2007 Delaware State University and University of Delaware Combined Research and Extension Plan of Work

Brief Summary about Plan of Work

Delaware agriculture faces a period of transition today unlike any encountered in the past. For decades, and still today, the driving force behind Delaware's agricultural economy has been its highly productive and geographically intensified poultry industry. In 2005, poultry and egg sales ($441M) accounted for 71% of the total market value of all Delaware agricultural products ($619M). Most of this income was associated with the production and sale of about 250 million broiler chickens. In turn, cropping systems in Delaware have always been influenced by poultry production because of the need of this industry for a large and readily available supply of feed grains. For decades, most of Delaware's cropland has been used for grain crop production; in 2005, corn, soybeans, and small grains represented about 85% of the 490,000 acres of field, hay, and vegetable crops harvested in Delaware and generated $72M in farm sales. Other major economic components of Delaware agriculture in 2005 were vegetables ($51M), dairy ($21M), and the rapidly growing "Green Industry" (nurseries, floriculture, greenhouses, and turf; $22M).

Today, many economic and social changes are in motion that may significantly alter the face of Delaware agriculture in the future. One of the primary reasons for the long-term success of the poultry industry, and Delaware agriculture in general, has been the proximity of the state to major urban markets, such as Baltimore, Philadelphia, New York, and Washington, D.C. However, recent trends in population growth and mobility in the Northeast and Mid-Atlantic regions have begun to markedly influence the nature of land use in Delaware and raise serious questions about the future role of agriculture in the state's economy. Simply put, there has been a population migration into Delaware from other states in response to economic opportunities, desirable retirement settings, and relatively low housing and land costs. The state population grew by nearly 20% from 1990 to 2000, accompanied by decreases in the number of farms and the amount of land in farms. In 1992, there were 2,633 farms and 589,000 acres of farmland; by 2005, the number of farms and farmland had decreased to 2,300 and 520,000 acres. Despite statewide efforts to preserve farmland and natural resource areas, agricultural lands are rapidly being converted into suburban developments, small towns are becoming small cities, and our natural ecosystems are becoming increasingly fragmented. Land use has become a politically charged issue, with agriculture firmly in the center of the debate. The value of farmland for development has skyrocketed, and Delaware farmers (average age is 55), are regularly offered lucrative opportunities to sell their farms for housing, schools, and other urban or suburban land uses. Clearly, Delaware agriculture must develop a new vision for the future, one that looks to new products and new markets, while integrating innovations in production and marketing into current agricultural systems, if it is to remain a viable segment of the state's economy. Of equal importance is the need to not only sustain, but improve Delaware's natural ecosystems and environment, including wildlife habitats, biodiversity, air, soil, and water quality.

Our plan of work is organized into the following nine planned programs intended to provide solutions to the complex challenges facing Delaware today. It is important to note that the divisions between these programmatic efforts are somewhat artificial. Our research and extension efforts are most commonly conducted by multi-disciplinary teams working across programs, often in collaboration with colleagues in other disciplines. We also regularly plan and work with a wide range of stakeholders in other University departments, other governmental agencies, foundations, community groups, universities, and political or policy-making positions.

(1) Animal Biology, Health, and Production Systems: Our focus is on sustaining animal agriculture as the major economic engine for Delaware agriculture by advancing our understanding of animal genomics, disease diagnosis and control, and innovative, environmentally friendly production practices. Animal-based agriculture is one of the major components of the economy of Delaware and has a major impact on the nature of crop production in the state. Poultry production is a half-billion dollar per year industry and other livestock sales (dairy, beef, swine) account for $30 million annually. The animal industries are also the main economic outlet for Delaware grain farmers who each year produce $70 to $80 million in corn, soybeans, and wheat. However, the fastest growing segment of animal agriculture in Delaware is the equine industry. In 2004, there were 13,000 equine (horses on private farms, small stables, and at racetracks) in Delaware with a total value of $135 million. Total equine-related expenditures in 2003 were $280 million (43% at racetracks), indicating the economic value of this industry to Delaware agriculture. Our main research and extension activities in this planned program are: diagnosis and control of infectious diseases, particularly in poultry; improving our understanding of avian genomics as it relates to production and disease; food safety and technology; animal welfare; enhancing the environmental compatibility of animal production with particular emphasis on nonpoint nutrient pollution, air quality, pathogens, and emerging issues (e.g., arsenic, antibiotics, endocrine disruptors); expanding our extension programs in equine health and nutrition; and building better community relations between all types of animal producers and their suburban, non-agricultural neighbors.

(2) Biotechnology and Biotechnology-Based Agribusinesses: The University of Delaware, in conjunction with the state and private industry, has devoted almost 20 years to the development of 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 being applied 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 are directed toward 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. In the plant arena, 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 the uptake of nutrients and heavy metals. Key elements of this planned program include: continuing and 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 as well as for animals; investigating new opportunities to apply biotechnology knowledge, such as through the development of alternate, bio-based energy sources (e.g., plant species for biofuels) that make economic sense for the Delmarva Peninsula; using genetically engineered plants to produce pharmaceuticals, vaccines, nutriceuticals and other important products of biotechnology, which will be done in close collaboration with industry; 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) Ecosystems and Biodiversity: Our long-term goal is to develop sustainable strategies that enhance and restore ecosystems and biodiversity in a state where land use change is creating an increasingly fragmented, suburbanized landscape. Key research and extension programs will focus on: bettering our understanding of how anthropogenic perturbation of natural ecosystems (forests, wetlands, marshes, ponds) affects their ecological functions and the values they provide to society; from this understanding, developing management strategies that improve managed natural areas (e.g., forests) and native wildlife habitat, protect endangered species, and increase biodiversity, particularly for native species; developing new agricultural management practices for the control of pests and invasive species that have minimal effects on natural ecosystems and environmental quality.
(4) Family and Youth Development: The rapid economic and social changes occurring in Delaware today place high demands on families and communities. These problems are not only confined to rural areas where development and urbanization of farmland are changing the nature of communities and the opportunities for youth, but also are found in our towns and cities. Strong families are the basic building unit for our future citizens, yet those charged with this important responsibility often do not have the time, money, or skills to carry out their family roles in a positive, productive manner. Preparing citizens to take prominent roles in shaping their future and the future of their communities is the fundamental goal of this planned program. Cooperative Extension activities are the major component of this program and focus on: helping Delaware youth develop the leadership and life skills needed to become productive, independent, contributors to our society; increasing the educational opportunities in science, engineering, and technology for youth; providing guidance and training in areas important to financial security of families and to family well-being across the generations; and safe community programs on drug and alcohol prevention and safety training for vehicles, bicycles, pedestrians, farm families, and businesses.
(5) Food Science, Technology, Safety, and Nutrition: Outbreaks of foodborne illness and human health problems associated with poor or inappropriate diets are areas of national concern and the focus of this planned program. Food safety research will address methods by which we can enhance the safety and wholesomeness of foods by improving our understanding of the means that food pathogens exist, enter, survive, and propagate in foods and actuate disease syndromes in individuals who consume contaminated products. Strategies and technologies to prevent foodborne illness, such as the use of high hydrostatic pressure processing, ultraviolet light, ozone treatment, active packaging and low-temperature storage, will be evaluated through multi-disciplinary research. Cooperative extension outreach programs will increase awareness by producers, processors, food handlers, and consumers of effective strategies for food product safety. Educating the public, particularly youth, minority, and low-income groups, about the relationship between chronic diseases (e.g., cancer, diabetes, heart disease), diet, nutrition, exercise, and how to make choices that reduce the negative effects of diets on health will be another major focus of Extension.
(6) Plant Biology and Crop Production Systems: Despite growing pressures to convert farmland to urban and suburban uses, production agriculture in Delaware remains a strong and vital part of the state’s economy. Grain and vegetable crop production are cornerstones of Delaware agriculture and many opportunities exist to increase the productivity, profitability, and environmental compatibility of these systems and sustain them as viable land uses for the future. At the same time, there is growing interest in new uses for existing crops (biodiesel fuels from soybeans, ethanol from corn) and in alternative, high value plant production systems (greenhouses for producing genetically engineered pharmaceutical and nutriceutical plants, herbs, spices, essential oil plants, exotic specialty vegetables and other niche market, high value plants). Key areas of emphasis in this planned program are: improving our understanding of plant genomes and the application of genomic information for crop improvement, crop quality, and crop protection; plant-soil interfacial reactions at the molecular scale to increase our knowledge of factors controlling symbiotic relationships between plants and soil microorganisms and plant uptake of nutrients and heavy metals; increasing the efficiency of current crop management systems by better cultural techniques, innovations in nutrient and manure management, adoption of improved crop and vegetable varieties, and enhancing the marketing skills of all producers; developing cultural practices and marketing strategies for niche market crops and mixed-use farms (beef and goat production on pastures); and research and extension programming on plant management strategies for suburban ecosystems that are

