the agricultural and natural resource communities about the programs we conduct related to Global Food Security and Hunger.

### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs that seek to further expand our efforts to address the global challenges related to producing a safe and secure food supply.

**V(A). Planned Program (Summary)**

**Program # 2**

**1. Name of the Planned Program**

Biotechnology and Biotechnology-based Agribusiness

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
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%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	19.1	4.5
Actual Paid Professional	0.0	0.0	21.9	0.6
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	30026	158148	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1031	30026	231049	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	4707531	404974

## 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, including those affected by microRNAs, disease etiology and control and emergence of new disease causing agents. Research will continue and expand on annotating 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 herpes viruses 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; new plant molecular biology research focuses on the molecular interactions between a devastating fungal pathogen of rice, barley and other cereal crops, called *Magnaporthe oryzae* and on *Phytophthora phaseoli*, a fungal-like organism that is of economic interest to lima bean breeders and farmers in Delaware, which, under the proper conditions, can destroy up to half of the lima bean yield in one season; 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 nutraceuticals, 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.

**3. How was eXtension used?**

Not used in this Planned Program

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	298	0	164	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	0	29	29

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

Year	Actual
2012	20

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

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

2012 6

**Output #3**

**Output Measure**

- Number of Research Projects Completed

<b>Year</b>	<b>Actual</b>
2012	17

**Output #4**

**Output Measure**

- Number of Undergraduate Researchers

<b>Year</b>	<b>Actual</b>
2012	19

**Output #5**

**Output Measure**

- Number of M.S. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	18

**Output #6**

**Output Measure**

- Number of Ph.D. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	19

**Output #7**

**Output Measure**

- Number of Post-doctoral Research Associates

<b>Year</b>	<b>Actual</b>
2012	8

**Output #8**

**Output Measure**

- Number of Refereed Journal Articles

<b>Year</b>	<b>Actual</b>
2012	29

**Output #9**

**Output Measure**

- Number of Books and Book Chapters

<b>Year</b>	<b>Actual</b>
2012	3

**Output #10**

**Output Measure**

- Number of Technical Reports

<b>Year</b>	<b>Actual</b>
2012	236

**Output #11**

**Output Measure**

- Number of Extension Bulletins and Factsheets

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

**Output #12**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	42

**Output #13**

**Output Measure**

- Number of Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	13

**Output #14**

**Output Measure**

- Number of Websites Established

<b>Year</b>	<b>Actual</b>
2012	6

**Output #15**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	7

**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.

Not Reporting on this Outcome Measure

### **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.

Not Reporting on this Outcome Measure

### **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**

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

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

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

If plants lack a specific protein, then this can allow bacteria to enter the plant and take sugar without producing anything in return. This can serve as a biotechnology lesson for students.

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

Janine Sherrier, professor in the Department of Plant and Soil Sciences at the University of Delaware, is part of a team to study the legume *Medicago truncatula*. Sherrier leads one of four research groups participating in this project, which represents a collaborative effort between

researchers at the Noble Foundation, the Boyce Thompson Institute at Cornell University, the University of Delaware, and the University of North Texas. The focus of Sherrier's research program is on the protein-to-protein interactions that are necessary for beneficial plant-bacteria relationships to occur. "If the plant lacks a specific protein, then this can allow bacteria to enter the plant and simply take the sugar without producing anything in return. This would be detrimental for a crop," she explained.

### Results

Sherrier's team will also be developing and teaching a 4-H summer camp across Delaware to teach children about how different microbes are important for agriculture. Campers will participate in science-based activities, such as using microscopes and making yogurt. The camps will contribute to the development of future growers in all three counties.

## 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.

Not Reporting on this Outcome Measure

### 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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The age of working class is getting older and the United States Department of Agriculture has recognized this and has put forth efforts to maintain a stable workforce as many reach retirement age. In addition, there is a need to maintain and boost the minority workforce within the government. To this end the DSU Ag Discovery program is designed to allow youth to become familiar with possible careers and opportunities in the field of Agriculture.

#### What has been done

The DSU Ag Discovery program was started to assist in providing opportunities for youth to explore careers in Agriculture and gain knowledge on what majors are available to assist with their career choices. Ag Discovery is an intensive two-week Agribusiness based program that is in partnership with the USDA/APHIS. The program contains workshops, presentations and experiential learning that allow youth to gather valuable information pertaining to Agriculture, thus leading to interests and possible career choices. The youth do a 5 minute presentation of their experience evaluating the program. 16 youth, five counselors and numerous USDA/APHIS and DSU staff participate in this program providing over 30 workshops, presentations and experiential learning experiences.

#### Results

Students leave the program filled with newfound thoughts on Agriculture, as most did not have any knowledge of the subject prior to the program. The program is in its 5th year and thus far all seniors that has been in the program, including juniors have gone on to college. 85% are majoring in an ag related subject.

### 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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Interdisciplinary research is essential in order to solve complex global health problems.

#### What has been done

The University of Delaware held its inaugural One World, One Health animal, human and environmental health symposium, titled "Global Thinking for the Greater Good: Interdisciplinary Health Discourse and Research," in the Townsend Hall Commons on Wednesday, Aug. 22. The event was sponsored by the UD College of Agriculture and Natural Resources (CANR), the College of Health Sciences (CHS) and the Delaware Environmental Institute (DENIN) in collaboration with the U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS).

#### Results

Scientists in attendance discussed regional interdisciplinary health efforts, funding options, interdisciplinary cooperation and opportunities, and the logistics of a successful partnership.

### 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**

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

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

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

Viral diseases of poultry affect the Delmarva Poultry industry, having the potential for catastrophic market failure.

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

UD research scientists have been involved in viral diagnostics and applied research on avian viral diseases affecting the Delmarva Poultry Industry. Mainly, they have been engaged in standardizing a rapid neuraminidase treatment procedure for the early detection and isolation of the infectious bronchitis virus (IBV) in samples submitted from commercial broiler flocks to the University of Delaware Poultry Health System. That has helped to speed up the turn around results and to decrease the cost of embryonated eggs used to replicate and isolate the virus. Similarly, a hemagglutination-inhibition testing procedure was put in place to adequately monitor the infectious bronchitis infection in commercial broiler flocks across the Delmarva Region. At the same time, they have been involved in developing and evaluating cold adapted vaccine candidates against the infectious laryngotracheitis virus (ILT) that is other important disease with negative impact for the commercial poultry (this research is still in process). UD research scientists also found that a commercially-produced immune stimulant increased the antibody response to the transgene encoded by a recombinant Marek's disease virus (MDV) vaccine. This may have profound consequences for the poultry industry as many use these recombinant vaccines. This immune stimulant also provides antibacterial protection and may be important as antibiotics are removed from poultry feed. They also found that splice variants of the oncoprotein, Meq, of MDV-1 strains, have higher affinity for the C-terminal binding protein (CtBP-1), a cellular protein that is a scaffold for chromatin remodeling enzymes. This may have profound importance to our understanding of the regulation of MDV latent infection and the transformation of T-cells by

MDV.

**Results**

These research results will drive the industry’s design of control strategies, and disease prevention.

**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 Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2012	0

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

**Issue (Who cares and Why)**

Basic research is needed to lead to an improved understanding of the processes by which plants grow, resist or adapt to diseases and other stresses.

**What has been done**

Three collaborating laboratories in the Department of Plant and Soil Sciences (PLSC) at the University of Delaware – those of professors Blake Meyers, Janine Sherrier and Pamela J. Green – recently identified a novel regulatory network within legumes, including in alfalfa and soybean plants. The work was performed predominantly by Jixian Zhai, a doctoral student in PLSC. The genomics project was funded by a grant from the U.S. Department of Agriculture. Conducting their research at the Delaware Biotechnology Institute (DBI), the investigators set out to get a

comprehensive view of how small RNAs function in legumes and how they might be important to these plant species. The researchers sequenced libraries containing millions of small RNAs, important gene regulatory molecules, as well as the genes targeted by these small RNAs.

### Results

They identified a novel function for a handful of "microRNAs" "special small RNAs that direct the targeted destruction of specific protein-coding messenger RNAs. Among these plant microRNAs, the team determined that many target "guard proteins" that function in defense against pathogenic microbe infiltration. These "guard proteins" function as an immune system to battle pathogens but presumably must be suppressed to allow the interactions with beneficial microbes for which legumes are particularly well known.

## 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.

Not Reporting on this Outcome Measure

### 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)

#### Evaluation Results

Evaluation of the Biotechnology and Biotechnology-Based Agribusiness planned program for FY12 (22.5 Research FTEs) shows continued excellence in basic research and an increasing emphasis on application of results from fundamental studies, particularly in the plant sciences. Plant molecular biology faculty are now conducting field studies with soybeans, corn, and rice in a concerted effort to extend findings from basic research to real-world conditions. Evaluations of research productivity showed that 6 major research grants were awarded and that faculty in this program supported the efforts of 64 graduate students, post-docs, and undergraduate researchers, that they published 32 refereed journal articles and book chapters, and made 55 invited and volunteered presentations at national and international meetings. Our evaluations focused on research and included annual internal administrative reviews, periodic University level Academic Program Reviews, and analyses of interactions of faculty with industry and state agencies interested in seeing biotechnology advances adopted by businesses. Feedback from all sources has been positive and we anticipate that expanded efforts in the translation of basic research in this planned program to both applied field studies and industrial applications will continue in the future.

### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs that seek to further expand our efforts to conduct fundamental studies on plant and animal biology and apply the results to global challenges related to producing a safe and secure food supply.

**V(A). Planned Program (Summary)**

**Program # 3**

**1. Name of the Planned Program**

Natural Systems, Biodiversity, and Wildlife Ecology

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	10%	10%	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%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.4	1.8	3.3	2.5
Actual Paid Professional	1.4	2.0	3.7	2.1
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
39844	91629	76258	148934
1862 Matching	1890 Matching	1862 Matching	1890 Matching
230841	91629	0	148934
1862 All Other	1890 All Other	1862 All Other	1890 All Other
109528	0	1023963	1058764

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

### 1. Brief description of the Activity

Research and extension programs will target: (1) Integrated Pest Management (IPM) - developing and delivering 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 is 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; (4) Wetlands Ecosystems - improve understanding of wetlands restoration, protection, and preservation. Emphasis will be on seasonally saturated and non-seasonally saturated wetlands and the wildlife species that inhabit them; (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, Rainwater harvesting, 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; and (10) Apiculture - New research is underway on the evolutionary biology of honey bees, pollination ecology, the population genetics of honey bees in the United States; and the genetic characterization of unmanaged honey bee populations.

### 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.

**3. How was eXtension used?**

In 2012, UD kick started efforts for a Delaware Extension Ask an Expert widget/feature on both the UD and DSU websites. Recognizing that 70% of the questions coming into the national system, including those questions funneled to Delaware from the national widget, are horticulture based, training has focused on gearing up Master Gardeners in all three counties to be able to navigate the system and answer questions. The feature will be released in 2013. Many Master Gardeners and UD/DSU Extension horticulture professionals have been added into the system and are joining Communities of Practice and communities of a horticulture nature.

Debbie Delaney, assistant professor of entomology at UD, is a member of the bee health community of practice, and has been working with other members on a grant to create a bee/pollinators app.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	20142	86338	4793	105

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

**Patent Applications Submitted**

Year: 2012

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	2	21	23

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

**Year                      Actual**

2012 30

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

<b>Year</b>	<b>Actual</b>
2012	18

**Output #3**

**Output Measure**

- Number of Research Projects Completed

<b>Year</b>	<b>Actual</b>
2012	17

**Output #4**

**Output Measure**

- Number of Undergraduate Researchers

<b>Year</b>	<b>Actual</b>
2012	48

**Output #5**

**Output Measure**

- Number of M.S. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	46

**Output #6**

**Output Measure**

- Number of Ph.D. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	8

**Output #7**

**Output Measure**

- Number of Post-doctoral Research Associates

<b>Year</b>	<b>Actual</b>
2012	3

**Output #8**

**Output Measure**

- Number of Refereed Journal Articles

<b>Year</b>	<b>Actual</b>
2012	23

**Output #9**

**Output Measure**

- Number of Books and Book Chapters

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

**Output #10**

**Output Measure**

- Number of Technical Reports

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

**Output #11**

**Output Measure**

- Number of Extension Bulletins and Factsheets

<b>Year</b>	<b>Actual</b>
2012	13

**Output #12**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	155

**Output #13**

**Output Measure**

- Number of Volunteered Presentations

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

**Output #14**

**Output Measure**

- Number of Websites Established

<b>Year</b>	<b>Actual</b>
2012	6

**Output #15**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	108

**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	Through the Center for Managed Ecosystems, 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**

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

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

**Issue (Who cares and Why)**

Agricultural growers and producers seek research-based information regarding weed management in their farming operations.

**What has been done**

Mark VanGessel, University of Delaware extension specialist and professor in the Department of Plant and Soil Sciences, and his team of weed science researchers, Barbara Scott and Quintin Johnson and summer students and interns organize Weed Science Field Day. Throughout the year UD Extension and research staff conduct unbiased studies on more than 70 trials (which amount to more than 700 comparisons) most are devoted to key agronomic crops, and evaluate their effectiveness of weed management. Chemical, mechanical and cultural practices are evaluated. Their findings are published in an annual guide of trial results that is made available to attendees and the results serve as the basis for educational programs throughout the year and provide the experience to answer questions from farmers and the agricultural industry. The goal of Weed Science Field Day is to deliver the latest research to the agricultural community. Communication to the industry is a key component in Delaware's continued agronomic success and is part of Cooperative Extension's outreach mission.

**Results**

More than 60 growers, pesticide applicators, crop advisers, and agricultural professionals from Maryland and Delaware attended the 2012 event to obtain information on the trial results and best practices.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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.

Not Reporting on this Outcome Measure

## **Outcome #3**

### **1. Outcome Measures**

Through the Center for Managed Ecosystems, 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 Action Outcome Measure

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

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

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

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

Homeowners, citizen groups interested in conservation and ecosystems, those concerned about how landscape management affects biodiversity and water quality.

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

Taking a fresh look at water quality management, a University of Delaware College of Agriculture and Natural Resources (CANR) research team is studying how the replacement of urban lawns

with more diverse vegetation can help protect water quality and make our landscapes more sustainable.

**Results**

The researchers will be working at the Winterthur Gardens on their project. Shreeram Inamdar, CANR associate professor of plant and soil sciences, is the principal investigator and the research team includes Doug Tallamy, chair of the Department of Entomology and Wildlife Ecology; Susan Barton, associate professor in the Department of Plant and Soil Sciences and a Cooperative Extension specialist; Jules Bruck, assistant professor of landscape horticulture and design; and Joshua Duke, professor in the Department of Food and Resource Economics. One of the main goals of the three-year study, is to try to curb water pollution at its source ? preventing pollution in the first place rather than waiting to treat contaminated water before it enters waterways. The researchers believe they can keep water clean by shrinking the lawn and replacing it with more diverse vegetation, thus reducing fertilizer and herbicide inputs and enabling water filtration, which will lead to less storm water runoff and cleaner water. Diverse vegetation also is expected to provide other natural ecosystem services ? such as carbon sequestration, preserving biodiversity and natural pest control ? that are associated with mixed vegetation landscapes

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
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**

<b>Year</b>	<b>Actual</b>
-------------	---------------

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Landscape management during the growing season for landscape maintenance professionals, public garden professionals, nursery personnel and garden center employees is a complicated topic. These landscapes contain hundreds of different plants, each with their own disease, insect or cultural problem. The industry is encouraged to practice an integrated pest management (IPM) approach, which means looking for pests at the appropriate life stage on the appropriate host plant, knowing what environmental conditions are likely to trigger disease and which cultural problems occur in response to drought, wet conditions or high temperatures. By practicing IPM, control measures are used only when needed, for the proper life stage of the pest, and by choosing the least toxic option.

#### What has been done

The technical information necessary to manage landscapes this way is provided on a weekly basis to Ornamentals Hotline subscribers depending on current pest and environmental conditions.

#### Results

A survey of Ornamentals Hotline was conducted at the end of the 2012 growing season. The survey response rate was 18.5%. The greatest number of respondents were landscape contractors (44%). Practices most often changed were: ?Correctly identify insects and diseases before deciding on control strategy? (61%); ?Replace problem plants with better adapted species? (53%); ?Scout for pests before deciding on control needed? (47%); ?Select least toxic pesticide available? (44%). Respondents said Ornamentals Hotline helped them implement these practices by: reminding them which insects and diseases to look for (most common response); providing information on why a practice should be implemented; providing staff training; providing information on which pesticides to use. When asked whether they have reduced the total volume of pesticides applied, most responded with some form of ?yes? (59%). The amount of reduction ranged from 10% to over 90%, with one respondent explaining they are now totally pesticide free. Only 15% of respondents have not reduced pesticide use at all. Most respondents (72%) think images of pests and diseases are extremely helpful with diagnosis and would like to see more images on the blog. As a result of this evaluation, the Ornamentals Task Force has decided to provide a link to a growing degree explanation at the bottom of the growing degree day box included in each issue. We will also provide a link to a blog that is updated weekly with pictures and additional resources. One of the additional resources will be a list of trade names of common pesticides.

### 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**

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

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

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

The Mid-Atlantic Region of the United States has been dealing with herbicide resistant weeds since 1972 when triazine resistance was identified in Maryland. Glyphosate- resistant horseweed was identified in 2000 in Delaware and, more recently, acetolactate synthase (ALS) -resistant smooth pigweed, ALS-resistant common chickweed , and glyphosate-resistant Palmer amaranth have been confirmed in the region. While, glyphosate-resistant weed species in grain crops have impacted the largest number of acres, ALS-resistant smooth pigweed remains a very big challenge for their vegetable industry (over 125,000 acres in the Delmarva region).

