2015 Rutgers Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 05/16/2016

I. Report Overview

1. Executive Summary

The New Jersey Annual Report of Accomplishments and Results is an integrated report reflecting Cooperative Research and Cooperative Extension programs. The report addresses all of the requirements regarding the use of Hatch Funds, Smith-Lever 3 (b) and (c) and required nonfederal funds. As recommended we have streamlined our report to focus on significant qualitative outcomes. The report reflects the work of the New Jersey Agricultural Experiment Station (NJAES). The mission of the NJAES is to enhance the vitality, health, sustainability, and overall quality of the life in New Jersey by developing and delivering practical effective solutions to current and future challenges relating to agriculture; fisheries; food; natural resources; environments; public health; as well as economic, community, and youth development. The NJAES through station supported Cooperative Research and Cooperative Extension focuses on innovative approaches to applying the land grant model to address the diverse needs of a highly urbanized state. Stakeholders have been active partners in identifying critical issues to be addressed.

The NJAES values the contributions that stakeholders make to ensure that all research and extension projects and programs are relevant and responsive to the needs of New Jersey residents. Cooperative Extension continues to expand its programmatic outreach to fully engage new audiences with a special focus on reaching those who have traditionally been underrepresented and/or underserved. Emphasis is given to increasing our urban audience base and to deliver programs which are culturally appropriate to meet the diverse needs of our many publics.

Planned programmatic focus areas which are being reported against include: Climate Change-Water Quality & Quantity; Childhood Obesity-Youth/Adult Obesity; 4-H Youth Development; Global Food Security and Hunger-Agricultural Viability; Climate Change-Home, Garden and Environment; Global Food Security and Hunger-Integrated Pest Management; Global Food Security and Hunger-Aquaculture; Food Safety; and Sustainable Energy.

NJAES researchers and extension faculty and staff have concentrated on these focus areas with relevant, innovative science-based educational programming and research solutions to address critical needs identified by New Jersey residents. NJAES has an organizational commitment to diversity which transcends the work of both Cooperative Research and Cooperative Extension. It is evident as we serve the needs of an environmentally, economically, geographic and ethnically diverse state. We meet the needs of agricultural producers who farm on the urban fringe, youth who are challenged by circumstances such as poverty and risks which impede their success, families who are faced with workforce employment issue and a growing number of families who are food insecure. We strive to implement RCE educational programs to meet the needs of underserved and underrepresented audiences and reduce any real or perceived barriers to participation.

Rutgers Cooperative Extension (RCE) continues to have a strong organizational commitment to diversity and meeting the needs of underserved communities. Programs span the scope of 4-H Youth Development and life skills to urban gardening and environmental issues with an emphasis on lead abatement of soil. Much attention is given to youth from urban communities, such as New Brunswick and Passaic, who have lower graduation rates, higher rates of poverty and unemployment, all of which contribute to educational deficiencies. These programs provid urban 4-Hers with opportunities to take on leadership roles.