environmentally sound and protective of water quality and wildlife habitats.
(7) Rural Development and Land Use Change: While agriculture remains an important sector of Delaware's economy, continued growth of the banking, recreation, retirement, retail, and wholesale trade industries has led to a growing suburban population and pressures to convert farms to other uses. Land use change is now a major social and political issue. Developers and farmers are pursuing conversion of cropland into housing and related infrastructure, while the state is attempting to restrict land use conversion by preserving farmland and natural resource areas. Loss of farmland will have far-reaching impacts on Delaware agriculture for several reasons. Perhaps most important, the majority of Delaware's cropland is used to produce grain crops for the poultry industry. Loss of this grain supply will create economic pressures on poultry integrators who will have to import grain from other regions at greater costs. Many Delaware farmers also now regularly face challenges as they interact with neighbors who are unfamiliar with farming and complain about odors, dust, noise, machinery on roads, and possible environmental and human health problems of pesticides, fertilizers, and manures. Fragmenting the agricultural landscape into smaller farms interspersed amongst suburban developments is also changing the social fabric of Delaware's rural communities. These demographic changes affect family and community values, political decision-making, the education and skills needed for new types of careers, and the financial stability of individuals and families. Our research and extension efforts focus on: aiding statewide efforts to understand, manage, and revitalize land use change, including reducing conflicts as change occurs; defining the necessary "critical mass" for future agricultural viability and the relationships between urban and rural land uses important to sustaining agriculture in the long-term; working with rural families to respond to changing communities through programs focused on education, career skills, and financial planning; helping to develop land use policies that are protective of the environment; and preserving agriculturally productive land and natural resource areas for future generations.
(8) Soils and Environmental Quality: Delaware's soil resources underpin agricultural success and are also linked closely with many of the long-term environmental challenges facing the state today. The major soils related challenges we continue to face are related to land use change, production agriculture, and industrial pollution. We are losing the most productive agricultural soils in the northern part of the state to suburban development at an alarmingly rapid pace. The environmental impacts of increased impervious surface and nutrient and pesticide use by new landowners are not well understood and will require more educational programs by Cooperative Extension in the future. In southern Delaware, the heart of production agriculture and the poultry industry, most soils are sandy, prone to drought and leaching, and overly shallow ground waters that are hydrologically linked to rivers and important coastal estuaries. Nonpoint nutrient (nitrate, phosphate) pollution of groundwater aquifers used for drinking water supplies and aquatic ecosystems, such as our Inland Bays (a national estuary), has been a serious problem for more than 30 years. Recent advances in nutrient management, and the passage of a state nutrient management law, have begun to significantly improve N and P management statewide. However, it is likely that phosphorus which has accumulated in soils and nitrates in shallow aquifers will continue to contribute to water quality degradation for a decade or more, thus there continues to be a need for innovative research and extension programs that can improve nutrient management practices by production agriculture. Other soil problems where we plan research are the remediation of metal and organic chemical contaminated soils in urban brownfields, emissions of gases and particulates from soils and surface applied waste materials (e.g., manures, biosolids) that can affect air quality, climate change, human health and nearby ecosystems; and the fate, transport, and potential human health impacts of pathogens (viruses, bacteria) originating in manures and other by-products.
(9) Aquaculture: The development of an aquaculture industry in Delaware has the potential to enhance diversification of farming in this region and increase farm income. Currently, the major obstacles to growth of the aquaculture industry are high (and growing) land costs and the lack of significant examples of aquacultural success in Delaware. Extension programming and research will focus on identification of the best aquaculture crops and management techniques that can minimize disruption of current farming practices and maximize available resources. Other areas of effort will include educating farmers, community leaders and other interested individuals on biological, technological and social issues pertaining to aquaculture.
.

Estimated number of professional FTEs/SYs to be budgeted for this plan.

Year	Extenion		Research	
	1862	1890	1862	1890
2007	57.4	11.4	108.7	10.0
2008	57.4	11.4	108.7	11.0
2009	58.4	11.4	110.7	11.0
2010	58.4	11.5	110.7	11.9
2011	59.4	11.5	111.7	11.9

Merit Review Process

The merit review process that will be employed during the 5-Year Plan of Work cycle

- 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)

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.

Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

Delaware State University and the University of Delaware have always participated in multi-state, multi-institutional, and multi-disciplinary projects and regularly engage in joint research and extension programs. All nine program areas in the 2007-2011 Plan of Work involve some multi-state and joint activities and all reflect multi-disciplinary research and extension efforts. The planned programs target issues of strategic importance to Delaware and the Mid-Atlantic and Northeastern regions that were identified through a thorough stakeholder input process. Program evaluations and surveys are used annually to ensure

that the planned programs are on track and relevant to state and regional needs. These programs have been effective in the past and continue to accomplish their goals. We regularly meet with colleagues from other states to discuss the relevance of our research and extension programs to multi-state issues and to develop plans to jointly address contemporary problems. For example, we share faculty in plant pathology with the University of Maryland; combined the dairy herds of Rutgers University and the University of Delaware to increase operational efficiency; cooperate actively with Mid-Atlantic and Northeastern states to develop fertilizer, lime, and manure recommendations for nutrient management plans for all crops; collaborate with Maryland, Virginia, and New Jersey on pesticide recommendations for field and horticultural crops; work actively with Maryland and Virginia to develop strategies to prevent and manage avian infectious diseases and potential outbreaks of major plant diseases such as Asian soybean rust; and participate in region-wide crisis management programs for beekeepers and stone fruit growers. We host the Northeast Center for Risk Management that coordinates extension efforts across all New England states, New Jersey, Pennsylvania, West Virginia, and Delaware designed to educate producers about the range of risk management strategies required to ensure profitability in their operations. The University of Delaware is also active in multi-state research. We have 20 multi-state research projects in place and anticipate that this number will increase in the future. These projects address a wide range of contemporary topics such as food safety, genetic bases for resistance to avian diseases, breeding and genetics of forage crops, chemical and physical properties of particulates affecting air, water, and soil quality, bioavailability of pharmaceuticals and pesticides in terrestrial and aquatic ecosystems, management of wildlife in suburban and rural landscapes, integrated pest management for insect pests of corn, and rural communities, labor markets, and public policy.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

Addressing the research and extension needs of underserved and underrepresented populations is a continuing challenge that we take very seriously. Representatives of these populations participate in our stakeholder input process and provided input into the goals and programs in our 2007-2011 Plan of Work. Further, during a recent civil rights audit of the Extension programs in Delaware, suggestions were made on how to attract more underrepresented groups to our programs. We are now working to implement new strategies to better involve underrepresented groups in our extension and research programs. Additionally, Delaware State University, because of its charter as an 1890 Land Grant University, will primarily target the needs of the underserved and underrepresented members of our state in this planned program.

3. How will the planned programs describe the expected outcomes and impacts?

Each of the nine planned programs contained in our 2007-2011 Plan of Work provides several short-term, medium-term, and long-term outcome measures. These outcome statements directly reflect the situation in our state and multi-state programs and the priorities we have established for the next five years (2007-2011) for our research and extension programs. The outcome measures clearly describe the impacts we anticipate occurring as a direct result of the resources we will expend to conduct the activities outlined in each planned program.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

The nine planned programs in our 2007-2011 Plan of Work are the result of long-standing collaborations between research and extension staff at the University of Delaware and Delaware State University. Because our programs are issue-based and multi-disciplinary, they foster cooperation across departments and universities which increases their overall effectiveness and maximizes the efficiency of our human resources and infrastructure. Cooperative Extension staff regularly identifies pressing needs in the state and region and communicate these to researchers who then develop teams to address applied problems. Knowledge gained from basic research is communicated by scientists to Extension staff and our stakeholders via workshops, training sessions, and public meetings. Sharing results of fundamental research with potential end-users stimulates ideas on how to apply this knowledge in the most efficient and cost-effective manner.

Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation (Check all that apply)

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

Brief explanation.

In the State of Delaware, the University of Delaware and Delaware State University use a multi-faceted approach to secure stakeholder input. We believe in direct contact with people and actively solicit input from a wide variety of clientele, users and stakeholders. College administrators, faculty working on research funded by state and federal agencies or industry, and Cooperative Extension staff regularly request input on the relevance of our research and extension priorities to state and regional problems. Numerous formal opportunities for input also exist and include, but are not limited to, the following: extension overall advisory committees, extension issue-based advisory committees, strengthening families statewide advisory committee, 4-H volunteers, 4-H Foundation, LINKS, agriculture commodity groups, environmental interests, the green industry, agribusinesses, agriculture associations (i.e., Farm Bureau, Grange, Pork Producers Association, Delmarva Poultry Industry, Soybean Board, Sheep Producers Association, etc.), Master Gardeners, Master Food Educators, and Master Financial Planners. We meet with these groups on a regular basis and request their input on our programs and encourage their involvement in all of our planning efforts.

2(A). A brief statement of the process that will be 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 will be used by the recipient institution to identify individuals and groups 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

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 2007-2011 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.

1. Name of the Planned Program

ANIMAL BIOLOGY, HEALTH, AND PRODUCTION SYSTEMS

2. Program knowledge areas

- 402 5% Engineering Systems and Equipment
- 401 5% Structures, Facilities, and General Purpose Farm Supplies
- 302 15% Nutrient Utilization in Animals
- 304 20% Animal Genome
- 311 30% Animal Diseases
- 301 5% Reproductive Performance of Animals
- 305 10% Animal Physiological Processes
- 307 10% Animal Management Systems

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

Animal-based agriculture is one of the largest and most profitable enterprises in Delaware. Poultry production alone is a half-billion dollar per year industry that accounts for about 70% of the total economic value of agriculture in the state. Delaware's livestock industries are also significant, with dairy valued at $20 million, beef cattle at $6 million, and swine at $2.6 million. The equine industry is growing rapidly and has become a major contributor to the state's economy. The economic importance of the poultry industry makes accurate diagnosis and effective control of infectious diseases of commercially produced chickens a high research priority. In addition to infectious-disease issues, nutrient management and water quality, air quality, food safety, labor, animal welfare, and community relations between agriculture and a rapidly urbanizing population have been and must continue to be addressed for all animal industries. Our research and extension programs focus on using knowledge gained from basic and applied research on the mechanisms of animal disease, avian genomics, and the efficiency of nutrient utilization to develop profitable, environmentally compatible management systems for animal agriculture.

6. Situation and priorities

Animal agriculture, and in particular poultry production, is a mainstay of Delaware's entire economy and dominates the agricultural economy. Many interacting factors must be addressed if we are to develop truly sustainable animal agricultural systems. Integrated research and extension programs addressing the following challenges are a high priority in Delaware's 2007-2011 Plan of Work: (i) prevention and control of infectious diseases that can affect animal and human populations; (ii) protecting air, water, soil, and human health from environmental pollution originating with animal agriculture; (iii) resolving socio-political conflicts between Delaware's animal industries and our growing urban and suburban communities; and (iv) providing the management practices and technologies needed for success in an increasingly competitive global economy.

7. Assumptions made for the Program

Integrated, multi-disciplinary research and extension projects, often including cooperators from other states, will become the model for future efforts in this area. Competitive funding will increase, cooperative interactions with the animal industry, state and federal agencies, and public advocacy groups will continue to grow, and comprehensive research and extension programs will be developed for established and emerging animal industries.

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 1 are increased profitability, global competitiveness, and environmental compatibility of animal agriculture through reduced disease losses, improved efficiency of animal production, and implementation of innovative approaches to address environmental and social conflicts.