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

The U.S. Environmental Protection Agency (EPA) and Weed Science Society of America (WSSA) have worked together in recent years on a number of weed management issues facing farmers, natural resource managers, and weed scientists. A one-day tour was organized to provide an opportunity for EPA staff and WSSA members to discuss herbicide resistant weeds and the impact they are having on agricultural production in this region. Twenty-seven EPA staff representing all of the divisions within the Office of Pesticide Programs participated on the tour along with 4 members representing the WSSA. The hosts of the tour were Dr. Mark VanGessel, University of Delaware, and Dr. Ron Ritter, University of Maryland. The objectives of the tour were: To demonstrate the complexity of herbicide resistant weed management; To demonstrate the severity of herbicide resistance in a variety of crops in the Mid-Atlantic region, including vegetable crops; To discuss how farmers in the Mid-Atlantic region are dealing with the problem, and discuss some of their constraints to management. To discuss how weed resistance has evolved to several herbicide families impacting all crops grown in the region; To discuss how approaches to weed management are often site and region specific. Four stops were included in the tour representing agricultural production and weed management issues on the Delmarva Peninsula. Stops included: University of Maryland's Wye Research Farm where the group

viewed research plots evaluating weed control programs in conventional and herbicide-resistant crops; A commercial soybean field near the DE/MD state line where the group discussed the programs designed by the University of Delaware for management of glyphosate-resistant horseweed and the effect of environmental conditions on the success of that program; A commercial lima bean field near Greenwood, DE where the management of ALS-resistant smooth pigweed has become a challenge due to the limited herbicide registrations; A soybean field near Denton, MD that was planted with soybean rather than corn (original choice, higher income potential) because of the weed spectrum in the field.

**Results**

The tour participants were surveyed at the end of the tour to determine the usefulness of the tour: 83 % rated the overall educational portion of the tour as very informative; 74% indicated that they have a better understanding of issues related to herbicide-resistance; 65 % indicated that they will use the information gained during the tour in their duties with EPA.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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**

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

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

**Issue (Who cares and Why)**

Accidentally introduced to the U.S. from China in the 1930s, stufies show mile-a-minute can grow six inches per day. Chemical control measures aren?t very effective and native insects don?t like to eat mile-a-minute.

**What has been done**

UD researchers are using weevils to check the spread of mile-a-minute weed. Judy Hough-Goldstein, professor of entomology, is using a weevil known as Rhinoncomimus latipes to help curb mile-a-minute weed. The itsy-bitsy Rhinoncomimus latipes, a native of China, is host-specific to mile-a-minute; it won?t eat any other plant.

**Results**

Since 2004, Hough-Goldstein and cooperators have released Rhinoncomimus latipes at numerous sites in Delaware and in Chester County, Pa. She was the first researcher in the world to obtain a permit to release a biological control agent of mile-a-minute weed. Today, her lab is still the only one in the U.S. ? and one of a handful in the world ? attempting to control this invasive plant through biological means.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Crop consultants and field workers require research-based information to make informed decisions in processing and fresh market vegetables.

#### What has been done

Joanne Whalen and Bill Cissel developed an Insect Trapping Systems for Integrated Pest Management (IPM) Decision Making in Processing and Fresh Market Vegetables. Thirteen black light traps and eleven corn earworm pheromone traps were placed on vegetable farms throughout Kent and Sussex counties in late April. A University of Delaware trap technician drove to each location twice a week from early May through mid-September and counted the number of corn borer and corn earworm moths in black light and pheromone traps. Information collected in the trapping program was sent to the University of Delaware's Extension IPM Associate (Cissel) and Extension IPM Specialist (Whalen) on each trapping day to ensure that clientele received timely information. The use of multiple methods of dissemination of trap information allowed users to access the information 24 hours a day. A phone hotline was set up and received approximately 30 -70 calls weekly, mainly from consultants and field men who then used the information for a larger group of clientele. Links in the Weekly Crop Update provided information on a weekly basis to 300 subscribers.

#### Results

Survey results indicate that trapping information was used to make management decisions on the following crop acres: (a) Processing Lima Beans: 15,800; (b) Fresh Market Peppers: 180; (c) Fresh Market Snap Beans: 1350; (d) Processing Snap Beans: 1550 (includes some VA acres); (e) Fresh Market Sweet Corn: 4,000; and (f) Processing Sweet Corn: 12,500 (includes MD acres in adjacent counties to Delaware). Respondents indicated that the trapping program helped to prevent yield loss on over 35,000 acres of vegetables. They reported savings in terms of yield loss for fresh market and processing snaps beans and fresh market sweet corn averaging \$44 per acre. Producers and consultants using trapping information to make spray decisions also reported improved quality of fresh market snap beans and sweet corn valued at an average of \$50 per acre.

### 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.

Not Reporting on this Outcome Measure

**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**

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

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

**Issue (Who cares and Why)**

Data is needed to determine how water and chemicals move through the forest canopy, soils and watersheds, and how future climate change may impact or alter such responses.

**What has been done**

An outdoor experimental watershed laboratory established by University of Delaware faculty members Shreeram Inamdar, associate professor in the Department of Plant and Soil Sciences, has investigated the role of soils, streams, and watersheds in leaching water and nutrients, while a professor in the Department of Geography, has studied the interactions of atmosphere and the forest canopy in leaching water and nutrients. Together, they have provided a complete picture of watershed hydrology and biogeochemistry. The two were awarded a grant in 2008 to study the

mechanisms behind the leaching and exports of carbon and nitrogen from watersheds and how these chemicals evolve as they change in space ? traveling through the forest canopy, soils, and stream drainage network ? and as they change in time through the different seasons. Climate change scenarios suggest that storms will become more intense with dry intervening periods similar to the conditions associated with the Hurricane Nicole event, and thus studying such extreme events provides a critical window into the future.

### **Results**

Sampling for multiple years has provided insights into how water chemistry changes with seasons. These measurements have allowed for the researchers to investigate how unique seasonal events ? such as autumn leaf fall or spring emergence ? alter water quality in the stream.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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.

Not Reporting on this Outcome Measure

## **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)**

### **Evaluation Results**

Evaluation of the Natural Systems, Biodiversity, and Wildlife Ecology planned program

for FY12 (5.8 Research FTEs, 3.4 Extension FTEs) shows ongoing high quality efforts by research and extension scientists and educators to address the ecological and natural resources problems facing Delaware and of relevance to many other states and countries. Significant advances have been made in our understanding of wildlife ecology and management, the role of migratory birds in the transmission of avian diseases, applications of radar technology to track migratory birds, and the use of biocontrol strategies to manage invasive plants and problem insects. Evaluations of research and extension productivity showed that 18 grants were awarded and that faculty in this program supported the efforts of 105 graduate students, post-docs, and undergraduate researchers, that they published 28 refereed journal articles and book chapters, made 220 invited and volunteered presentations at national and international meetings, and conducted 108 workshops. Our evaluations have included annual internal administrative reviews, periodic University level Academic Program Reviews, and - for extension - surveys and other evaluations conducted with stakeholders participating in workshops and other extension programs. All evaluations and feedback from stakeholders have been positive in terms of the direction of research and extension programs, their relevance to Delaware, and their contributions to basic and applied science.

### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs that seek to further expand our efforts to conduct research and outreach programs that meet the growing need to restore degraded ecosystems, protect biodiversity, and address the growing global problem of invasive species control.

**V(A). Planned Program (Summary)**

**Program # 4**

**1. Name of the Planned Program**

Family and Youth Development

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	25%	25%	0%	50%
802	Human Development and Family Well-Being	25%	25%	0%	50%
806	Youth Development	40%	40%	0%	0%
903	Communication, Education, and Information Delivery	10%	10%	0%	0%
<b>Total</b>		100%	100%	0%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.2	4.2	0.0	0.6
Actual Paid Professional	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
136381	278381	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
187275	278381	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1180149	32500	0	78843

## **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); extension advisory committees; and Family and Community Educators. Special attention will be paid to training volunteers in risk management and emergency preparedness issues. (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; youth tobacco prevention will also be an area where significant resources are targeted; (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 and community involvement, and career exploration with emphasis on science, engineering and technology knowledge. Rural communities in southern Delaware will be targeted. The goal is to provide expanded youth opportunities for out-of-school time, develop human and community capital and develop and strengthen youth-adult partnerships. Also, using technology as a tool, significant mentoring to reduce inappropriate behaviors that lead to poor choices by youth will be implemented. 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.

### **3. How was eXtension used?**

For Planned Program #4, eXtension funded the development of Just in Time Parenting (JITP), a pioneer Community of Practice at [www.extension.org/parenting](http://www.extension.org/parenting) led by UD faculty member Patricia Nelson. JITP is offering the best of Extension parenting and family resources - available to every interested family (and the professionals who work with families) nationwide.