As a result of the forecasts by the President's Council of Advisors on Science and Technology estimating the need for approximately one million more college graduates in STEM fields than expected over the next decade to fulfill anticipated jobs. 4-H has designed and implemented programs that highlight the cutting edge science at Rutgers to inspire and educate NJ young people about STEM careers.
In addition NJAES plays a significant role in the State's economic growth by: Funding cutting-edge, innovative research; Fostering technology and innovation transfer to industry; Launching start-up enterprises through incubators and business development support; Providing a well-educated highly skilled workforce; and Developing sustainable growth strategies for urban and rural communities.
As our climate changes, New Jersey can expect more intense storms and more annual rainfall, resulting in more flooding and higher risk for residents and businesses within the Raritan River Basin. To facilitate the implementation of green infrastructure, impervious cover assessments were conducted by Rutgers Cooperative Extension which identified the amount of impervious cover in each of the municipalities and the storm water runoff volumes associated with impervious cover for the New Jersey water quality design storm. This project is laying the foundation to reduce future flooding impacts from the impervious surfaces in the Raritan River Basin, improve water quality, enhance wildlife habitat, and increase resiliency.
Adults in New Jersey, as is the case nationally, are at an increased risk for developing diabetes, high blood pressure, heart disease, and other chronic illnesses while challenged with increasing health care costs. The Department of Family and Community Health Sciences (FCHS) has responded to this need by offering various wellness programs and technical assistance for employers and their employees. In addition, RCE specialist and agents provide resources to teach consumers about health finance and education topics. NJAES researchers are working to identify and understand the health promotion phytochemicals in foods and natural resources, and providing guidance so that individuals and families are able to make informed, science-based decisions about their health and well-being.
RCE faculty work have been working with farms in participating states to establish appropriate crop and market connections for the ethnic immigrant communities in various states. In addition, RCE faculty continue to serve as a resource for women farmers in New Jersey through Annie's Project. In New Jersey this project focuses on creating farm business plans, using social media education and tools, and other education learning opportunities.
RCE faculty have partnered with a number of New Brunswick based organization to develop a Lead-Safe Backyard Gardening Program in New Brunswick. This program provides culturally appropriate education about the availability of clean soil or methods for composting and creating safe soil. In addition, in Salem and Cumberland counties RCE faculty offer educational covering water conservation with rain barrels and environmentally-friendly lawn care.
Urban pests cause billions of dollars of commodity loss, structural damage, and a number of diseases. An RCE specialist conducted a bed bug control program in apartment buildings resulting in several housing authorities adopting the IPM techniques identified by the study.
RCE faculty and agriculture staff continue to address current and emerging grower needs by insecticide testing, research trials on grower-farms evaluating alternative tactics which will reduce insecticide inputs. An integrated pest management program was delivered to commercial blueberry growers that maintained high fruit quality while minimizing pesticide use.
Base funding from the State of New Jersey and from USDA - NIFA formula funds provides NJAES with a foundation for program development and delivery, while competitive grants, contracts, and gifts increase the scope and impact of research and education programs. "Other" funding includes restricted and unrestricted gifts, income from sales and service activities, and patent and plant licensing income. County appropriations include salaries paid by counties to Rutgers Cooperative Extension (RCE) faculty and staff. We gratefully acknowledge the personnel, facilities, and other support that each county provides to Rutgers Cooperative Extension. Increased funding from grants and contracts allowed NJAES to maintain research and extension programs. Grant income is the primary source of support for our nutritional assistance programs, national pesticide testing and pest management services and continuing professional education programs for New Jersey's farmers, businesses, and residents. Grant income in FY15 also supported important research and extension initiatives in horticulture and plant pathology, climate change, water quality, and other environmental research as well as basic research into metabolic

and other influences on human and animal health and wellbeing.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	130.0	0.0	60.0	0.0
Actual	135.5	0.0	52.1	0.0

II. Merit Review Process

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

- Combined External and Internal University External Non-University Panel
- Expert Peer Review

2. Brief Explanation

Merit review is performed by internal peer-review committees at departmental, school and University levels. External peer-review was performed for faculty under consideration for promotion and/or tenure evaluation. Review of scientific merit is also reviewed externally by granting agency panels, journal editorial boards, and external university panels.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (focus group sessions)

Brief explanation.

A variety of methods were utilized to engage our many publics in the program planning and budget process. During 2015 county stakeholder meetings were held throughout the state. The Director

and the Associate and/or Assistant Director of Extension attended a selected number of these meetings. These meetings serve as an open forum for state residents to identify critical issues and needs. Attendees of stakeholder meetings were representative of the diversity of the state's population. Efforts are made to ensure that underserved and/or non-traditional groups and individuals were actively engaged. These meetings also engaged strategic collaborative partners in identifying research needs and extension program direction. Input from these meetings was used to identify emerging issues and guide the program an budget process.

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

1. Method to identify individuals and groups

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

Brief explanation.

At the county and state levels faculty and staff engage partners and potential clientele in a variety of processes to collect input. Individuals who participate in these processes are those who serve on advisory boards, special research and extension committees, leaders of commodity groups, partners who participate on government and service related boards, and individuals who participate in programs. Opportunities to participate in the process of gathering input are widely publicized through newsletters, websites, mass media and work of mouth. Engagement of input from groups and individuals who are underrepresented is proactively done to ensure that extension programs and research initiatives are relevant, responsive and address the diverse needs of our many publics.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

Brief explanation.