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Extension
- Multistate Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	3.2	0.0	28.2	0.0
2008	3.2	0.0	28.2	0.0
2009	3.2	0.0	28.2	0.0
2010	3.2	0.0	28.2	0.0
2011	3.2	0.0	28.2	0.0

Outputs for the Program

13. Activity (What will be done?)

Research and extension programs will target: (1) Poultry Health and Disease Prevention and Control - understanding mechanisms of disease induction, host genetic resistance and immune responses in broiler chickens emphasizing respiratory diseases and oncogenic and immunosuppressive diseases. Disease prevention and control will focus on diagnostic surveillance methodology, vaccination and biocontainment procedures; (2) Poultry Growth and Development - understanding 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 - evaluation of alternative production systems that reduce disease, mortality, and waste production, minimize antibiotic use, and foster compatibility between animal production, environmental quality, and the expanding urban population; (5) Nutrient Utilization in Poultry and Ruminants - increased nutrient utilization from an improved understanding of animal biology via the use of chemical and biological inputs and via improved management techniques to improve milk production, weight gain and feed efficiency; and (6) Equine Health and Management Systems – outreach on equine health and management systems needed for growth of the industry.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations	• Public Service Announcement • Newsletters • TV Media Programs • Web sites • Other 1 (Newspapers)

15. Description of targeted audience

Poultry integrators, growers, breeders, trade groups and allied industries; dairy and beef producers and allied industries; livestock commodity groups; forage producers, equine owners, producers and interest groups; state and federal agencies; federal research laboratories; peer scientists, and environmental and community groups.

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	15000	15000	10000	2000
2008	15000	15000	10000	2000
2009	15000	15000	10000	2000
2010	20000	15000	10000	2000
2011	20000	15000	10000	2000

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 1 2010 : 0 2011 : 1

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 30 2008: 30 2009: 32 2010: 32 2011: 34

Output Target

Number of Competitive Grants Awarded

2007: 16 2008: 16 2009: 18 2010: 18 2011: 20

Output Target

Number of Research Projects Completed

2007: 1 2008: 1 2009: 2 2010: 2 2011: 3

Output Target

Number of Undergraduate Researchers

2007: 22 2008: 22 2009: 25 2010: 25 2011: 25

Output Target

Number of M.S. Graduate Students

2007: 15 2008: 15 2009: 16 2010: 16 2011: 17

Output Target

Number of Ph.D. Graduate Students

2007: 3	2008: 3	2009: 4	2010: 4	2011: 5

Output Target

Number of Post-doctoral Research Associates

2007: 3	2008: 3	2009: 4	2010: 4	2011: 5

Output Target

Number of Refereed Journal Articles

2007: 23	2008: 23	2009: 25	2010: 27	2011: 30

Output Target

Number of Books and Book Chapters

2007: 7	2008: 7	2009: 7	2010: 8	2011: 8

Output Target

Number of Technical Reports

2007: 3	2008: 3	2009: 3	2010: 4	2011: 4

Output Target

Number of Extension Bulletins and Factsheets

2007: 4	2008: 4	2009: 5	2010: 6	2011: 6

Output Target

Number of Invited Presentations

2007: 30	2008: 30	2009: 35	2010: 35	2011: 40

Output Target

Number of Volunteered Presentations

2007: 52	2008: 52	2009: 55	2010: 58	2011: 62

Output Target

Number of Websites Established

2007: 0	2008: 1	2009: 0	2010: 1	2011: 0

Output Target

Number of Workshops Conducted

2007: 5	2008: 5	2009: 6	2010: 6	2011: 7

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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.

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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, the results of poultry directed research will 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. Research will also result in enhanced collaboration between University and industry partners. Findings will help to increase the efficiency of livestock production and new technology will be transferred to stakeholders.

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

practices to equine professionals and enthusiasts.

Outcome Type: Long

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)
- Comparison between locales where the program operates and sites without program intervention

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- Structured
- Unstructured
- Observation

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

AQUACULTURE

2. Program knowledge areas

- 307 50% Animal Management Systems
- 301 25% Reproductive Performance of Animals
- 302 25% Nutrient Utilization in Animals

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

The development of an aquaculture industry in Delaware has the potential to allow for on-farm diversification in the region. High land costs and the lack of significant examples of aquacultural success are major obstacles to the development of an aquaculture industry in Delaware, deterring potential aquaculturists from entering the arena. Options that could allow on farm diversification and provide the local farming community with niche-market opportunities are needed if agriculture is to thrive in the mid-Atlantic. To this end, aquaculture crops and management techniques that minimize disruption of current farming practices and maximize available resources are sought

6. Situation and priorities

Although the aquaculture industry in Delaware is limited in scale, there is a large potential for growth. A lack of knowledge about growing aquatic species, which species to grow and how to market the products once they are produced, and the lack of a model that fits into the existing farm infrastructure, may in part, be responsible for the limited industry. Our efforts will largely be aimed at identifying suitable aquaculture species for use in Delaware and low input methods to raise them profitably.

7. Assumptions made for the Program

Agriculture is one of the largest sectors of the economy in Delaware, and as such represents an import thread in the social fabric. The economic success of agriculture is threatened by pressures being exerted on agriculture producers as a result of rising production costs and reduced commodity prices and barriers to new farmers as land costs skyrocket. On-farm diversification can reduce risk and increase overall farm income. Aquaculture production represents one such option. This is particularly true as the federal trade deficit for seafood nears $7 billion dollars annually.

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 9 are: to promote the development and growth of an economically viable and environmentally sustainable aquaculture industry in Delaware; to identify suitable aquaculture species, production and management methods and recognize markets for Delaware grown aquaculture products, and to educate farmers, community leaders and other interested individuals on biological, technological and social issues pertaining to aquaculture.

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.4	0.0	2.6
2008	0.0	0.4	0.0	3.6
2009	0.0	0.4	0.0	3.6
2010	0.0	0.5	0.0	4.5
2011	0.0	0.5	0.0	4.5

Outputs for the Program

13. Activity (What will be done?)

In addition to aquaculture research trials that will be conducted at the Delaware State University Aquaculture Research and Demonstration Facility, a series of informational workshops and on-farm demonstration/field days will be held. One-on-one technical assistance will be provided through telephone, e-mail and site visits as needed. Furthermore, research findings will be disseminated through the publication of extension fact sheets, and peer-reviewed publications. A display will be set up at pertinent regional events, including the University of Delaware Coast Day, the Maryland Watermen's East Coast Commercial Fisherman's and Aquaculture Trade Exposition and Delaware Ag Week, to highlight our aquaculture research and extension program activities.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Workshop • One-on-One Intervention	• Newsletters • Web sites

15. Description of targeted audience

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

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	150	300	2000	100
2008	175	325	2000	100
2009	200	350	2000	125
2010	200	350	2000	125
2011	225	375	2000	150

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0	2008 : 0	2009 : 0	2010 : 0	2011 : 0

18. Output measures

Output Target

Number of Refereed Journal Articles

2007: 2	2008: 3	2009: 3	2010: 4	2011: 4

Output Target

Number of Extension Bulletins and Factsheets

2007: 3	2008: 3	2009: 4	2010: 4	2011: 5

Output Target

Number of Volunteered Presentations

2007: 2	2008: 3	2009: 3	2010: 4	2011: 4

Output Target

Number of Workshops Conducted

2007: 1	2008: 2	2009: 3	2010: 3	2011: 4

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

2. Increased ability of aquaculturists to manage production and financial risks.

Outcome Type: Medium

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

20. External factors which may affect outcomes

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

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- On-Site
- Structured

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

1. Name of the Planned Program

BIOTECHNOLOGY AND BIOTECHNOLOGY-BASED AGRIBUSINESS

2. Program knowledge areas

- 601 10% Economics of Agricultural Production and Farm Management
- 201 30% Plant Genome, Genetics, and Genetic Mechanisms
- 604 10% Marketing and Distribution Practices
- 304 30% Animal Genome
- 603 10% Market Economics
- 602 10% Business Management, Finance, and Taxation

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

Delaware has considerable expertise in basic biotechnology dating back about twenty years. Areas of existing strength are avian virology, physiology, and genomics and in basic plant biology and plant breeding. With regard to avian programs, biotechnology is being applied at the basic level to improve poultry health and immune competence and to understand basic disease mechanisms. At the applied level, efforts are directed toward improving diagnostic testing methods, developing vaccines and other disease control methods, surveying for emerging avian disease causing agents, and developing disease resistant breeds of chickens. In the plant biology arena, basic biotechnology efforts include understanding basic methods of 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 the importance of interfacial relations at the molecular and atomic levels in plants used for agriculture and environmental remediation. We anticipate that plant diagnostic methodology will increasingly be biotechnology based. We are interested in applying the biotechnology expertise existing at the University of Delaware toward the development of alternate energy sources that make economic sense for the Delmarva Peninsula. The use of genetically engineered plants to produce pharmaceuticals, vaccines, and other important products of biotechnology is being investigated in collaboration with a variety of industries. The evaluation of the marketability and consumer acceptance of biotechnology based products is a high priority.

6. Situation and priorities

The University of Delaware has existing strengths in avian biotechnology and basic plant biotechnology. We have seven faculty members in the avian group and six faculty members in the plant group who are principally engaged in biotechnology- based research. Our infrastructure for carrying out biotechnology-based research is good and includes the Charles C. Allen Biotechnology Laboratory, the Delaware Biotechnology Institute, and a new Plant Growth Chamber Facility. Our major priorities are to conduct basic research, much of which is defined by the funding successes of individual faculty members and to apply biotechnology-based discoveries to field and industry situations wherever possible.

7. Assumptions made for the Program

For this program, we are assuming that individual faculty members will be successful at obtaining competitive grants from federal and state funding agencies and from foundations and that liaisons with industry will be not only maintained but strengthened as much as possible in the future. Federal formula funding provides some infrastructure assistance but is inadequate to provide the required resources for these sophisticated programs. Our challenge is to make good decisions about where to focus basic research and what will ultimately pay off in terms of the creation of industries capable of producing biotechnology-based products of value to agriculture, environmental preservation, and human health.

8. Ultimate goal(s) of this Program

The ultimate goals of this program are to advance basic knowledge in the areas of avian and plant molecular biology. We also seek to apply those discoveries to the improvement of plant and animal agriculture through the development of agribusinesses that produce and market the plants and animal products generated from basic and applied biotechnology research. We focus on Delmarva agriculture but recognize that most of what we do is applicable to the global agricultural economy and to worldwide environmental and human health issues.