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

### **1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	12075	15423	38371	8438

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

Year: 2012  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	1	0	1

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

Year	Actual
2012	19

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

Year	Actual
2012	16

**Output #3**

**Output Measure**

- Number of Research Projects Completed

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

2012 2

**Output #4**

**Output Measure**

- Number of Undergraduate Researchers

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

**Output #5**

**Output Measure**

- Number of Refereed Journal Articles

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

**Output #6**

**Output Measure**

- Number of Technical Reports

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

**Output #7**

**Output Measure**

- Number of Extension Bulletins and Factsheets

<b>Year</b>	<b>Actual</b>
2012	108

**Output #8**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	34

**Output #9**

**Output Measure**

- Number of Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	22

**Output #10**

**Output Measure**

- Number of Websites Established

<b>Year</b>	<b>Actual</b>
2012	7

**Output #11**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	841

**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 preparedness to their future careers.
3	Educational programming for adults 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, and that result in improved academic, social, and job preparedness skills.
5	Number of parents/families participating in extension programming who demonstrate positive parenting skills.
6	Number of youth and adults adopting increased leadership, communication, conflict management and decision-making skills
7	Number of program participants adopting skills for balancing work and family and stress management that promote healthy, well-functioning individuals and families
8	Number of families who adopt best practices in financial management, retirement planning and consumer decision-making.
9	Number of adults adopting best practices in child development, business development, educational program development in child care settings.
10	Number of youth who have increased science, engineering, and technology skills.
11	Number of youth with greater involvement in citizenship and community service programs.
12	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.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

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

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

**Issue (Who cares and Why)**

Many children and families living within Delaware State Housing Authority (DSHA) communities are given little to no access to the educational benefits of their surrounding areas. This, at times, has led to high crime rates, poor academic performance and a continued cycle of being stuck in a system from which so many want to desperately free themselves.

**What has been done**

Delaware 4-H Afterschool has begun to change all of that. Through a Grant from the 21st Century Learning Centers, 4-H Afterschool and DSHA have paired up to give these children experiences that may be foreign to them, in an educational and fun way. The five DSHA sites are Liberty Court, Mifflin Meadows, Clarks Corner, Burton Village, Laverty Lane and Knollwood. In discussions with DSHA staff, 4-H Afterschool staff came up with a list of areas where the children needed extra education. The staff focused on: Academic improvement; Behavior modification; Attendance at school; Healthy Lifestyles; Exposure to outside positive influences.

**Results**

Since the program's inception in 2009: DSHA staff has reported an increase of children attending school regularly; Crime during the time period when afterschool takes place is down significantly, as is other times during the day; 4-H Afterschool staff has seen detentions and suspensions for the enrolled children fall; Children have completed in county and statewide contests with great self-respect; Worked with outside agencies to bring in Adult learning component to the communities; Created a safe environment for children to come when they need it.

#### 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 adults and youth emphasizing the development of positive life skills related to parenting, family financial planning, and safe communities.

Not Reporting on this Outcome Measure

#### Outcome #4

##### 1. Outcome Measures

Number of youth adopting behaviors that reduce their risk of using alcohol, tobacco and related substances, and that result in improved academic, social, and job preparedness skills.

Not Reporting on this Outcome Measure

#### Outcome #5

##### 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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Parents and families are in need of developmentally scientific information to support child development

#### What has been done

Just in Time Parenting (JITP) is an unusually parent-friendly series from prenatal through the teen years written at the 4th grade reading level, in Spanish and English. JITP highlights key research-based messages to help the whole child thrive -- providing developmentally specific information at the most teachable moments. About 4098 Delaware families receive mailed, print versions of Just in Time Parenting. Of those, 3821 families receive information focused on the early years (prenatal - age 5). Another 307 families of young children receive JITP electronically. An additional 227 parents are receiving monthly Families Matter! updates, based on the age of their school-age child (through the teen years).

#### Results

Those who report changing behaviors and attitudes most as a result of JITP are youngest, poorest and least educated. Having realistic developmental expectations is one of the most important behaviors reported by JITP subscribers as it helps reduce child maltreatment. Parents receiving JITP online report gaining new knowledge and behaviors in ten critical areas essential to their child's healthy physical and social-emotional growth and development. JITP parents report engaging their child in learning games and activities that promote literacy, language and school readiness.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
806	Youth Development

### Outcome #6

#### 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	Actual
2012	0

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

**Issue (Who cares and Why)**

Life skills development and workforce preparedness are critical for young adults.

**What has been done**

The 4-H residential camp program in Delaware hires young adults to serve as counselors each summer Delaware 4-H camp has been in existence for over 60 years and serves as an educational program for youth ages 10-19. Former campers are invited to apply to serve as a camp counselor for a two-week period during the summer. Counselors are hired in the winter; training and camp planning begin in the early spring. Counselors are trained in curriculum development, as well as youth development principles and camp management. The camp training program was created to assist camp counselors in life skills such as: leadership, conflict management, planning and organization, and responsibility and accountability. During their camp experience counselors are given the responsibility of caring for a group of approximately 15 youth in a cabin, developing class curriculum and effectively teaching that curriculum, and operating the entire camp program in a safe and educational manner.

**Results**

The camp counselor program was evaluated by 4-H staff based on surveys developed by University of Delaware Cooperative Extension and Rutgers University Cooperative Extension. The results showed that the 100% of the young adults felt the camp counselor experience allowed them to develop leadership skills and teaching skills, and found their one-on-one assessment with the camp director and 4-H staff to be effective. In addition, counselors felt respected and confident in their work with campers. Counselors will be able to take these skills and utilize them in the workplace and in their educational efforts.

**4. Associated Knowledge Areas**

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

## **Outcome #7**

### **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**

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

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

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

Many children in Delaware have one and sometimes both parents called into action who can be gone from one to eighteen months. In 2012-2013 Delaware Reserve and National Guard members are facing one of the largest deployments in many years.

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

through the Cooperative Extension System, particularly the 4-H and youth development program, to support the children and youth affected by deployment. This initiative was officially launched in April 2005. Since its inception, OMK has touched thousands of military youth in Delaware and provided information to thousands more community members about the issues affecting military families across Delaware. In Delaware OMK is an ongoing community support system for families, particularly children of parents in the National Guard and the Army Reserves. It provides an outlet with recreational, educational and social opportunities for military youth, which helps them to deal with their parents being in a risky atmosphere. Through a grant from the Department of Defense, the Delaware 4-H OMK Program offered six camps to 191 youth ages 6-17 whose parents are in the reserve or National Guard in 2012. The purpose of these camps was to teach the military youth life skills and coping skills to assist them as parents or loved ones deployed.

#### **Results**

The camps were evaluated by the Virginia Tech Community and Family Research Lab based on surveys developed by the American camping Association. The results showed that campers perceived improvement for themselves in all six domains measured. Mean scale scores for all six domains placed Delaware campers above the national norms, in the 70th-90th percentiles. The six domains were: friendship, independence, responsibility, teamwork, family citizenship, and competence. In addition 93% of campers agreed that participating in camp reduced their stress and 97% of campers had a Social Support score of 4.0 or greater, indicating that they agree or

strongly agree they had social support.

**4. Associated Knowledge Areas**

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

**Outcome #8**

**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**

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

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

**Issue (Who cares and Why)**

In today?s economic climate, families are seeking ways to become more financially literate.

**What has been done**

UD Extension family and consumer sciences programs addressed financial literacy. Educators completed a series of financial literacy programs with limited income, workforce bound adults in partnership with the Delaware Money School and Connections Inc.

**Results**

Over 70 individuals indicated that they learned at least one financial best practice that they would implement as a result of attending the program. In addition, 147 UD custodial staff attended a workshop on understanding credit and reducing debt. Survey results suggest that 80% will work reduce debt while 85% indicated they would review their credit report.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 adults adopting best practices in child development, business development, educational program development in child care settings.

Not Reporting on this Outcome Measure

**Outcome #10**

**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**

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

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

**Issue (Who cares and Why)**

There is a shortage of scientists to fill jobs and a need for citizens who understand and appreciate science. 4-H members need increased opportunities in science based learning to develop interest in careers in this industry as well as to gain important life skills. These opportunities will also allow these individuals to improve their science literacy.

**What has been done**

Kent County 4-H has developed several initiatives to provide increased science based learning opportunities to 4-H members. County 4-H Educators have developed collaborations, encouraged science based learning at the club, county and state levels, and encouraged and expanded opportunities in 4-H events where science based learning was not previously available. These

initiatives include Agilent Kit distribution, county club participation in National 4-H Science Day, development of science project groups in county clubs, addition of science classes at summer 4-H Day Camps, creation of a new County Robotics Club and County Science Club, and promotion of science exhibits at the Delaware State Fair. Through a collaboration with Agilent Technologies, a science based company that provides measurement tools and expertise to meet the world's critical requirements for electronic and bio-analytical measurement, Agilent kits have been provided to the Delaware 4-H Program free of charge to help educate youth and create an interest in science. These science based kits, which are available via a national website to the general public at a cost of \$25 to \$35 per kit, explore over 21 science learning in areas that include topics of electric circuits, motion, properties of light and sound, solar energy, motion and design, meteorology and hydraulics. Each kit provides all materials available to support a science based learning activity for 4 youth. Kent County 4-H has had a strong 4-H club participation in National 4-H Science Day for the past 3 years. Kits have been made available to county 4-H clubs to encourage their involvement and learning of the annual themed science experiment. Kits were purchased utilizing funds made available by National 4-H Council to Kent County 4-H based on that county being the top participating county in the state.