Through our county stakeholder meetings individuals participate in open forums where current issues and concerns which impact the county are identified. Stakeholders are active participants in strategic planning processes conducted to identify priority needs which guide research and extension programming. Surveys sent to a variety of different audiences are also utilized to gather data. Extension Specialists engage stakeholders, collaborators, commodity groups, public, private and government officials to identify research needs both applied and basic. Stakeholder meetings and other processes (i.e. focus groups) result in the identification of priority needs on the local and state levels that could benefit from Cooperative Extension programs and or Cooperative Research solutions. Our partners in the educational process are key to helping faculty and staff identify effective methods for providing the research-based information which is the core of the land grant mission of transformation education that impacts individuals, communities, the environment and the quality of life of all.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

NJAES truly welcomes and values the input of our stakeholders. We strive to create welcoming environments where stakeholders feel comfortable and trust what is shared will be carefully considered as policies are set, programs are developed, research direction is set and budget priorities are identified. Stakeholders are critical partners, and their input in necessary to ensure that the work we engage in is relevant and responsive. The NJAES Board of Managers are stakeholders who are actively engaged in the process of providing input on an ongoing basis throughout the year. They attend regular meetings with the Extension and Research Directors to share their knowledge of their local county or special interest areas the represent. They are true representatives of the diversity of research and extension that NJAES extends to the residents of NJ and beyond. Not only do they provide invaluable feedback on issues, but they also function in supportive roles as advocates for our research initiatives and extension educational outreach. Other important sources: N.J. State Board of Agriculture and the N.J. Farm Bureau.

Brief Explanation of what you learned from your Stakeholders

Stakeholders provide valuable information that contributes to the prioritization process for staffing decisions and program development.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
2728570	0	3348251	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	2306089	0	3330356	0
Actual Matching	12131427	0	12324227	0
Actual All Other	2023022	0	2478284	0
Total Actual Expended	16460538	0	18132867	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Climate Change - Water Quality & Quantity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%		10%	
111	Conservation and Efficient Use of Water	20%		20%	
112	Watershed Protection and Management	40%		40%	
133	Pollution Prevention and Mitigation	20%		20%	
605	Natural Resource and Environmental Economics	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	4.0	0.0
Actual Paid	7.0	0.0	3.0	0.0
Actual Volunteer	177.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
140798	0	201202	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
814864	0	879868	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
159529	0	138500	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Work with municipalities to help them meet their regulatory responsibilities on stormwater management and watershed restoration
• Perform experiments to investigate what the current nutrient loads are in NJ water
• Determine the best methodologies for developing Total Maximum Daily Load (TMDL) values for NJ waterways
• Examine the effectiveness of alternative onsite wastewater treatment systems
• Provide scientifically sound advice to state regulatory bodies on water quality issues
• Math modeling of contamination transport in surface and groundwaters
• Create a program comprising of faculty, staff, volunteers, industry partners and government officials

2. Brief description of the target audience

• Municipalities
• State Department of Environmental Protection
• Staff and students who gain valuable scientific experience
• Industry partners who learn ways to meet water quality standards
• Communities who learn watershed restoration methods
• NJAES Faculty and Staff involved in water research/outreach
• School age youth
• Residents

3. How was eXtension used?

eXtension was used in this program through participation in the Water Conservation for Lawn and Landscape. Faculty answered the ask the expert questions, developed collaborative educational products and provided leadership to the CoP.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4198	19793	1130	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	7	17	24

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,and publications.In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short term - Knowledge of nutrient loads in various NJ waterways. Find the best methodologies for determining TDMLs
2	Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.
3	Long Term - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
4	Agrochemical Impacts on Human and Environmental Health: Mechanisms and Mitigation - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
5	Microbial Processes in Bioenvironmental Engineering: Bioremediation, Bioaerosols and Bioenergy - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
6	Transformations and Bioavailability of Mercury in Aquatic Ecosystems - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
7	Using smart sewers to provide safe water to New Jersey - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
8	(Alder)Agrochemical Impacts on Human and Environmental Health: Mechanisms and Mitigation - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
9	Impervious Cover Assessments: A New Tool in Urban Extension to Reduce Flooding and Improve Water Quality in New Jersey - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

Outcome #1

1. Outcome Measures

Short term - Knowledge of nutrient loads in various NJ waterways. Find the best methodologies for determining TDMLs

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Long Term - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Role of Microbial Transformations in the Geochemical Cycling of Mercury

The need for the development and delivery of practical solutions to a myriad of problems associated with toxicity and environmental distribution of mercury is imperative in order to enhance the vitality, health, sustainability and overall quality of life in New Jersey and beyond.