9. Scope of Program

- In-State Research
- Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	0.0	0.0	10.7	0.0
2008	0.0	0.0	10.7	0.0
2009	0.0	0.0	11.7	0.0
2010	0.0	0.0	11.7	0.0
2011	0.0	0.0	12.7	0.0

Outputs for the Program

13. Activity (What will be done?)

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

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Education Class • Workshop • Group Discussion	• Newsletters • TV Media Programs • Web sites • Other 1 (Newspapers)

15. Description of targeted 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.

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	50	200	50	250
2008	100	300	100	500
2009	150	400	150	750
2010	200	500	200	1000
2011	250	600	250	1250

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 1 2010 : 0 2011 : 1

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 12 2008: 12 2009: 12 2010: 14 2011: 14

Output Target

Number of Competitive Grants Awarded

2007: 6 2008: 6 2009: 6 2010: 7 2011: 7

Output Target

Number of Research Projects Completed

2007: 2 2008: 2 2009: 2 2010: 2 2011: 2

Output Target

Number of Undergraduate Researchers

2007: 4	2008: 4	2009: 4	2010: 5	2011: 6

Output Target

Number of M.S. Graduate Students

2007: 1	2008: 1	2009: 1	2010: 2	2011: 2

Output Target

Number of Ph.D. Graduate Students

2007: 3	2008: 3	2009: 4	2010: 4	2011: 5

Output Target

Number of Post-doctoral Research Associates

2007: 3	2008: 3	2009: 4	2010: 4	2011: 5

Output Target

Number of Refereed Journal Articles

2007: 10	2008: 11	2009: 12	2010: 13	2011: 14

Output Target

Number of Books and Book Chapters

2007: 2	2008: 2	2009: 3	2010: 3	2011: 3

Output Target

Number of Technical Reports

2007: 0	2008: 0	2009: 1	2010: 1	2011: 2

Output Target

Number of Extension Bulletins and Factsheets

2007: 0	2008: 0	2009: 1	2010: 1	2011: 1

Output Target

Number of Invited Presentations

2007: 12	2008: 12	2009: 12	2010: 14	2011: 14

Output Target

Number of Volunteered Presentations

2007: 8	2008: 8	2009: 8	2010: 10	2011: 10

Output Target

Number of Websites Established

2007: 0	2008: 1	2009: 1	2010: 0	2011: 0

Output Target

Number of Workshops Conducted

2007: 1 2008: 1 2009: 1 2010: 2 2011: 2

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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.

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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.

Outcome Type: Long

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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.

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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 Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- Structured

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

ECOSYSTEMS AND BIODIVERSITY

2. Program knowledge areas

- 112 10% Watershed Protection and Management
- 306 5% Environmental Stress in Animals
- 215 15% Biological Control of Pests Affecting Plants
- 136 15% Conservation of Biological Diversity
- 135 20% Aquatic and Terrestrial Wildlife
- 216 20% Integrated Pest Management Systems
- 123 15% Management and Sustainability of Forest Resources

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

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.

6. Situation and priorities

Delaware's natural ecosystems are becoming increasingly fragmented as urbanization converts farmland into homes, businesses, roadways, and other suburban land uses. Changes in these ecosystems reflect new cropping systems, the growing presence of invasive plants in natural areas, loss of wetlands, and the impacts of nonpoint pollution associated with urbanization of adjacent lands (e.g., air pollution, erosion). Our priorities are research and extension programs that guide statewide efforts to: develop agricultural/forestry practices that ensure ecosystem integrity and enhance biodiversity; maximize the extent of biodiversity in the newly fragmented landscapes coming to dominate Delaware; work cooperatively with state and regional environmental and wildlife agencies to expand our current collaborations and use this to identify key fisheries, wildlife and environmental monitoring needs; encourage proven bioenergy technology using native plant material (biomass); prevent or reverse encroachment of invasive plants; and provide quality habitats that sustain wildlife.

7. Assumptions made for the Program

The State of Delaware's rich terrestrial and coastal ecosystems have helped develop two main industries, agriculture and tourism, which for many years have partially defined the state's economic landscape. However, prosperity and economic diversification have improved the state's appeal, increasing both human population growth and the subsequent demand for land. Competition for land has not only affected agriculture by reducing farm size and increasing the need to achieve higher crop yields, but it has also impacted the terrestrial and coastal environments by destroying natural areas, marshes and degrading water quality. It seems certain today that land use changes will lead to an increasingly fragmented landscape in Delaware, with less open space and more urban/suburban environments. Farmland area will decrease and remaining farms will slowly change their cropping systems to introduce new, value-added crops (e.g., vegetables, herbs, biofuels), some of which will be genetically modified. Public pressure to prevent ecological degradation will increase, resulting in the need for science-based management practices and policies for agriculture, forestry, suburbia, and natural areas that can sustain or restore ecosystems and provide suitable habitat for wildlife, fish, and endangered species.

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 3 are to redesign agricultural and forestry practices and suburban/urban landscaping paradigms in ways that sustain the competitiveness of Delaware's agricultural and forestry enterprises while enhancing

biodiversity and the production of ecosystem services. We plan to promote the conservation and wise utilization of Delaware's aquatic and natural resources; gain a better understanding of issues related to habitat quality and natural resource protection; and educate stakeholders on the need for increased protection and conservation of aquatic and terrestrial habitats that will impact the future of Delaware's natural resources.

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Extension
- Multistate Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	5.7	0.0	9.0	3.5
2008	5.7	0.0	9.0	3.5
2009	5.7	0.0	9.0	3.5
2010	5.7	0.0	9.0	3.5
2011	5.7	0.0	9.0	3.5

Outputs for the Program

13. Activity (What will be done?)

Research and extension programs will target: (1) Integrated Pest Management - developing and delivering integrated pest management (IPM) programs, a "systems" approach using chemical, cultural, mechanical, and biological control to increase profits to producers and protect the environment; (2) Sustainable Agriculture/Forestry - developing and promoting efficient and sustainable agricultural, forestry, and other resource conservation practices and policies that ensure sustained ecosystem function and provide food and habitat for biodiversity, including crop diversification, agroforestry, native windbreaks, cover crops, living mulches, field border systems, and conservation buffers; (3) Wildlife, Woodlands, and Aquatic Resources - understanding and mitigating the impact of agricultural practices and urbanization on biodiversity, woodlands, and aquatic resources. Focus will be on human impacts on the fundamental processes that create and maintain biodiversity, such as atmospheric nitrification of ecosystems, minimal habitat requirements, speciation, predator-prey interactions, community and ecosystem structure, and extinction processes. Approaches to develop and maintain biodiversity in agriculture, suburban landscapes, and natural habitats, will be investigated. Nonpoint source nutrient pollution models will assess impacts of land use/cover change from agriculture to urban on water quality and quantity on local ponds and creeks; (4) Wetlands Ecosystems - improve our understanding of wetlands restoration, protection, and preservation. Emphasis will be on seasonally saturated and non-seasonally saturated wetlands, the wildlife species that inhabit them, and the importance of sedges in wetland habitats; (5) Protection of Delaware's Native Species - research on non-indigenous invasive species, a leading cause of plant and animal extinction in Delaware, will focus on the impact 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 that provide training in Wildlife Habitat Gardening, Waterwise Gardening, and use of native landscape plants in suburban gardens for residents; (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 we experience from these changes; (8) Wildlife Management - research will assess effects of human activity on migratory shore birds, box turtle populations in suburban habitat fragments, neotropical bird migrants in Delaware, Bobwhite quail in warm season grassland prairies, 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.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations	• Newsletters • Web sites

15. Description of targeted 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.

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	500	500	500	500
2008	750	750	750	750
2009	1000	1000	850	850
2010	1000	1000	950	950
2011	1500	1500	1000	1000

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 0 2010 : 0 2011 : 0

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 6 2008: 6 2009: 6 2010: 7 2011: 8

Output Target

Number of Competitive Grants Awarded

2007: 3 2008: 4 2009: 4 2010: 4 2011: 5

Output Target

Number of Research Projects Completed

2007: 2	2008: 3	2009: 3	2010: 3	2011: 4

Output Target

Number of Undergraduate Researchers

2007: 10	2008: 10	2009: 12	2010: 14	2011: 16

Output Target

Number of M.S. Graduate Students

2007: 6	2008: 6	2009: 6	2010: 7	2011: 8

Output Target

Number of Ph.D. Graduate Students

2007: 3	2008: 3	2009: 3	2010: 4	2011: 4

Output Target

Number of Post-doctoral Research Associates

2007: 2	2008: 2	2009: 2	2010: 3	2011: 3

Output Target

Number of Refereed Journal Articles

2007: 12	2008: 12	2009: 14	2010: 14	2011: 16

Output Target

Number of Books and Book Chapters

2007: 3	2008: 2	2009: 3	2010: 2	2011: 4

Output Target

Number of Technical Reports

2007: 8	2008: 8	2009: 8	2010: 10	2011: 10

Output Target

Number of Extension Bulletins and Factsheets

2007: 6	2008: 6	2009: 6	2010: 8	2011: 8

Output Target

Number of Invited Presentations

2007: 16	2008: 16	2009: 18	2010: 20	2011: 22

Output Target

Number of Volunteered Presentations

2007: 15	2008: 15	2009: 20	2010: 20	2011: 25

Output Target

Number of Websites Established

2007: 0	2008: 1	2009: 0	2010: 1	2011: 0

Output Target

Number of Workshops Conducted

2007: 3	2008: 4	2009: 4	2010: 6	2011: 8

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target

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.

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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.

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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.

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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.

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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.

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target

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 Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- Structured
- Case Study
- Observation

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

FAMILY AND YOUTH DEVELOPMENT

2. Program knowledge areas

- 801 10% Individual and Family Resource Management
- 802 10% Human Development and Family Well-Being
- 806 80% Youth Development

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

Rapid economic and social changes challenge the capacity of families to function well, placing extremely high demands and workloads on those charged with raising children and caring for dependent elderly. 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 has been a signature trait of Cooperative Extension. While many challenges face society today, perhaps none is more critical than helping youth develop the leadership and life skills necessary to survive in the 21st century. When environments include sustained opportunities for young people to gain a sense of belonging, independence, mastery and generosity, youth can master skills to make positive life choices, effectively contribute to decision-making and act responsibly; and positively influence their communities and beyond. On-going and caring relationships are essential to positive development. The need for science, engineering and technology (SET) education is essential for today's young people. Financial security is one of the most pressing concerns for Delawareans. Studies show the importance of financial well being to overall well being of families. On average, median income in Delaware has dropped by $3,542 between 1999 and 2004 based on three year moving average calculation. There has been a 30% increase in the number of personal bankruptcies filed between 2000 and 2004. Data indicate that most families would be three to six months away from bankruptcy if their income was unexpectedly lost, pointing to the insecurity faced by many families with respect to their income.