### Results

County 4-H clubs have been encouraged to start science project groups in their clubs. The creation of these project groups has allowed for several science based learning opportunities for club members. Kent County 4-H developed and offered two new county-based science initiatives by beginning a new County Robotics Club and new County Science Club. Both of these opportunities have many county 4-H members attending to participate in various science based learning activities. In addition, science themed classes were developed by camp counselors to present at both summer 4-H day camp opportunities conducted each year. Science exhibit classes were also developed and added to the class listing of potential exhibits at the Delaware State Fair. We continue to see increased participation in each of these classes annually. Science based learning has definitely increased in Kent County 4-H through many opportunities that have been developed as follows: To date, over 4,049 kits have been provided by Agilent and used by the Delaware 4-H Program in all 21 areas of science learning with over 16,200 youth involved at at the club and county levels, 4-H After School Program and 4-H Military initiative. On an annual basis, 20+ Kent County 4-H club units have participated in National 4-H Science Day with over 450 participants. County clubs have established ongoing science project groups to serve their membership. 25+ members meet monthly and participate in the County Robotics Club. 9 members meet monthly and participate in a new County Science Project Club learning scientific method through hands on experiments. Annual 4-H Summer Day Camps have included science-based classes with over 65 youth taking part in this initiative on an annual basis. 50+ science exhibits are entered each year in the 4-H Department at the Delaware State Fair. Increased enthusiasm and interest can clearly be seen in 4-H members who participate in these programs.

## 4. Associated Knowledge Areas

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

**Outcome #11**

**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**

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

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

**Issue (Who cares and Why)**

Youth need to gain citizenship and leadership skills that will enable them to contribute as members of a civil society. Many youth have never visited state government offices or Legislative Hall and lack a clear understanding of how the state government process works as well as the purpose and function of various state government offices.

**What has been done**

Delaware 4-H develops and conducts an annual 4-H Legislative Day. The primary purpose of this day is to allow 4-H members to learn more about their state government process, meet and discuss issues and situations with state legislators, participate in a 4-H Rally while interacting with state legislators, see government in action, and allows for the promotion and advocacy of the Delaware 4-H Program. A schedule of events is developed each year for participants to attend and learn more about state government. All 4-H members and adults who attend participate in 2 workshops during the day. First year attendees participate in a two part workshop that involves a tour of Legislative Hall and includes an interactive session with a designated state legislator who meets with them and discusses the state government process, provides information of the duties of a state legislator and allows for a question and answer session for youth in attendance. These individuals also participate in a workshop and tour held at the Public Archives Building related to historic documents archived and stored in this facility. Members who attend a 2nd or subsequent year are assigned to various other scheduled workshops conducted by the Department of Education, Superior Court, Delaware State Education Association Lobbyist, Old State House, Public Archives, Governor's Office, the Court House, and the Department of Elections. All members attending participate in a 4-H Rally on the steps of Legislative Hall where individuals such as the Governor, Lt. Governor, and other state legislators come out to talk with attendees, provide speeches to the group, and participate in interactive competitive questions with our State Teen Council Officers. The day ends with all attendees sitting in the balcony of the House

Chambers to see the House Representatives in action as government is called to order. The State Teen Council President also provides comments on the house floor on behalf of the Delaware 4-H Program.

### **Results**

Over 125 youth and adults attend this annual event and are provided a unique opportunity to learn more about their state government. Many of these participants have attended for multiple years since the incorporation of this event. Many attendees have the ability to see and talk with their respective state legislators during the day. Schedule workshops provide increased educational value to all participants to learn about state government offices, their purposes, and respective functions. In addition, participants learn how to participate and be involved in a positive rally while also having the opportunity to see government in action as they sit in the House Chambers and watch the state legislators conduct government business. The chance for the State Teen Council President to present comments on the House Floor on behalf of the Delaware 4-H Program is definitely a unique and sometimes a once in a lifetime opportunity. Finally, and just as important, this event allows the 4-H members to advocate and promote the 4-H program to our elected officials in an effort to make them more aware of the outstanding 4-H youth development program offered through Cooperative Extension of the University of Delaware.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
801	Individual and Family Resource Management
806	Youth Development

## **Outcome #12**

### **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

Not Reporting on this Outcome Measure

## **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)**

### **Evaluation Results**

Evaluation of the Family and Youth Development planned program for FY12 (1 Research FTE, 13 Extension FTEs) shows a continued dedication by Extension faculty and professionals to meet the many challenges faced by Delaware families today. Issues where evaluations indicate particular success are those related to family financial planning, youth development and mentoring - particularly on the importance of education, strengthening families and parenting skills, and youth learning to avoid risks related to drugs and alcohol. Evaluations of extension programming showed a continuation of remarkable success in grants (16 of 19 submitted were awarded), the publication of 108 new fact sheets, 56 invited and volunteered presentations in local communities and at regional and national meetings, and the presentation of more than 840 workshops. Our evaluations have included annual internal administrative reviews and numerous surveys and other evaluation methods conducted with stakeholders participating in workshops and other extension programs. Specific examples of stakeholder evaluation of these programs are provided in the "Outcomes" section of the FY12 annual report. The response from our stakeholders and internal reviews has been universally positive and complimentary of the dedicated efforts of Extension professionals to address the very complex challenges faced by Delaware families and youth today

### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs which seek to develop innovative educational programming that strengthens families, fosters positive youth development and education, and builds stronger communities in the difficult financial times we all face today

**V(A). Planned Program (Summary)**

**Program # 5**

**1. Name of the Planned Program**

Food Safety

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	15%	15%	40%	40%
502	New and Improved Food Products	10%	10%	15%	15%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	60%	60%	40%	40%
903	Communication, Education, and Information Delivery	15%	15%	5%	5%
<b>Total</b>		100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.2	2.1	3.9	1.1
Actual Paid Professional	1.2	2.3	4.9	0.6
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
21696	61862	4533	108700
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	61862	0	108700
1862 All Other	1890 All Other	1862 All Other	1890 All Other
634766	147000	1626193	319998

**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 pathogenic bacterial species with high pressure and mild heat; using various antimicrobial films to control bacteria, such as *Listeria monocytogenes*; physiological and genetic analysis of pressure-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 DineSafe, ServSafe®, Don't Give Kids a Tummy Ache, Food Safety for Entrepreneurs, GAP/GHP training, Don't Bug Me!, FoodSkills, Expanded Food and Nutrition Education workshops, 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 reach a variety of audiences.

**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.

**3. How was eXtension used?**

Not reporting this year.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	3180	2060	4166	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

<b>2012</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	2	22	24

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

<b>Year</b>	<b>Actual</b>
2012	22

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

<b>Year</b>	<b>Actual</b>
2012	8

**Output #3**

**Output Measure**

- Number of Research Projects Completed

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

**Output #4**

**Output Measure**

- Number of Undergraduate Researchers

<b>Year</b>	<b>Actual</b>
2012	13

**Output #5**

**Output Measure**

- Number of M.S. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	9

**Output #6**

**Output Measure**

- Number of Post-doctoral Research Associates

<b>Year</b>	<b>Actual</b>
2012	2

**Output #7**

**Output Measure**

- Number of Refereed Journal Articles

<b>Year</b>	<b>Actual</b>
2012	24

**Output #8**

**Output Measure**

- Number of Books and Book Chapters

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

**Output #9**

**Output Measure**

- Number of Technical Reports

<b>Year</b>	<b>Actual</b>
2012	3

**Output #10**

**Output Measure**

- Number of Extension Bulletins and Factsheets

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

**Output #11**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	24

**Output #12**

**Output Measure**

- Number of Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	25

**Output #13**

**Output Measure**

- Number of Websites Established

<b>Year</b>	<b>Actual</b>
2012	3

**Output #14**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	360

**Output #15**

**Output Measure**

- Number of Newsletters

<b>Year</b>	<b>Actual</b>
2012	405

**Output #16**

**Output Measure**

- Number of Ph.D. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	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 that will help reduce the likelihood of food-borne illness.
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	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.
8	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**

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

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

**Issue (Who cares and Why)**

Consumers report increasing discomfort in the kitchen with food preparation and skills.

**What has been done**

UD Extension has developed a Master Food Educator program, where trained volunteers offer programs for consumers.

**Results**

MFE volunteers reached over 250 adults and youth by staffing educational displays, conducting workshops and demonstrating healthy food recipes. They worked to develop an educational series for adults who just don't know how to cook and entitled it "Clueless in the Kitchen". Twelve individuals attended and they learned knife skills, quick cooking techniques and how to read and complete recipes. They learned about stir-fry cooking, pasta sauces, and cooking cuts of beef effectively. They all had the chance to practice cooking foods under the guidance of MFE volunteers. All indicated that they learned skills that they will use in the future.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 that will help reduce the likelihood of food-borne illness.

Not Reporting on this Outcome Measure

**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	Actual
2012	0

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

**Issue (Who cares and Why)**

There is a need in Delaware to address the increasing concerns over food safety of produce and to help growers meet buyer demands for food safety.

**What has been done**

A team of agricultural and family and consumer science educators delivered an educational program targeting commercial fruit and vegetable growers in Delaware. Delaware growers attended a two-part voluntary Good Agriculture Practices/Good Handling Practices (GAP/GHP) training. Classes consisted of the rationale behind food safety strategies, tactics for implementing GAPs and GHPs, what an audit would look like, how to implement GAP/GHP, information about on-farm worker training, and developing a food safety plan for the operation.