What has been done
NJAES researchers are studying the methylation of mercury in Arctic wetlands. Samples were collected from wetlands in Alaska and analyzed for rates of Hg methylation, biogeochemical markers, and community structure analysis. Several strains of methylating microorganisms were tested for the isotopic fraction of mercury during methylation and research has continued on the transformation of mercury by thermophilic bacteria from hot springs in Yellowstone National Park and on methylation of mercury in Arctic wetlands. The understanding of these processes resulting from the project will serve as the scientific basis for remedial action toward the reduction of mercury contamination, and will provide knowledge to support environmental management decision-making toward minimizing the impact of mercury in contaminated environments.

Results
Results are suggesting that microbial methylation are directly related to the nutrient status of the sampled wetlands. There are mass dependent fractions and preference for lighter isotopes during methylation. In addition, the study has revealed the existence of different pools of mercury in the cells of methylating microbes. The understanding of these processes resulting from the project will serve as the scientific basis for remedial action toward the reduction of mercury contamination, and will provide knowledge to support environmental management decision-making toward minimizing the impact of mercury in contaminated environments.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Agrochemical Impacts on Human and Environmental Health: Mechanisms and Mitigation - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agrochemical Impacts on Human and Environmental Health: Mechanisms and Mitigation

Fresh and saltwater fisheries in New Jersey are a multi-million dollar industry and effects due to contamination can reduce the standing stocks having an economic impact on recreational and commercial fisheries. There is concern among the public regarding the potential impact of pesticides on neurodevelopment following exposure while critical pathways are being formed (i.e. chemical exposure and autism or hyperactivity). Currently many of the pesticides and chemicals used in commerce have not been evaluated for neuro-behavioral effects brought on by in utero exposure. Even to a lesser extent there have not been studies examining behavioral effects in fish exposed from run-off.

What has been done
Over the last five years NJAES researchers have been studying how endocrine and petroleum products entering our ecosystems from sewage treatment plants, spills and particle associate runoff from anthropogenic (man-made) sources may result in biochemical-induced birth/developmental defects that can compromise survival, cause tissue damage, disrupt normal behavior and disrupt reproduction in finfish populations. These compounds are utilized around the world and are present in water and biota throughout the United States and the world. The zebrafish model system used can be directly applied to fish living in the wild and can provide information on conserved biochemical pathways that may translate to impacts on organs/systems in early human development.

Results
NJAES researchers have learned that exposure during sensitive developmental periods of embryonic development can cause permanent changes that are manifested in adult fish that have not been exposed since the egg stage in several different ways. This has opened up a new area of scientific investigation into the physical and chemical associated toxicity from particulates on the cardiovascular system in fish. This research has begun an important conversation about the importance of particle associated toxicity from chemicals adsorbed to their surface when carrying out an ecological risk assessment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Microbial Processes in Bioenvironmental Engineering: Bioremediation, Bioaerosols and Bioenergy - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding and/or controlling microbial communities across a range of environments can allow better prediction of environmental outcomes, restore polluted environments and achieve a more sustainable environment. Common paradigms of behavior of complex microbial systems and systematic methods of study of microbial communities also link these projects.

What has been done
NJAES researchers conducted research to address the identity, function and implications of microorganisms in natural and engineered systems whose activities may have an impact on ecological and human health and environmental sustainability. The research activities focused in three major thrust areas in the field of bioenvironmental engineering: (1) Bioremediation, (2) Bioaerosols, and (3) Bioenergy. The common thread linking these areas is that activities of complex microbial communities greatly affect environmental.