6. Situation and priorities

Societal and economic pressures on families and youth are greater and more complex than ever before. The nature of the family itself is changing, which increases pressures on our youth and puts them at greater risk. Parents struggle to sustain families financially and to provide guidance and economic support to their children and also to elderly relatives. Our extension and research priorities focus on delivering educational programs that: build the capacity of families to nurture and support their members over the life span; give youth the leadership, career development and life skills needed for academic and personal success; and provide financial planning, and consumer decision making skills to relieve economic stresses on family members.

7. Assumptions made for the Program

Social and economic stresses faced by Delaware families will increase and become more complex. Youth will be constantly faced with a need for support external to the family to provide programs on social and leadership skills, academic success, financial planning, and preparation for an increasingly sophisticated, technologically oriented workplace. Adults will face serious challenges as their parents and other relatives age. Public pressure to provide assistance and educational programs to families will grow, providing opportunities for Extension to lead family and youth development programs that can contribute significantly to this societal need.

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 4 are an increased capacity of families, individual adults and youth, and communities to improve their quality of life and financial status through comprehensive, research-based, outreach and educational programming. 4-H Youth Development will work to ensure opportunities for all youth to participate in long-term, sustainable relationships under the direction of caring adults in community-based settings.

9. Scope of Program

- In-State Extension
- Multistate Extension

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	18.1	3.0	0.0	0.0
2008	18.1	3.0	0.0	0.0
2009	19.1	3.0	0.0	0.0
2010	19.1	3.0	0.0	0.0
2011	20.1	3.0	0.0	0.0

Outputs for the Program

13. Activity (What will be done?)

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

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations	• Public Service Announcement • Newsletters • Billboards • TV Media Programs • Web sites

15. Description of targeted 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.

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	4200	213900	46300	2000
2008	4275	214350	49300	2100
2009	7600	214550	50300	2200
2010	4310	214680	51300	2300
2011	4325	214800	52300	2400

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 0 2010 : 0 2011 : 0

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 13 2008: 13 2009: 15 2010: 15 2011: 17

Output Target

Number of Competitive Grants Awarded

2007: 5 2008: 5 2009: 6 2010: 6 2011: 7

Output Target

Number of Extension Bulletins and Factsheets

2007: 10 2008: 10 2009: 12 2010: 12 2011: 14

Output Target

Number of Invited Presentations

2007: 10 2008: 10 2009: 12 2010: 12 2011: 14

Output Target

Number of Volunteered Presentations

2007: 20 2008: 30 2009: 35 2010: 40 2011: 50

Output Target

Number of Websites Established

2007: 0 2008: 1 2009: 0 2010: 0 2011: 0

Output Target

Number of Workshops Conducted

2007: 150 2008: 150 2009: 160 2010: 160 2011: 175

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
Dollars saved through volunteer interventions.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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 Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- Structured
- Unstructured
- Observation

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

FOOD SCIENCE, TECHNOLOGY, SAFETY, AND NUTRITION

2. Program knowledge areas

- 724 20% Healthy Lifestyle
- 712 10% Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxi
- 702 10% Requirements and Function of Nutrients and Other Food Components
- 502 10% New and Improved Food Products
- 703 20% Nutrition Education and Behavior
- 704 10% Nutrition and Hunger in the Population
- 501 20% New and Improved Food Processing Technologies

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

The American food system provides consumers with an abundant supply of convenient, economical, high-quality, nutritious, and safe food products. However, foodborne illness and poor food choices still occur in the U.S. Outbreaks of foodborne illness due to microbial contamination continue to be a major but preventable public health problem. While advances in understanding and controlling foodborne pathogens have been significant, new pathogens, new food products, increases in imported foods, and increasing anti-microbial resistance present new challenges to the nation's food safety programs. Further, despite the fact that Americans have access to an abundant, nutritious, affordable food supply and many tools to help them select a nutritious diet, concerns about diet and human health persist. In particular, child and adult obesity, including a sharp rise in diabetes in all age groups, is a growing, diet-related health concern. Chronic diseases cause seven out of ten deaths each year in the U.S. and are responsible for 78% of all health care costs. Compared to U.S. averages, mortality rates in Delaware are higher for heart disease, cancer and diabetes. Of the ten leading causes of death due to disease, five are linked with diet. Nationwide data suggest that minority, low-income and educationally disadvantaged individuals have a disproportionate share of diet-related diseases. Although many diseases occur more frequently with advancing age, dietary practices in young people significantly affect the occurrence and onset of these diseases. Our research programs focus on understanding foodborne pathogens and reducing the occurrence of these microbes during pre- and post-harvest by intervention strategies (e.g., high pressure, ultraviolet light, antimicrobial packaging). Extension activities center on food safety education of food handlers and youth; emerging food safety and nutrition issues; and the role of diet and physical activity in reducing chronic disease.

6. Situation and priorities

Americans have access to an abundant, nutritious, affordable food supply and have many tools available to help them select a nutritious diet. Changes in the dietary recommendations confuse many Americans. Furthermore, concerns about diet and human health escalate. Chronic diseases cause seven out of ten deaths each year in the U.S. and are responsible for 78 percent of all health care costs. Compared to national averages, mortality rates in Delaware are higher for heart disease, cancer, and diabetes. Additionally, obesity is now considered a national epidemic. In 2004, the National Center for Health Statistics estimated that 59 percent of adults in Delaware were obese or overweight as compared to 48 percent 10 years earlier. To combat this weight gain, 39 percent of Delawareans in 2000 indicated they were trying to lose weight with only 12 percent reporting that they received medical advice to do so. Ten percent said they were eating fewer calories, 19 percent were consuming less fat, 40 percent were watching both calorie and fat intake, and 60 percent noted they were using physical activity to lose or maintain their weight. However, 2000 BRFSS data suggest that 56 percent of adults are either inactive or irregularly active. Obesity among children in this country has risen threefold since 1980. Fourteen percent of Delaware students in grades 9-12 are overweight and another 18 percent are at risk of becoming overweight. Surveys of adolescents in grades 6-8 found that they have higher BMI values than high school students. Adolescents who are overweight are likely to become overweight adults. Although being overweight can have a major impact on appearance, self-esteem, and overall mental health of the individual, physical health is drastically affected. Problems can include high blood cholesterol levels, hypertension, sleep apnea, learning and memory problems, asthma, and abnormal glucose metabolism. An obese individual can expect to have a shorter life than normal weight individuals. Little is known about the food intake of Delawareans. In 2002, 81 percent of adult Delawareans did not consume the recommended five or more servings of fruits and vegetables. Males were less likely to consume foods from this group than females. Likewise, younger individuals and blacks reported eating fewer fruits and vegetables. Based on data from 24-hour food recalls taken on individuals entering Delaware EFNEP in 2005, only 9, 17, 22, 25, and 52 percent were eating the minimum number of servings from the dairy, fruit, vegetable, bread/cereal, and meat/meat alternate groups, respectively.

Another health concern is foodborne illness, which causes an estimated 13 million cases each year in the U.S. Of these individuals, 2 to 3 percent develop long-term health problems, such as reactive arthritis, paralysis, liver damage, or kidney failure. Approximately 4,500 to 6,000 individuals die annually. The Centers for Disease Control estimates that 77 percent of all foodborne outbreaks can be traced to foodservice operations, 20 percent to home food preparation practices, and 3 percent to mistakes in the food processing industry. Cooperative Extension programs target people in all age groups to teach them more effective ways to control their diets and improve overall health. Education initiatives in this planned program address nutrition, food safety, food resource management and the importance

7. Assumptions made for the Program

Many individuals lack the understanding and skills to plan and prepare nutritious meals. Individuals who are overweight have increased risk of developing various health problems. It is often assumed that people who maintain what is accepted as a healthy weight are undernourished. Many people lack the understanding of the role diet plays in reducing the risk of certain chronic diseases. Moreover, if an individual is diagnosed with a chronic illness, they often lack the skills to translate their medical diagnosis into a healthy lifestyle. An assumption is that one of the most effective ways to improve our health, including decreasing obesity and the risk and effect of chronic diseases, is through behavior modification that changes our actions. The modification must focus on positive goals, small steps, and behaviors encouraging healthy food choices and physical activity each day that can be maintained over a lifetime. Because prevention is important in maintaining health, effective programs must concentrate on improving dietary patterns and increasing physical activity. A variety of reasons are thought to hinder individuals from adopting a healthy lifestyle. Some of these reasons include lack of time, resources, understanding what needs altering, and motivation to change. Likewise, marketing of food products and our culture influences our behavior. It is also presumed that certain segments of the population, such as youth and limited-resource individuals, lack the knowledge and/or ability to choose a healthy diet. For these individuals, improving skills associated with meal planning and purchasing and preparing foods are critical. The public is concerned about conflicting nutrition advice and the safety of the food supply. Much of this concern can be traced to a lack of understanding of the issues. The media play to these concerns, providing limited or incomplete information on which to make informed choices. Examples of recent concerns include food allergens and bird flu. Interest groups often distort sound scientific facts to further their causes. Foodservice workers, producers, and food entrepreneurs lack the knowledge and skills to handle food safely to prevent foodborne illness. Although the incidence of foodborne illness has decreased for a wide variety of reasons, such as requiring HACCP and food safety education certification, continual food safety training is needed. Through training, food handlers develop skills and motivation to produce safe food. Because many youth are responsible for part or all food preparation in the home, it is critical that we teach children safe food handling techniques to reduce the incidence of foodborne illnesses. They get little or no training in school or by their parents, often don't have a parent available to observe preparing food in the home and if they do, the parent often lacks safe food handling skills. Research is continually finding new ways to reduce pathogens on food products while maintaining sensory quality. New techniques such as ultraviolet light and antimicrobial packaging can protect the food supply thereby decreasing foodborne illness. Interdisciplinary and inter-institutional research and extension programming will continue to be the guiding goal.

8. Ultimate goal(s) of this Program

In research, the ultimate goals of Planned Program 5 are increasing the understanding of foodborne pathogens and reduction of these pathogens during pre- and post-harvest processing by using intervention strategies such as high pressure, ultraviolet light, and antimicrobial packaging. Extension goals are to reduce the incidence of foodborne illness, increase the understanding of the scientific facts surrounding emerging issues in nutrition, food safety, and health so that informed choices can be made, improve health of individuals by their becoming physically active on a regular basis and consuming healthy foods in appropriate quantities, and improve the health status of individuals with certain chronic diseases (heart disease, certain cancers, diabetes, osteoporosis) or at risk for these problems.