**Results**

Six-month post and final program surveys were sent to 156 participants who completed training. Of the 70 respondents returning the six-month survey, 90 percent reported being better able to manage risks as they relate to farm food safety and 95 percent better understand their role in preventing foodborne illness. Over 430 farm workers were trained by operators, 23 mock audits

were conducted by operators/consultants, and 18 percent completed a farm safety plan. In 2011, an additional 58 producers, 20 larger wholesale, and 38 smaller growers participated in 6-hour and 3-hour training sessions, respectively. Two farms had GAP/GHP audits, and assistance was provided in writing three produce food safety plans in 2011.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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**

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

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

**Issue (Who cares and Why)**

Regulators, farmers, packers and others along the supply chain need the scientific and technological knowledge needed to develop and defend produce safety protocols, or ?metrics? as the industry calls them.

**What has been done**

Kali Kniel and Kathryn Everts from the University of Delaware are participating in a project that is focused on increasing produce safety and delivering more trustworthy salad fixings. The three-year study promises to be one of the most comprehensive studies of fresh produce safety ever conducted.

**Results**

The project will involve extensive testing and data collection by industry, supplemented by field experiments involving eight other university and federal laboratories around the country.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
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**

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

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

**Issue (Who cares and Why)**

Professional food handlers require professional training and certification in the handling and serving of foods.

**What has been done**

University of Delaware Cooperative Extension has two programs that target quantity food handlers. The ServSafe® program is the premiere food safety certification offered by the National Restaurant Association Educational Foundation. This program is designed for managers of

foodservice operations. Successful completion of the certification exam helps in meeting Delaware Food Code requirements. Dine Safe is designed for quantity food preparers working in a variety of settings, including restaurants, fire halls, churches, and child care centers. They learn skills and strategies required to keep food safe, regardless of their specific job.

### **Results**

During the last two years, University of Delaware Cooperative Extension has reached over 350 quantity foodservice workers in both the ServSafe® and Dine Safe programs. As a result of the program, 86 percent passed the ServSafe® certification examination. Additionally, participants indicated that they would personally, or have their staff, wash hands more frequently (89%), improve personal hygiene (70%), calibrate thermometers on a regular basis (80%), keep foods above 140°F (74%), cool foods more rapidly (68%), use sanitizers correctly (71%), and thoroughly wash and sanitize work surfaces (81%). Likewise, Dine Safe participants indicated that they would improve food safety practices with 87 percent reporting the intent to wash hands more frequently, 71 percent keeping foods hot and cooling food rapidly, and 76 percent thoroughly washing and sanitizing work surfaces before preparing food.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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.

Not Reporting on this Outcome Measure

### **Outcome #7**

#### **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 Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

E. coli bacteria (STEC) poses a serious threat to the food supply, resulting in more than 265,000 infections in the United States each year.

#### What has been done

K. Eric Wommack, professor of environmental microbiology in the Department of Plant and Soil Sciences at the University of Delaware, is part of a five-year study aimed at preventing potentially fatal illnesses linked to Shiga toxin-producing E. coli bacteria (STEC) in the nation's food supply. The coast-to-coast study includes a team of 48 investigators from multiple universities and government agencies, with the University of Nebraska and Kansas State University as the lead institutions. For this study, Wommack will examine the microbial communities that form around STEC to see if there is a pattern that scientists can pinpoint.

#### Results

This would allow the researchers to trace non-toxic levels of STEC by determining the kinds of microbial communities where it is most likely to occur.

### 4. Associated Knowledge Areas

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

### Outcome #8

#### 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.

Not Reporting on this Outcome Measure

#### **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)**

##### **Evaluation Results**

tbd

##### **Key Items of Evaluation**

tbd

**V(A). Planned Program (Summary)**

**Program # 6**

**1. Name of the Planned Program**

Childhood Obesity

Reporting on this Program

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	10%	10%	10%	10%
703	Nutrition Education and Behavior	20%	20%	20%	20%
724	Healthy Lifestyle	60%	60%	60%	60%
903	Communication, Education, and Information Delivery	10%	10%	10%	10%
	<b>Total</b>	100%	100%	100%	100%

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

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

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	16.0	2.6	0.0	0.3
Actual Paid Professional	17.4	2.3	0.0	0.1
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
110789	148144	0	381729
1862 Matching	1890 Matching	1862 Matching	1890 Matching
58874	148144	0	381729
1862 All Other	1890 All Other	1862 All Other	1890 All Other
568205	174909	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. In addition, using videography and other tools, youth will document both the healthy and unhealthy aspects of their communities. This includes those areas involving food, food choices, food safety, food security and other healthy/unhealthy lifestyle aspects of their communities.

**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

**3. How was eXtension used?**

Not reporting this year.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	7861	36175	15545	1073

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

**Patent Applications Submitted**

Year: 2012

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

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

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

<b>Year</b>	<b>Actual</b>
2012	12

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

<b>Year</b>	<b>Actual</b>
2012	8

**Output #3**

**Output Measure**

- Number of Extension Bulletins and Factsheets

<b>Year</b>	<b>Actual</b>
2012	54

**Output #4**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	9

**Output #5**

**Output Measure**

- Number of Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	23

**Output #6**

**Output Measure**

- Number of Websites Established

<b>Year</b>	<b>Actual</b>
2012	3

**Output #7**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	365

**Output #8**

**Output Measure**

- Number of Research Projects Completed

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

**Output #9**

**Output Measure**

- Number of Undergraduate Researchers

<b>Year</b>	<b>Actual</b>
2012	9

**Output #10**

**Output Measure**

- Number of M.S. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	2

**Output #11**

**Output Measure**

- Number of Refereed Journal Articles

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



**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**

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

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

**Issue (Who cares and Why)**

: Youth and adults are reflecting rates of increased obesity and health problems at an ever-increasing rate.

**What has been done**

In 2010, an intensive 30-hour course in nutrition, physical activity, and food safety was reinstated to provide volunteers with the tools to either assist FCS staff or deliver basic programs in New Castle County. Both technical background information and hands-on experiences are included in the training. Participants successfully completing the training are designated as Master Food Educators (MFEs). The role of the Extension Agent in this area is assisting the curriculum educator and program coordinator to train the volunteers, inform MFEs of volunteer opportunities throughout the year to enable them to complete their required hours, prepare meeting/advanced training agendas, coordinate the preparation & gather supplies for workshops and events, prepare reports of volunteer hours and programs presented or types of events attended, and provide research-based responses to questions posed throughout the year from the volunteers.

**Results**

A total of 12 individuals graduated in 2012. This group of volunteers donated 700 hours to Cooperative Extension last year, with an approximate value of over \$16,000. Examples of activities include assisting with Extension programs such as Eat Smart for a Healthy Heart and Dining with Diabetes, judging 4-H foods at Delaware State Fair, developing and conducting Clueless in the Kitchen workshops, giving presentations at libraries throughout the county, and staffing both food safety and nutrition displays for public events.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
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	Actual
2012	0

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

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

Low-income families often turn to unhealthy, ?empty? calorie, easy to prepare, convenience foods to feed their families, thus resulting in high obesity rates.

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

Two federally-funded programs, the Expanded Food and Nutrition Education Program (EFNEP) and Supplemental Nutrition Assistance Program Education (SNAP-Ed) provide a minimum of 10 hours of interactive, hands-on education. The focus of both programs is on participants developing skills to make healthy food choices based on their budget, to use their resources wisely, to handle food safely, and to participate in physical activity each day. These programs empower individuals and families participating in the sessions to expand their horizons and to link diet, physical activity, and health together. The Extension Agent assists the State Food Specialist to administer this program, assuring that EFNEP nutrition assistants have the materials and supplies needed to perform their duties effectively. Data is collected, upon request by the EFNEP Coordinator, and supplies are organized, inventoried, and delivered state-wide. Extension Scholars are mentored and supervised during the summer months to deliver the youth camp

programs.

### Results

During 2011, participation in SNAP-Ed increased to 511 individuals compared to 406 individuals in 2010. When asked to rate their eating habits on a 10 point scale, 94 percent of the participants indicated a higher rating at the end of the class compared to the beginning of the class. Additionally, 66 and 63 percent of participants improved one or more nutrition and food resource management practices, respectively. Although initially 64 percent demonstrated acceptable food practices related to thawing and storing food properly, safe food handling practices improved among SNAP-Ed graduates with 36 percent reporting improvement in one or more food safety practices. FNEP reached 406 adults and 1,127 youth in 2011. Based on food recalls taken at the beginning of the program and at the end, improvement in intake of grains, fruits, vegetables, milk, and meat were noted by 37, 52, 62, 64, and 37 percent of participants, respectively. Of the families graduating in 2011, 85 percent improved at least one nutrition practice, 77 percent improved at least resource management practice, and 60 percent improved at least one food safety practice.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
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	Actual
2012	0

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

**Issue (Who cares and Why)**

Following a careful meal plan is the first step in controlling blood sugar. This is also the hardest step in diabetes control. This program helps those individuals with diabetes or pre-diabetes learn strategies to manage their diabetes through menu planning, carbohydrate counting, portion control and label reading.