Results
The identification of novel putative aniline degraders expands current knowledge regarding the potential fate of aniline under anaerobic conditions. This work was published in Environmental Science and Technology. Long-term (years-long) incubations of PCDD/F-amended microcosms made with sediment from a variety of contaminated sites were continued. Because of the very slow rates of degradation, monitoring is on-going, however active microcosms have not yet been characterized with respect to the identities of the dechlorinating bacteria. On-going work is monitoring progress of organohalide respiration in long-term microcosms amended with tetra-chlorodibenzo- p-dioxin and examining the impact of electron donor addition on biostimulation. NJAES researchers also found that a landfill in Thailand houses ammonia-tolerant organisms that

acclimated rapidly to a high N model feedstock and operated with high methane production under an imposed TAN of 12.5 g/L. The New Jersey waste (leachate mixed with composting liquids and domestic wastewater) did not exhibit similar robustness.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Transformations and Bioavailability of Mercury in Aquatic Ecosystems - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mercury is a potentially serious public health concern due to its accumulation in aquatic and terrestrial food chains. The consumption of marine and freshwater fish containing elevated concentrations of mercury by women of child-bearing age has been linked to adverse health outcomes for their children (Oken et al., 2005; Grandjean and Perez, 2008).

What has been done
Ongoing research led to the development and testing of a mercury biosensor to evaluate the bioavailability of mercury-thiol complexes and mechanisms of mercury uptake in bacteria, and the examination of the mercury isotopic composition of methylmercury in estuarine sediments, the

mercury isotopic composition of estuarine fish, and mercury isotopic fractionation during microbiologically-catalyzed mercury methylation.

Results
The development and testing of a microbial biosensor for mercury provides a tool to examine the bioavailability of various species of mercury in aquatic systems. These findings are relevant to the assessment of the accumulation of mercury at the base of aquatic food webs. Measurements of the mercury isotopic composition of methylmercury in estuarine sediments are the first such measurements in non-animal environmental samples. NJAES researchers have also determined the mercury isotopic fractionation factors during microbiologically-catalyzed mercury methylation. These findings, together with those for various consumers, may be used to track mercury from its sources through aquatic food webs to upper trophic level consumers including birds and mammals where methylmercury acts as a developmental neurotoxin.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #7

1. Outcome Measures

Using smart sewers to provide safe water to New Jersey - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In New Jersey, untreated sewage frequently contains on average 64 ng/L of polychlorinated biphenyls (PCBs), which is a thousand times higher than the federal surface water quality standard of 64 pg/L. Wastewater also contains unacceptably high concentrations of dioxins, chlorinated pesticides (such as DDT), brominated flame retardants, and other persistent organic pollutants (POPs). Wastewater and drinking water treatment plants are not designed to remove these POPs. Once they are taken up by organisms, POPs biomagnify, or increase in concentration at higher trophic levels, leading eventually to human exposure when people drink contaminated water or eat contaminated food.

What has been done

NJAES researchers are studying the conditions within sewers that lead to the detoxification of POPs, so that sewer design and management can be optimized, allowing the sewer to serve as an anaerobic pretreatment zone that destroys POPs. Researchers have discovered that sewers do a fairly good job of destroying many POPs before they reach the wastewater treatment plant, due to microbial action in the anaerobic portions of the sewer. Biological processes occurring in sewers provide the unintended benefit of waste treatment in the form of reduction of biological oxygen demand (BOD), removal of nitrogen, and total suspended solids (TSS). Researchers have discovered that PCBs and polychlorinated dibenzo-p-dioxins and -dibenzofurans (PCDD/Fs) are also detoxified in sewers. Progress has been made as the group continues to monitor sewer mesocosms containing sewer sediment that are fed biweekly with simulated sewage.

Results

Researchers have found thus far that PCBs show no signs of degradation, suggesting that the half-lives of PCBs in the sewer are long, on the order of years. PBDEs, on the other hand, do show signs of degradation that may have occurred in the sewer system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #8

1. Outcome Measures

(Alder)Agrochemical Impacts on Human and Environmental Health: Mechanisms and Mitigation - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over the last 50 years, reproductive health has declined in both males and females of human populations. Evidence includes increased prevalence of genital abnormalities in boys (hypospadia and cryptorchidism), accelerated sexual maturation in girls, increased prevalence of testicular and breast cancers, and poor semen quality. During this period, developmental and reproductive anomalies have also been documented in wildlife species, and environmental chemicals with endocrine-mimetic properties are suspected as likely causative agents. Epidemiologic and field evidence suggests that the developmental and reproductive pathologies observed above are most prevalent in cultivated areas and are correlated with pesticide use. About 80% of pesticide application is herbicidal, and currently atrazine is one of the most common herbicidal contaminants of ground and surface waters. Furthermore, atrazine is purported to be an endocrine disruptor. Amphibians serve as early sentinels of environmental toxicants due to their common occurrence in and sensitivity to pesticide-containing waters. More information is needed about the low dose effects of atrazine on amphibians.