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	7.6	2.5	4.9	0.0
2008	7.6	2.5	4.9	0.0
2009	7.6	2.5	4.9	0.0
2010	7.6	2.5	4.9	0.0
2011	7.6	2.5	4.9	0.0

Outputs for the Program

13. Activity (What will be done?)

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 Keep Food Safe, ServSafe®, Don't Give Kids a Tummy Ache, Food Safety for Entrepreneurs, Keep'em Down on the Farm, Chances and Choices, Operation Risk, Microbial Contamination, Don't Bug Me!, Families First Nutrition Education and Wellness System (FFNEWS), Power of Choice, Dining With Diabetes, Give Your Heart A Healthy Beat!, Boning Up On Health, Strive For 5, Intelligent Eaters Club, Dietary Effects On Cancer Risks, Stretch, Flex, And Endure, Snacks to Please!, Planning Meals for Children, Create A Healthy Environment, Putting Good Nutrition To Work for Children, FoodSkills, and Expanded Food and Nutrition Education workshops; training volunteers including Master Food Educators, 4-H leaders, agency personnel, and teachers; providing Great Beginnings and Families Matter newsletters; publishing a quarterly nutrition newsletter for general audiences and giving handouts to parents of children in targeted schools as well as to other school personnel; developing and delivering programs on Kids Cooking (1890 EFNEP), Food Safety for Youth, Eat Smart, Play Hard, and Diet and Cancer; conducting favorite foods and 4-H foods contests; developing web-based information and fact sheets; distributing information to media; developing a marketing campaign to expand program participation; developing a marketing strategy with state and local government partners, faith-based groups, parents, social workers, childcare providers, low income housing managers, and corporate wellness centers to collectively deal with low income and socially disadvantaged individuals.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• Workshop • One-on-One Intervention • Other 1 (Train the trainer) • Other 2 (4-H programs)	• Newsletters • Web sites • Other 1 (News releases)

15. Description of targeted 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, adults at risk for chronic disease (diabetes, osteoporosis, heart disease, certain cancers), adults with chronic diseases (diabetes, heart disease) policy makers, and media.

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	2500	46025	6595	5925
2008	2860	46300	7220	6585
2009	3270	46580	7385	7245
2010	3290	46855	7450	7900
2011	3550	47150	7725	8555

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 0 2010 : 0 2011 : 0

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 5 2008: 5 2009: 6 2010: 6 2011: 7

Output Target

Number of Competitive Grants Awarded

2007: 2 2008: 3 2009: 3 2010: 3 2011: 4

Output Target

Number of Research Projects Completed

2007: 4 2008: 4 2009: 4 2010: 5 2011: 5

Output Target

Number of Undergraduate Researchers

2007: 3 2008: 3 2009: 3 2010: 4 2011: 5

Output Target

Number of M.S. Graduate Students

2007: 4 2008: 4 2009: 4 2010: 5 2011: 5

Output Target

Number of Post-doctoral Research Associates

2007: 1 2008: 1 2009: 1 2010: 2 2011: 2

Output Target

Number of Refereed Journal Articles

2007: 6	2008: 6	2009: 7	2010: 8	2011: 8

Output Target

Number of Books and Book Chapters

2007: 1	2008: 1	2009: 1	2010: 2	2011: 2

Output Target

Number of Technical Reports

2007: 1	2008: 1	2009: 1	2010: 2	2011: 2

Output Target

Number of Extension Bulletins and Factsheets

2007: 10	2008: 12	2009: 12	2010: 14	2011: 16

Output Target

Number of Invited Presentations

2007: 2	2008: 2	2009: 3	2010: 4	2011: 5

Output Target

Number of Volunteered Presentations

2007: 6	2008: 8	2009: 10	2010: 12	2011: 14

Output Target

Number of Websites Established

2007: 0	2008: 1	2009: 0	2010: 0	2011: 1

Output Target

Number of Workshops Conducted

2007: 200	2008: 215	2009: 225	2010: 235	2011: 250

Output Target

Number of Newsletters Distributed

2007: 32000	2008: 33000	2009: 34000	2010: 35000	2011: 36000

Output Target

Number of New Program Partners

2007: 15	2008: 15	2009: 20	2010: 20	2011: 25

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target
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.

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target
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.

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target
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 Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

20. External factors which may affect outcomes

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

Description
{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)

Description
We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Whole population
- Mail
- On-Site
- Structured
- Tests

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

PLANT BIOLOGY AND CROP PRODUCTION SYSTEMS

2. Program knowledge areas

- 206 10% Basic Plant Biology
- 203 10% Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 213 10% Weeds Affecting Plants
- 402 5% Engineering Systems and Equipment
- 216 10% Integrated Pest Management Systems
- 604 5% Marketing and Distribution Practices
- 205 20% Plant Management Systems
- 601 10% Economics of Agricultural Production and Farm Management
- 212 10% Pathogens and Nematodes Affecting Plants
- 201 10% Plant Genome, Genetics, and Genetic Mechanisms

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

Grain crops, vegetable crops for processing and fresh markets, and a rapidly growing horticultural industry for urban and suburban populations dominate Delaware's plant management systems. Most crop acreage in Delaware is devoted to corn, soybean, and small grains, primarily used as feed by the poultry and livestock industries; however, use of soybeans as biofuels is growing. The vegetable industry contributes nearly $58 million in farm income to producers and more acreage is devoted to vegetable production in Delaware than in surrounding states. Development of beach resorts and residential communities has led to an expanding horticulture industry, focused on greenhouse, nursery, and turf production, emphasizing the need for environmentally efficient horticultural management systems. The market potential for herbs, spices, essential oil plants, and exotic specialty vegetables in the U.S. is considerable, but has not been exploited by small farmers because of a lack of information on management systems, marketing, and the availability of germplasm that meets market specifications. Other areas of interest are pasture selection, sustainable grazing, reducing loss of open space while curbing the spread of invasive plants and discouraging loss of native species, collecting native species for preservation and storage in herbariums, and helping farmers compete in national and global agricultural markets. In the long-term, crop management systems will increasingly depend upon fundamental research that improves our understanding of plant genomes and how genomic information can help solve production-related problems in agronomic and horticultural settings. We also need advances in field-scale crop management and farm marketing skills to ensure that farmers and the "green industry" will be profitable in the long-term. Hence, acquisition and application of genomic information along with using proteomics and bioinformatics for plant improvement and protection is a high priority for the future. Basic studies on how plants adapt to their environments and manage biotic and abiotic stress are priorities, as are studies on soil microorganism-plant relationships and plant/soil interfacial reactions important to plant nutrient use and plant adaptation to contaminated soils.

6. Situation and priorities

Land use changes in Delaware will exert increasing pressures to convert farmland to developed, urban and suburban uses. At the same time, the poultry industry will continue to need a large and reliable source of grain crops as a feed; vegetable and specialty crop production should grow as the urban market for fresh and processed vegetables expands; and the need for horticultural plant production and landscaping should increase dramatically. The proximity of state farmers to major urban areas within and outside the state will provide growing opportunities for transition to a variety of agricultural products. For example, the U.S. continues as the largest importer and consumer of herbs, spices, and essential oils providing an ever-increasing market of botanical and dietary supplements and new markets in organically grown materials. This market will likely expand because, increasingly, third world sources of these plant materials have become contaminated, adulterated, threatened, and/or eliminated. We also anticipate that rapid human population growth in the state will continue and, unless checked by new research and extension programs, lead to further loss of native plant species and landscape diversity, encourage the spread of invasive species and contribute to degradation of water quality. Research and extension priorities for Planned Program 6 include the use of advances in plant genetics/breeding and engineering technologies (e.g., irrigation) and molecular biology (genomics, proteomics, and bioinformatics) to increase agronomic and vegetable crop yields from a decreasing land base; expanding the variety and marketability of vegetable and specialty crops; improving the environmental efficiency of all agronomic and vegetable

crop management systems; pasture management for mixed meat goat-beef cattle grazing, including control of invasive pasture weed species; integrating more biological control practices into hay production, particularly for alfalfa; establishing domestic procurement of safe, reliable sources of herbs and essential oil plants; enhancing the marketing skills needed by producers to adapt to changes in cropping systems and consumer preferences; and developing environmentally sound horticulture programs emphasizing the use of native plant species.

7. Assumptions made for the Program

The State of Delaware is committed to preserving agricultural farmland and sustaining the land base needed to produce crops for poultry and livestock. However, agricultural success is threatened by pressures exerted on farmers by rising production costs, reduced commodity prices and barriers to an increase in the number of new farmers due to high land costs. Farmers will also seek new land uses and new, value-added cropping systems to increase profitability from smaller land bases. Diversification of agricultural products will reduce risk and increase overall farm income. As an example, there is increasing market for herbs and essential oil plants that has not been fully exploited by small farmers because of lack of information on efficient agronomic management, processing, and marketing. Crop production for bioenergy will become more important, particularly the production of biodiesel fuels from soybeans. Mixed meat goat/beef cattle pasture systems will expand, in response to an increased urban market for goat meat, and management systems using goats to control invasive plants in pastures will be developed. The horticulture industry will expand and become a major economic force in the state; greenhouse production of a diverse variety of bioengineered plants for non-agricultural uses (e.g., pharmaceuticals, nutriceuticals) will emerge as new opportunities for Delaware agriculture. For all plant production systems, protecting and improving water, air, and soil quality will remain a high priority for research and extension programs.

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 6 are increased productivity, profitability, and environmental compatibility of agronomic, vegetable, and ornamental crop producers through more efficient management systems, improved marketing skills, reduced costs of production, higher percentages of marketable product per acre, better cultural techniques, innovations in nutrient management, adoption of improved crop and vegetable varieties, and the development and release of new, improved germplasm for plant flavor, fragrance and medicinal uses. We also seek to increase knowledge about production practices and niche markets for vegetables, herbs, and essential oils, assist limited resource farmers and ranchers in identifying new crops and markets, develop and demonstrate efficient, economic, pasture-based animal production systems that are environmentally sound, and identify species or genotypes of grasses and legumes most suitable for the region for production and/or soil protection purposes.