**What has been done**

Dining with Diabetes consists of three classes that provide diabetes education, cooking demonstrations and tasting of healthy foods. The first class focuses on desserts, the second class focuses on main dishes, and the last class focuses on side dishes. After each lesson the participant takes home recipes and diabetes resources, as well as knowledge on how they can manage their diabetes on a daily basis. This program teaches its participants about reducing sugar, salt and fat without giving up on taste. In New Castle County, a Cooperative Extension agent, who also maintains credentialing as a registered dietitian, up-dates the research, develops recipe grocery lists and specific talking points for recipes, coordinates the food preparation with assistance of an EFNEP Nutrition Assistant and Master Food Educators, reviews and up-dates the resources in the workshop take-home folders, explains homework assignments to childcare providers enrolled in the series, coordinates the demonstrators, assistants, and exercise leaders, providing specific talking points & direction, and delivers the subject matter via power point presentation for the three classes. Master Food Educators or nutrition students deliver the food demonstrations and serve the workshop participants.

**Results**

Participants are given the tools, knowledge, and opportunity to improve their overall health. In 2012, a total of 22 individuals enrolled in the Dining with Diabetes workshop series in New Castle County. As a result, attendees reported eating more vegetables (40 percent), eating more fruits (40 percent), reading Nutrition Facts labels (40 percent), reading ingredient labels (70 percent), being more physically active (10 percent), more likely to eat on a regular basis (30 percent), and more likely to eat breakfast (30 percent). Furthermore, planning healthier meals, using different artificial sweeteners, and using better portion control were noted as additional ways to manage their diabetes by 40, 10, and 85 percent of participants, respectively.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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.

Not Reporting on this Outcome Measure

**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 Knowledge Outcome Measure

**3b. Quantitative Outcome**

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

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

**Issue (Who cares and Why)**

Kent County has the highest rate of heart disease in Delaware.

**What has been done**

Strong Women, Healthy Hearts, a 6 week 12 session physical activity and healthy eating program was offered at Wyoming United Methodist Church.

**Results**

Ninety percent of participants report eating more healthfully with the same percentage reporting that they have become more active.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
724	Healthy Lifestyle
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.

Not Reporting on this Outcome Measure

## **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.

Not Reporting on this Outcome Measure

## **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)**

### **Evaluation Results**

Evaluation of the Childhood Obesity planned program for FY12 (0.1 Research FTE, 19.5 Extension FTEs) shows a diverse and comprehensive extension effort to address the statewide issues associated with health, nutrition, diets, and families. Some particularly strong areas of extension programming include: (i) an integrated team effort to modify individual, family, and community behavior in a manner that promotes healthy lifestyles, encourages physical activity on a regular basis, promotes the consumption of healthy foods in appropriate quantities, and increases the frequency of family meals and (ii) an extensive set of programs for after-school children and childcare providers on healthy lifestyles and diets. Evaluations of extension programming showed continued excellent success in grants (8 of 12 submitted were awarded), the publication of 54 new fact sheets, 32 invited and volunteered presentations in local communities and at regional and national meetings,

and the presentation of more than 365 workshops. Our evaluations have included annual internal administrative reviews and numerous surveys and other evaluation methods conducted with stakeholders participating in workshops and other extension programs. Specific examples of stakeholder evaluation of these programs are provided in the "Outcomes" section of the FY12 annual report. Stakeholder feedback and internal reviews are quite positive and appreciative of the very comprehensive programs our Extension professionals have developed and are implementing widely and successfully today.

### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs that will help build on our current successes and allow us to reach more families and provide them with the skills needed to prevent or correct the serious problem of childhood obesity.

**V(A). Planned Program (Summary)**

**Program # 7**

**1. Name of the Planned Program**

Climate Change

Reporting on this Program

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	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	5%	5%	5%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%	10%	10%	10%
205	Plant Management Systems	10%	10%	10%	10%
305	Animal Physiological Processes	10%	10%	10%	10%
307	Animal Management Systems	10%	10%	10%	10%
311	Animal Diseases	5%	5%	5%	5%
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%
	<b>Total</b>	100%	100%	100%	100%

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

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

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	6.8	0.9	19.4	1.2
Actual Paid Professional	6.8	1.1	21.0	1.2
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
403408	150042	643518	116859
1862 Matching	1890 Matching	1862 Matching	1890 Matching
332534	150042	445573	116859
1862 All Other	1890 All Other	1862 All Other	1890 All Other
644519	12500	3162766	179682

## 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; New research and extension demonstration programs are focusing on the potential to increase barley and sweet sorghum acreage in response to growing interest in use of these crops for ethanol production; (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 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.

**3. How was eXtension used?**

Not reporting this year.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	18470	19157	180	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	3	53	56

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

**Output Target**

**Output #1**

**Output Measure**

- Number of Competitive Grants Submitted

<b>Year</b>	<b>Actual</b>
2012	69

**Output #2**

**Output Measure**

- Number of Competitive Grants Awarded

<b>Year</b>	<b>Actual</b>
2012	37

**Output #3**

**Output Measure**

- Number of Research Projects Completed

<b>Year</b>	<b>Actual</b>
2012	45

**Output #4**

**Output Measure**

- Number of Undergraduate Researchers

<b>Year</b>	<b>Actual</b>
2012	60

**Output #5**

**Output Measure**

- Number of M.S. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	32

**Output #6**

**Output Measure**

- Number of Ph.D. Graduate Students

<b>Year</b>	<b>Actual</b>
2012	24

**Output #7**

**Output Measure**

- Number of Post-doctoral Research Associates

<b>Year</b>	<b>Actual</b>
2012	10

**Output #8**

**Output Measure**

- Number of Refereed Journal Articles

<b>Year</b>	<b>Actual</b>
2012	56

**Output #9**

**Output Measure**

- Number of Books and Book Chapters

<b>Year</b>	<b>Actual</b>
2012	7

**Output #10**

**Output Measure**

- Number of Technical Reports

<b>Year</b>	<b>Actual</b>
2012	32

**Output #11**

**Output Measure**

- Number of Extension Bulletins and Factsheets

<b>Year</b>	<b>Actual</b>
2012	26

**Output #12**

**Output Measure**

- Number of Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	133

**Output #13**

**Output Measure**

- Number of Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	101

**Output #14**

**Output Measure**

- Number of Websites Established

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

**Output #15**

**Output Measure**

- Number of Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	16

**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	Actual
2012	0

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

**Issue (Who cares and Why)**

Feed comprises the largest portion of livestock production costs. Corn and soybeans are main ingredients in livestock and specifically beef cattle diets. Beef producers have been facing significant increases in feed costs over the past few years. This is a result of issues such as competition for feedstuffs from the production of renewable fuels like ethanol and biodiesel and varying degrees of drought. As a result, it is important to look at maximizing the use of less costly sources of feed for cattle.

**What has been done**

Of the 38 producers in attendance at the workshop, responses given indicated that attendees rated the workshop (utilizing a Likert scale) as "Very Useful" with an average score of 4.2 out of 5. 92% of attendees indicated that their knowledge of utilizing pasture as main feed source and techniques for extending the grazing season increased as a result of participation in the workshop. 77% indicated that they would be applying some of the methods learned in the workshop in their own cattle operation within the next year.

**Results**

The majority of beef cattle producers in Delaware are cow calf operations that could more efficiently and effectively utilize pasture as a main feed source for their cattle herd. Cooperative Extension professionals designed a beef cattle workshop that focused on maximizing production of cattle feed from pasture based sources. In addition to presenting methods for extending the grazing season to maximize days on pasture, solutions also focused on modifying the cattle management calendar to better match cattle demand with pasture production. Information on new forage crops for grazing was also shared with producers. Finally, information on irrigation programs available to producers to assist in maximizing pasture yield was also presented.

#### 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	Actual
2012	0

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

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

Climate change and drought have meant that growers are looking to irrigation to increase farm profits.

###### What has been done

The University of Delaware Irrigation Program invited farmers, industry and the general public to tour UD's Warrington Irrigation Research Farm on Wednesday, Sept. 19. UD Irrigation Engineer James Adkins along with Sussex County Agent Cory Whaley and Kent County Agent Phillip Sylvester presented the following: First year experiences with Subsurface Drip Irrigation (SDI): Tour the newly installed 42 zone SDI research facility and discuss the potential of SDI to irrigate previously uneconomical fields. Join in a candid discussion of the benefits and challenges of SDI in sandy soils and the nuances every farmer should consider before installation. The Potential for Variable Rate Center Pivot Irrigation (VRI): Discuss the feasibility, practicality and affordability of VRI as a tool to improve irrigation management in highly variable fields. View a

the UD 4 tower VRI system and the potential applications of VRI technology outside of irrigation research. Soil Moisture Monitoring as a Tool to Refine Irrigation Management: View many of the various options to monitor soil moisture levels with a discussion of the pros and cons of each option. Irrigated Corn, Full Season and Double Soybean Irrigation Research Plots: Discuss the preliminary results of multiyear irrigation research to improve the yields of irrigated agronomic crops.

### Results

Farmers in the region are seeking irrigation information from UD's irrigation experts as they look to drought solutions. Combined research and extension programs led by the UD Irrigation Team are providing research-based solutions that are leading to more efficient use of water and energy to mitigate the effects of drought on crop production in Delaware's sandy soils.