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Extension
- Multistate Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	13.1	5.5	28.6	3.9
2008	13.1	5.5	28.6	3.9
2009	13.1	5.5	28.6	3.9
2010	13.1	5.5	28.6	3.9
2011	13.1	5.5	28.6	3.9

Outputs for the Program

13. Activity (What will be done?)

Research and extension programs will target: (1) Agronomic, Vegetable and Horticultural Crop Production - improving varietal selection, disease and pest resistance, seed technology, cultural production practices, and marketing practices and skills for the many and diverse types of crop producers in Delaware; (2) Culinary Herbs and Essential Oils - management practices for propagation of plants of flavor, fragrance, and medicine will be developed and techniques for production, harvesting, and distillation will be demonstrated and disseminated; the Herb Research Center, along with the Claude E. Phillips Herbarium, will continue to analyze living plants, dried botanicals, and essential oils to help small farmers, processors, and distributors of these products when they otherwise have no means of certifying their products as safe in the American food supply; a national collection scheme of living herbs will be continued, as formulated under the aegis of the Herb Society of America, to not only preserve germplasm but also to provide correctly labeled material to gardeners, farmers, nurseries, and researchers. We will also continue to be the primary source of information on herbs and nomenclature for a worldwide audience, including manufacturers of culinary herbs and dietary supplements; (3) New Crops - financial and environmental impacts of growing new varieties of existing crops (Fordhook lima beans), new crops (greenhouse vegetables, crowder peas, garbanzo beans), horticultural varieties (herbaceous perennials), and turfgrass will be investigated. The potential of organic production of crops for processing will be evaluated; (4) Value-added Agricultural By-Products - we will evaluate the feasibility of using agricultural by-products (crop residues, manures, municipal composts, yard wastes, biosolids, and industrial materials) for fuel, feed, and litter for poultry houses; (5) Integrated Pest Management - improved methods for control of insect pests, weeds, and plant pathogens, understanding pesticide movement and interactions within the soil, and identifying herbicide combinations that improve weed control and reduce active ingredient application are priorities; (6) Nutrient Management - nutrient recommendations and nutrient management best management practices will be reviewed and research will be targeted at improving the efficiency of nitrogen and phosphorus use by agronomic, vegetable, and horticultural crops will be priorities; (7) Engineering Technologies - improvements in mechanical harvesting and automated guidance systems for harvesters will be sought and water resource protection will be enhanced by research on irrigation management and will develop irrigation scheduling strategies that are effective and easy to implement. Advances in remote sensing, tillage, and pesticide application are emerging research priorities; (8) Plant Breeding, Crop Genomics, Proteomics, and Bioinformatics to Genetically Engineer Plants - research that improves our understanding of plant genomes and the application of genomic information for crop improvement and crop protection will be continued and expanded. Basic studies on how plants adapt to their environments and manage stress, including disease, will be conducted. Studies that address soil microorganism-plant symbiotic relationships and plant/soil interfacial reactions, such as rhizosphere effects, to enhance crop growth and quality will be undertaken. The feasibility of growing genetically engineered crops and greenhouse plants in Delaware will be evaluated; (9) Urban/Suburban Horticulture - developing guidelines for safe establishment of community gardens in impoverished neighborhoods will be a priority, particularly for areas where soils may be contaminated by heavy metals such as lead and arsenic; demonstration gardens, workshops, and training programs for agriculture science teachers will focus on landscape diversity, exotic invasive species, water quality and conservation; (and 10) Pasture and Forage Management - research on animal production systems in pastures will expand with an emphasis on meat goats and beef cattle and forage research will emphasize improving biological control systems for alfalfa.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations	• Newsletters • Web sites • Other 1 (Newspapers)

15. Description of targeted audience

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

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	4290	11375	1100	3050
2008	4415	11500	1250	3450
2009	5040	11625	1350	3750
2010	5165	11750	1500	3950
2011	5290	11875	1600	4150

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 1 2010 : 0 2011 : 1

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 12 2008: 13 2009: 14 2010: 16 2011: 18

Output Target

Number of Competitive Grants Awarded

2007: 3 2008: 4 2009: 4 2010: 5 2011: 6

Output Target

Number of Research Projects Completed

2007: 2 2008: 2 2009: 3 2010: 3 2011: 4

Output Target

Number of Undergraduate Researchers

2007: 4 2008: 4 2009: 6 2010: 6 2011: 8

Output Target

Number of M.S. Graduate Students

2007: 4 2008: 4 2009: 5 2010: 5 2011: 6

Output Target

Number of Ph.D. Graduate Students

2007: 6 2008: 6 2009: 8 2010: 8 2011: 8

Output Target

Number of Post-doctoral Research Associates

2007: 4 2008: 4 2009: 5 2010: 5 2011: 6

Output Target

Number of Refereed Journal Articles

2007: 28 2008: 30 2009: 32 2010: 34 2011: 36

Output Target

Number of Books and Book Chapters

2007: 2 2008: 3 2009: 3 2010: 3 2011: 4

Output Target

Number of Technical Reports

2007: 12 2008: 14 2009: 16 2010: 16 2011: 18

Output Target

Number of Extension Bulletins and Factsheets

2007: 40 2008: 45 2009: 50 2010: 50 2011: 55

Output Target

Number of Invited Presentations

2007: 30 2008: 35 2009: 40 2010: 45 2011: 50

Output Target

Number of Volunteered Presentations

2007: 45 2008: 50 2009: 55 2010: 60 2011: 65

Output Target

Number of Websites Established

2007: 0 2008: 1 2009: 0 2010: 0 2011: 1

Output Target

Number of Workshops Conducted

2007: 20 2008: 20 2009: 25 2010: 25 2011: 30

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Medium

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Medium

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Medium

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- On-Site
- Structured
- Observation

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

RURAL DEVELOPMENT AND LAND USE CHANGE

2. Program knowledge areas

- 608 20% Community Resource Planning and Development
- 805 10% Community Institutions, Health, and Social Services
- 131 20% Alternative Uses of Land
- 605 20% Natural Resource and Environmental Economics
- 803 10% Sociological and Technological Change Affecting Individuals, Families and Communities
- 112 20% Watershed Protection and Management

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

Conversion of agricultural land and forests to other uses continues to escalate in Delaware and the region. Critical land use issues in Delaware involve traffic congestion, costs of providing services (water, sewer, and schools), development patterns, preservation of working lands and the impact of land use conversions on wildlife and plant populations. Delaware maintains an active Agricultural Lands Preservation program to purchase development rights to agricultural lands. Delaware's economy is growing, diverse and ever changing, and economic development remains a critical issue for Delaware. Agriculture remains an important economic base, but major growth in Delaware's economy now comes from other sectors, such as banking, retail/wholesale trade, and service. As the economy changes, there is a need to understand the changes and provide assistance in the transition for members of rural communities. Concerns about employment, skill development, education, careers, and family financial stability are intertwined with the strength of the State's economy, as well as that of local communities. The state and local communities must work to attract new businesses as well as retain existing businesses. New approaches must focus on rural and family development, given continuing changes in cultural composition, community structure, and family organization.

6. Situation and priorities

The nature of land use is changing rapidly and irrevocably in Delaware. Agricultural land is being converted to suburban uses and small towns are slowly changing into small cities as population grows and nearby land is annexed. Loss of natural areas (forests, wetlands) is occurring, resulting in increasingly fragmented agro-ecosystems. As land use changes, the social and economic fabric of rural communities is also altered, causing conflicts between long-time residents and new community members. Many rural areas face unfamiliar challenges to family and youth and increasingly encounter personal, social, and economic problems found in urban areas. Our priorities are to contribute to the development of land use policies that minimize conflict as land use changes; build the capacity of rural communities to adapt successfully to social and economic changes associated with new, mixed land uses; and sustain agriculture and natural ecosystems as valued segments of our society.

7. Assumptions made for the Program

Land use change from agriculture to urban/suburban communities will continue and accelerate in the future. Citizens of Delaware desire policies that control land use in a manner that sustains an economically viable agricultural land base, provides for open space, and maintains the viability of rural communities. We have expertise and capacity in the development of land use policies that can sustain agriculture and natural ecosystems, and in outreach programs designed to resolve conflicts between farmers, rural citizens, and the urban/suburban populations that bring new, and often quite different, visions of land use to the rural landscape.

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 7 are increased capacity of rural communities and families to enhance their economic well being; reduced conflict between competing forces in land use and development; and protection of agriculturally productive land for future generations.

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Extension
- Multistate Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	4.7	0.0	9.3	0.0
2008	4.7	0.0	9.3	0.0
2009	4.7	0.0	9.3	0.0
2010	4.7	0.0	9.3	0.0
2011	4.7	0.0	9.3	0.0

Outputs for the Program

13. Activity (What will be done?)

Research and Extension programs will target: (1) Rural Revitalization and Community Development - the process of change in rural economies will be monitored and opportunities for rural revitalization and community development identified; (2) Individual Academic and Family Financial Success - factors that encourage individual academic and family financial success will be identified and strategies developed to enhance those assets; (3) Social and Economic Development for All Family Members - programs to assist communities in building the social and economic capital important for civic, social, emotional and educational development of all family members including youth and the elderly will be developed and delivered; (4) Economic Growth for Rural Communities - business expansion and retention strategies for rural communities that encourage and/or manage economic growth will be developed and delivered; (5) Minimizing Land Use Conflicts and Protecting Natural Amenities - strategies to minimize land use conflicts and protect natural amenities in an urbanizing environment will be investigated, including use of integrated conceptual models that aid those responsible for resource management decisions; (6) Benefits and Costs of Alternative Surface and Ground Water Quality Protection - a framework will be developed to examine the economic benefits and costs of alternative approaches to protect surface and ground water quality; (7) Protection and Preservation of Agricultural Land - current strategies to protect and preserve agricultural land will be evaluated and promising new approaches will be investigated and assessed; (8) Rural Communities - social and economic structures of rural communities will be studied and used to formulate strategies for sustainable development; (9) Training Programs - Training programs in land use change will be developed and delivered to provide farmers, landowners, and community members decision-making tools for land use and preservation issues; (10) Critical Mass and the Urban Interface - the economic, social and cultural impacts of land fragmentation, increased spatial interfaces with urban uses and effects on agricultural support industries will be used to assess the necessary "critical mass" for future agricultural viability; and the web of relationships between urban and rural land uses will be documented.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Workshop • Group Discussion • One-on-One Intervention • Demonstrations	• Newsletters • Web sites

15. Description of targeted audience

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

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	2000	2000	100	200
2008	3000	3000	200	300
2009	4000	8000	300	600
2010	5000	10000	400	800
2011	6000	12000	500	1000

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 0 2010 : 0 2011 : 0

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 3 2008: 3 2009: 4 2010: 5 2011: 6

Output Target

Number of Competitive Grants Awarded

2007: 1 2008: 1 2009: 2 2010: 2 2011: 3

Output Target

Number of Research Projects Completed

2007: 1 2008: 1 2009: 2 2010: 2 2011: 3

Output Target

Number of Undergraduate Researchers

2007: 3	2008: 3	2009: 4	2010: 5	2011: 6

Output Target

Number of M.S. Graduate Students

2007: 4	2008: 4	2009: 5	2010: 5	2011: 6

Output Target

Number of Refereed Journal Articles

2007: 5	2008: 5	2009: 6	2010: 6	2011: 8

Output Target

Number of Books and Book Chapters

2007: 1	2008: 1	2009: 1	2010: 2	2011: 2

Output Target

Number of Technical Reports

2007: 3	2008: 3	2009: 3	2010: 4	2011: 4

Output Target

Number of Extension Bulletins and Factsheets

2007: 2	2008: 2	2009: 3	2010: 3	2011: 4

Output Target

Number of Invited Presentations

2007: 2	2008: 2	2009: 3	2010: 4	2011: 4

Output Target

Number of Volunteered Presentations

2007: 4	2008: 5	2009: 5	2010: 8	2011: 10

Output Target

Number of Websites Established

2007: 0	2008: 1	2009: 0	2010: 1	2011: 0

Output Target

Number of Workshops Conducted

2007: 3	2008: 3	2009: 4	2010: 4	2011: 5

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Short

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
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.

Outcome Type: Medium

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

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

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

Outcome Target
Land Use Change: research will identify strategies needed to manage land use change in a state where preserving farmland

is a major goal, but economic and social forces are resulting in steady conversion of agricultural lands to suburban and urban uses. The economic, social, and cultural impacts of land fragmentation, suburban sprawl, and the “critical mass” of land and businesses needed to sustain agriculture in the long-term will be determined. Research knowledge and extension programs will help to guide long-term land use planning in cooperative efforts

Outcome Type: Long

2007: 0	2008: 0	2009: 0	2010: 0	2011: 0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Case Study
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Whole population
- Mail
- Telephone
- Structured
- Case Study

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.

1. Name of the Planned Program

SOILS AND ENVIRONMENTAL QUALITY

2. Program knowledge areas

- 101 10% Appraisal of Soil Resources
- 112 10% Watershed Protection and Management
- 403 10% Waste Disposal, Recycling, and Reuse
- 141 5% Air Resource Protection and Management
- 104 10% Protect Soil from Harmful Effects of Natural Elements
- 133 30% Pollution Prevention and Mitigation
- 404 5% Instrumentation and Control Systems
- 102 20% Soil, Plant, Water, Nutrient Relationships

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Brief summary about Planned Program

Environmentally sound management of our soil resources is critical if we are to achieve greater harmony between agricultural production, our urbanizing landscape, and the environment. In Delaware, we must focus on several critical issues that can impact surface and ground water quality, soil quality, and air quality: 1) efficient use of nutrients in animal and crop production, 2) enhanced understanding of the fate, mobility, speciation, and bioavailability of metals and organic chemicals in soil and water environments, 3) efficient use of ground water for irrigation, 4) appropriate use of pesticides and herbicides, and 5) emission of gases and particulates from soils and waste materials (e.g., biosolids) that can affect air quality, climate change, human health and nearby ecosystems. Use of state-of-the-art molecular scale spectroscopic/microscopic and molecular biological approaches in development of effective remediation strategies is essential for environmental management. The focus of this program is basic research that increases our fundamental understanding of soil processes and applied research and extension programs that develop and implement management strategies to sustain agriculture and other land uses while protecting the quality of our air, soil, and water.

6. Situation and priorities

The U.S. faces many problems and challenges related to soils and environmental quality. Protecting soils from degradation and managing them in a manner that sustains agricultural productivity are critical issues for all land uses in Delaware. Specific priority areas for our soil and environmental quality research and extension programs are: contamination of soil and water resources with nutrients, metals, salts, radionuclides, organic chemicals, and pathogenic microorganisms; prevention of soil contamination and remediation of damaged soils; reduction of erosion to conserve soils; maintenance of soil productivity for food production; land use and preservation issues; preservation of wetlands to filter and clean surface waters; loss of biodiversity; waste disposal and/or beneficial re-use; atmospheric pollution via particulates by emissions from soils, agricultural operations, and landfills; and the chronic, deleterious effects of pollutants on human health.

7. Assumptions made for the Program

Soils are a vital natural resource and protecting and improving soil quality is of equal importance as water and air quality and will be an increasing challenge as Delaware continues to convert farmland to urban/suburban uses. Improved fundamental understanding of soil biology, chemistry, and physics is central to developing best management practices for agricultural soils, soils in natural ecosystems, and for contaminated soils. Inter-disciplinary research is needed to link

8. Ultimate goal(s) of this Program

The ultimate goals of Planned Program 8 are improved understanding of the transport and fate of nutrients, metals, and organics through soil; development of new practices, technologies and educational programs to assist producers in managing plant nutrients and animal wastes; integrating the basic principles of soil science into watershed scale efforts to improve surface and ground water quality in Delaware

9. Scope of Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Extension
- Multistate Integrated Research and Extension
- Multistate Research

Inputs for the Program

10. Expending formula funds or state-matching funds : Yes

11. Expending other then formula funds or state-matching funds : Yes

12. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2007	5.0	0.0	18.0	0.0
2008	5.0	0.0	18.0	0.0
2009	5.0	0.0	19.0	0.0
2010	5.0	0.0	19.0	0.0
2011	5.0	0.0	19.0	0.0

Outputs for the Program

13. Activity (What will be done?)

Research and extension programs will target: (1) Fate, Transport, and Reaction Mechanisms - understanding the fate, transport and reaction mechanisms of plant nutrients (nitrate, phosphate), metals (copper, chromium, arsenic, mercury, other heavy metals), wastes (manures, sludges, industrial by-products and co-products) and organic chemicals (pesticides, industrial organic chemicals) in soils and soil components, and their effects on soil and water contamination using multi-spatial and multi-temporal scale approaches; (2) Cost-Effective, In-Situ Remediation - developing cost-effective, in-situ methods for the remediation and speciation of contaminated soils, including phytoremediation, bioremediation, and atomic and molecular approaches. Molecular environmental and biological approaches will be applied to study the mechanisms used by plants to take up, transport, and tolerate metals. Emphasis will be placed on the role of plant/soil/microbial interfacial reactions on contaminant accumulation and bioavailability; (3) Nutrient Management/Water Quality/Air Quality - develop fertilizer and waste management programs that ensure economic and environmental sustainability while considering crop needs, soil fertility, application technology, alternative fertilizer sources, and government policies. Research on non-point source pollution of surface and ground water by nutrients will continue. Best management practices for phosphorous will be developed with animal scientists, soil scientists, hydrologists, and environmental engineers. Education/certification programs in nutrient management and water quality will continue. Research on air emissions from poultry operations and methods to control these emissions will be started. (4) Irrigation Water Management – continue extension education and demonstration programs on more efficient water management practices.

14. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations	• Newsletters • TV Media Programs • Web sites • Other 1 (Newspapers)

15. Description of targeted audience

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

16. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2007	1500	2000	100	200
2008	1500	2000	200	400
2009	2000	3000	300	600
2010	2500	5000	400	800
2011	3000	6000	500	1000

17. (Standard Research Target) Number of Patents

Expected Patents

2007 : 0 2008 : 0 2009 : 0 2010 : 0 2011 : 0

18. Output measures

Output Target

Number of Competitive Grants Submitted

2007: 22 2008: 24 2009: 26 2010: 28 2011: 30

Output Target

Number of Competitive Grants Awarded

2007: 6 2008: 7 2009: 8 2010: 9 2011: 10

Output Target

Number of Research Projects Completed

2007: 3 2008: 3 2009: 4 2010: 5 2011: 6

Output Target

Number of Undergraduate Researchers

2007: 7	2008: 8	2009: 8	2010: 10	2011: 10

Output Target

Number of M.S. Graduate Students

2007: 2	2008: 4	2009: 4	2010: 6	2011: 6

Output Target

Number of Ph.D. Graduate Students

2007: 16	2008: 16	2009: 18	2010: 18	2011: 20

Output Target

Number of Post-doctoral Research Associates

2007: 3	2008: 3	2009: 3	2010: 4	2011: 4

Output Target

Number of Refereed Journal Articles

2007: 30	2008: 32	2009: 34	2010: 36	2011: 38

Output Target

Number of Books and Book Chapters

2007: 5	2008: 5	2009: 5	2010: 6	2011: 6

Output Target

Number of Technical Reports

2007: 15	2008: 15	2009: 20	2010: 20	2011: 25

Output Target

Number of Extension Bulletins and Factsheets

2007: 24	2008: 26	2009: 28	2010: 28	2011: 30

Output Target

Number of Invited Presentations

2007: 60	2008: 65	2009: 70	2010: 70	2011: 75

Output Target

Number of Volunteered Presentations

2007: 100	2008: 105	2009: 110	2010: 115	2011: 120

Output Target

Number of Websites Established

2007: 0	2008: 1	2009: 0	2010: 1	2011: 0

Output Target

Number of Workshops Conducted

2007: 30 2008: 35 2009: 40 2010: 45 2011: 50

Outcomes for the Program

19. Outcome measures

Outcome Text: Awareness created

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Short

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

Outcome Type: Medium

2007: 0 2008: 0 2009: 0 2010: 0 2011: 0

Outcome Target

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

soils.

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

Outcome Target

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

Outcome Type: Long

2007:	0	2008:	0	2009:	0	2010:	0	2011:	0

20. External factors which may affect outcomes

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

Description

{NO DATA ENTERED}

21. Evaluation studies planned

- Retrospective (post program)
- During (during program)

Description

We will use similar evaluation studies for all planned programs developed for the 2007-2011 Plan of Work. During this 5-year period we will conduct regular evaluations at workshops, training sessions, and education programs and also periodically survey our stakeholders for input on the appropriateness of our research and extension programs relative to their needs. We will also conduct a retrospective evaluation at the end of this 5-year period to assess the performance of our research and extension programs relative to the Outputs and Outcomes provided in the 2007 Plan of Work.

22. Data Collection Methods

- Sampling
- Mail
- On-Site

Description

Data for evaluation studies will include program-specific evaluation forms collected on a regular basis, periodic surveys of stakeholders and target audiences, input from formal advisory committees, departmental reviews conducted by universities and CSREES, and specific advice provided by program review panels with expertise in each planned program area.