## 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
903	Communication, Education, and Information Delivery

## 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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Forestry can serve carbon sequestration needs and provide for an alternative to fossil fuels.

**What has been done**

UD renewable resources gave a presentation at the 2012 Delaware Arborist Conference to a diverse audience of 100+ tree care businesses and individuals.

**Results**

This presentation resulted in two major companies and one large community in Sussex investing in procedures to utilize urban wood residues for bioenergy activities instead of mulching applications; hopefully this action will stimulate a change in the current Delaware legislation prohibiting bioenergy combined heat & power facilities.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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.

Not Reporting on this Outcome Measure

**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.

Not Reporting on this Outcome Measure

**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	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

There is a great deal of diversity in corn found in the tropics, but that diverse corn has been underutilized in the U.S., mainly because the corn raised in tropical areas are unadapted to North American environments.

#### What has been done

The University of Delaware's Randall Wisser and a group of six fellow researchers have received a five-year grant to study the genetics of adaptation and crop improvement. Populations that lack genetic diversity can fall prey to climate change or other stressors by not having an array of genes on which to draw from. Breeding-based solutions to addressing abiotic and biotic challenges require access to genetic diversity.

#### Results

Through its research, the team aims to help plant breeders increase breeding efficiency and access more genetic diversity, increasing their capability of responding to current and future challenges in food production.

## 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.

Not Reporting on this Outcome Measure

**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.

Not Reporting on this Outcome Measure

**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

Not Reporting on this Outcome Measure

**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.

Not Reporting on this Outcome Measure

## **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)**

### **Evaluation Results**

Evaluation of the Climate Change planned program shows growing activity in research and extension in this area as faculty and extension professionals have begun to incorporate a range of aspects on climate change into existing projects and launch new studies where climate change impacts are a central component. Nearly 70 grants supported the efforts of 126 graduate students, post-docs, and undergraduate researchers who conducted studies in areas that would be affected by expected changes in future climates. Similarly, 56 refereed journal articles, 234 invited and volunteered presentations, and 121 workshops were completed in areas where climate change impacts must be considered more carefully in the future. Our evaluations suggest that farmers, land managers, state and federal agencies, environmental groups, and the public value efforts to determine how current priority areas for research in Delaware may be affected by the anticipated changes in future climate

### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs that seek to incorporate potential climate change impacts into current and planned projects on areas of high priority to Delaware.

**V(A). Planned Program (Summary)**

**Program # 8**

**1. Name of the Planned Program**

Sustainable Energy

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	15%	15%	15%	15%
201	Plant Genome, Genetics, and Genetic Mechanisms	25%	25%	25%	25%
205	Plant Management Systems	25%	25%	25%	25%
403	Waste Disposal, Recycling, and Reuse	10%	10%	10%	10%
601	Economics of Agricultural Production and Farm Management	15%	15%	15%	15%
605	Natural Resource and Environmental Economics	5%	5%	5%	5%
903	Communication, Education, and Information Delivery	5%	5%	5%	5%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.5	0.5	1.5	0.5
Actual Paid Professional	1.4	0.3	1.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
27815	30026	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
598	30026	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
91220	21000	177688	47917

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

### 1. Brief description of the Activity

Research and extension programs will focus on: (1) Plant molecular biology studies with bioenergy crops. Research is now underway to identify small RNAs (short stretches of ribonucleic acid) related to stresses such as drought, temperature and nutrient deprivation and then correlate them to the emerging genetic code of *Brachypodium distachyon*, thus enhancing the plant's value as a functional genomic model for energy crops and temperate grasses. *Brachypodium* has many advantages for carrying out functional studies in the laboratory compared to energy crops such as switchgrass and *Miscanthus*, and temperate grasses that are important sources of food like wheat. (2) Plant and soil management systems for existing (e.g., corn) and newly emerging bioenergy crops (e.g., barley, sweet sorghum). While just beginning, we expect this research to address many aspects of biomass/bioenergy crop production including genetics and basic plant biology studies, especially of plant-microbe interactions that enhance growth and water use efficiency of biomass crops; production and agronomic management practices for current (barley) and innovative new cropping systems (e.g., sweet sorghum, switchgrass, poplars); equipment changes and needs for new biomass crops, especially related to planting and harvesting; improving nutrient management BMPs (reduces energy consumption for fertilizer production); mitigating potential environmental impacts of biomass energy crops and assessing their impacts on water quality relative to current cropping systems; and addressing economic, social and cultural issues related to changing from long-standing to new cropping systems. (3) Bioenergy production systems and re-use of byproducts: evaluation of farm-scale anaerobic digestion for bioenergy production, using animal manures, cover crops (e.g., forage radishes), and other by-products; evaluation of gasification/pyrolysis technologies, especially those using poultry litter. Related studies will focus on finding beneficial agricultural uses for the by-products of energy production such as biochar from litters and distillers' grains.

### 2. Brief description of the target audience

For animal agriculture, the targeted audience is broad, given the impacts of energy costs on all aspects of animal production and includes 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.

**3. How was eXtension used?**

Not Reporting this year.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	1813	741	180	0

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
<b>Actual</b>	0	6	6

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

**Output Target**

**Output #1**

**Output Measure**

- Competitive Grants Submitted

**Year                      Actual**

2012 10

**Output #2**

**Output Measure**

- Number Undergraduate Researchers

<b>Year</b>	<b>Actual</b>
2012	12

**Output #3**

**Output Measure**

- Competitive Grants Awarded

<b>Year</b>	<b>Actual</b>
2012	7

**Output #4**

**Output Measure**

- Number MS Graduate Students

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

**Output #5**

**Output Measure**

- Number PhD Graduate Students

<b>Year</b>	<b>Actual</b>
2012	2

**Output #6**

**Output Measure**

- Number Post-doctoral Research Associates

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

**Output #7**

**Output Measure**

- Number Refereed Journal Articles

<b>Year</b>	<b>Actual</b>
2012	6

**Output #8**

**Output Measure**

- Number Extension Fact Sheets

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

**Output #9**

**Output Measure**

- Number Invited Presentations

<b>Year</b>	<b>Actual</b>
2012	8

**Output #10**

**Output Measure**

- Number Volunteered Presentations

<b>Year</b>	<b>Actual</b>
2012	15

**Output #11**

**Output Measure**

- Number Workshops Conducted

<b>Year</b>	<b>Actual</b>
2012	16

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

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

O. No.	OUTCOME NAME
1	Fundamental plant biology research on plant-based energy sources will lead to the development of renewable sources of energy.

## **Outcome #1**

### **1. Outcome Measures**

Fundamental plant biology research on plant-based energy sources will lead to the development of renewable sources of energy.

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

- 1862 Research
- 1890 Research

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

Change in Knowledge Outcome Measure

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

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

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

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

Biofuels are fuels made from renewable resources, such as agricultural and forest products and byproducts. Unlike their non-renewable fossil fuel counterparts, such as oil, their increased usage has the potential to reduce pollution and U.S. dependence on foreign resources. Their production, however, is problematic. Biofuels must be produced quickly and at high concentrations in order to make them economically feasible. Unfortunately, the process can be toxic to cells necessary in their manufacture.

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

Blake Meyers, Edward and Elizabeth Goodman Rosenberg Professor and chair of the Department of Plant and Soil Sciences, is part of a team at UD that is working to create hardy organisms for producing biofuels and chemicals from renewable sources ? microorganisms that are more resistant to toxic chemicals and engineered to withstand the stress response that can inhibit cell growth and cause cell death.

#### **Results**

Meyers will perform deep sequencing to help researchers understand the complexity of the transcriptome, which is the set of all RNA molecules.

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

<b>KA Code</b>	<b>Knowledge Area</b>
----------------	-----------------------

201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems

#### **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)**

##### **Evaluation Results**

Evaluation of the Sustainable Energy planned program indicates that this area is not a major research or extension effort at the present time. However, the emergence of the multi-disciplinary, university-wide Delaware Energy Institute is expected to foster greater basic and applied research on sustainable energy in the future. Areas of particular interest and strength will most likely be in plan molecular biology, as related to the identification and characterization of plants most suitable for use in new technologies to generate biofuels from agricultural crops. Extension programs in the near term will most likely continue to focus on improving energy use efficiency by Delaware's large poultry industry and by farmers using irrigation to produce grain crops. In FY12, there were 7 grants awarded to support the efforts of 19 graduate students, post-docs, and undergraduate researchers who conducted studies in areas that would be affected by expected changes in future climates. This led to 6 refereed journal articles, 23 invited and volunteered presentations, and 16 workshops in areas related to various aspects of the development and implementation of programs focused on alternative energy sources. Our evaluations suggest that the agricultural and environmental communities are interested in energy conservation and alternative sources of energy (solar, wind, bioenergy) and that industry, state and federal agencies and advisory are also interested in continued multi-disciplinary efforts on the development of plant-based renewable feedstocks for biofuels, which we plan to pursue through the University of Delaware Energy Institute in the future.

##### **Key Items of Evaluation**

There are no major items requiring NIFA attention at this time, other than the continued need for more federal funding for research and extension programs that will support cross-disciplinary efforts to educate our constituents about energy use and

conservation and support basic and applied research to identify bioenergy sources that fit Delaware agriculture.