What has been done
NJAES researchers are studying the environmental and biological effects of agrochemicals in unintended target wildlife. They have completed experiments on the effects of atrazine on the development of larval amphibians (larval frogs).

Results
Researchers have found that atrazine altered the duration of the larval period prior to metamorphosis but did not appear to have measurable effects on other aspects of development. The interest in atrazine is particularly timely, as the leading manufacturer of atrazine for agricultural applications has provided a strong scientific rebuttal to the predominant body of research suggesting that atrazine is a major environmental toxicant. Their research on steroidal growth regulators (androgens and estrogens) is particularly timely in the face of established and emerging knowledge of natural and synthetic estrogens in the environment, in part due to agrochemical applications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #9

1. Outcome Measures

Impervious Cover Assessments: A New Tool in Urban Extension to Reduce Flooding and Improve Water Quality in New Jersey - LONG TERM - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Raritan River Basin is approximately 1,100 square miles in size and contains portions of seven counties and 98 municipalities. Based upon a preliminary land cover analysis of the entire basin, the basin contains approximately 140 square miles of impervious cover or 89,482 acres of impervious cover. For the New Jersey water quality design storm of 1.25 inches of rain over two-hours, approximately three billion gallons of stormwater flows across these impervious surfaces in the design storm. Assuming an annual rainfall of 44 inches, approximately 107 billion gallons of stormwater drains from these impervious surfaces per year. As our climate changes, New Jersey can expect more intense storms and more annual rainfall, which will result in more flooding and higher risk for residents and businesses within the Raritan River Basin. Better management of stormwater runoff from impervious surfaces will help municipalities in the Raritan River Basin become more resilient.

What has been done
The impact from impervious surfaces can be reduced through the use of green infrastructure. To facilitate the implementation of green infrastructure, impervious cover assessments were conducted for municipalities in the Raritan River Basin by the Rutgers Cooperative Extension Water Resources Program. These assessments identified the
amount of impervious cover in each of the municipalities and the stormwater runoff volumes

associated with impervious cover for the New Jersey water quality design storm, the 2-year design storm, the 10-year design storm, and the 100-year design storm. An impervious cover reduction target was determined for each municipality. The assessment also provided several examples of potential locations where impervious cover can be reduced or disconnected.

Results
This project is laying the foundation to reduce future flooding impacts from the impervious surfaces in the Raritan River Basin, improve water quality, enhance wildlife habitat, and increase resiliency. Impervious cover assessments have been completed for 54 municipalities within the Raritan River Basin, and reduction action plans are currently underway for the municipalities. A guidance document for municipalities on "How-To" implement green infrastructure strategies to reduce the impact of stormwater runoff from impervious surfaces on water quality will be produced as part of this project. A sampling of local ordinances and master plans will be reviewed to determine how to incorporate impervious cover reduction strategies into such plans and ordinances. This project will also include the installation of "climate resilient" green infrastructure practices in the Basin to reduce the water quality and flooding impact of impervious surfaces, helping to move these 54 municipalities towards climate resiliency.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

External Factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Childhood Obesity - Youth/Adult Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food	5%		10%	
702	Requirements and Function of Nutrients and Other Food Components	10%		10%	
703	Nutrition Education and Behavior	25%		25%	
704	Nutrition and Hunger in the Population	15%		15%	
724	Healthy Lifestyle	40%		40%	
801	Individual and Family Resource Management	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	0.0	5.0	0.0
Actual Paid	13.5	0.0	8.0	0.0
Actual Volunteer	1998.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
436255	0	507861	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1348217	0	1756224	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
501230	0	669631	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• To identify the factors that promote excessive weight gain as well as protect against childhood obesity
• Measure how children born small for age are different with respect to body composition and risk for diabetes prior to developing diabetes or obesity.
• Collect and analyze data on obesity-related measures (i.e., BMI) in adults and children
• Examine how weight loss affects calcium absorption and bone mass
• Create a multidisciplinary program comprising of faculty, staff, the medical community, industry partners and government officials
• Conduct adult/youth education and deliver targeted messages on healthy food choices and increased physical activity education using the following strategies:

Direct Methods:
• Educate Youth
• Educate Parents
• Educate Volunteers
• Food and Fitness Ambassadors
• Educate Child Health Summit Professionals
• Educate Teachers/School Nurses
• Educate Communities

Indirect Methods:
• Website
• Social Marketing

2. Brief description of the target audience

• Clinicians, Physicians and Nurses
• Health Care Professionals
• Hospitals (including teaching hospitals)
• Staff and students who gain valuable scientific experience
• Industry partners that benefit from fundamental and applied research in obesity and related chronic diseases
• Communities that benefit from increased knowledge about the mechanisms involved in obesity
• Other faculty and staff working on similar research
• Health-related organizations and foundations interested in obesity/nutrition issues
• School Age Youth
• Teens
• Teachers
• After School Providers
• Parents
• Volunteers
• Extension Professionals
• State and County Agencies and Organizations
• Schools

3. How was eXtension used?

RCE faculty used the following CoPs: Family Food and Fitness; Evaluation; Creating Healthy Communities; Healthy Food Choice in Schools; Community Nutrition Education; Child Learning Network. Faculty answered ask the expert questions, developed collaborative educational products, conduted learn professional development sessions and provided leadership to CoPs.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	30574	53510	39352	12237

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	19	35	54

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,publications. In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Individuals gain awareness, knowledge, skills related to: Attitudes about healthy eating for adults/youth. Healthy food choices for adults/youth. Selection of healthy foods for adults/youth. Benefits of physical activity (reduced overweight and obesity, reduced risk of diabetes, heart disease and cancer.) Physical activity recommendations for health for adults/youth. Identify factors that promote excessive weight gain and protect against childhood obesity. Understand the molecular mechanisms of lipid transport in the intestinal cell. Demonstrate the affects on calcium absorbtion and bone mass by weight loss
2	Medium Term - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity. Increased use of new 'campaign' website. Improved understanding of the relationship between early nutrition and later risk for chronic disease. Understanding the process by which perilipins at the surface of lipid droplets control how much energy is released from the adipocyte at times of need. Understanding how the intestines and body uptake and process dairy fat. Identify genes, their protein product and how the proteins influence the way the body processes fat.
3	Long Term - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.
4	Health Finance Education- MEDIUM TERM - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity.
5	The Greenwood Avenue Farmers Market (GAFM) - MEDIUM TERM - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity. Increased use of new 'campaign' website. Improved understanding of the relationship between early nutrition and later risk for chronic disease.
6	Hunterdon Diabetes Care - Community Access to Resources and Education - MEDIUM TERM - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity.
7	Beneficial and Adverse Effects of Natural Chemicals on Human Health and Food Safety - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.
8	Identification and mechanism of antioxidative, anti-inflammatory and antidiabetic phytochemicals in foods - LONG TERM - Individuals experience: Decreased overweight and

	obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.
9	Feeding practices, energy intake, and physical activity as related to childhood weight status - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.
10	Assessing and addressing individual and environmental factors that influence eating behavior of young adults - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.
11	Union County Senior Meals Program: Farmer's Market for Seniors-Long Term-Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

Outcome #1

1. Outcome Measures

Short Term - Individuals gain awareness, knowledge, skills related to: Attitudes about healthy eating for adults/youth. Healthy food choices for adults/youth. Selection of healthy foods for adults/youth. Benefits of physical activity (reduced overweight and obesity, reduced risk of diabetes, heart disease and cancer.) Physical activity recommendations for health for adults/youth. Identify factors that promote excessive weight gain and protect against childhood obesity. Understand the molecular mechanisms of lipid transport in the intestinal cell. Demonstrate the affects on calcium absorbtion and bone mass by weight loss

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year **Actual**

2015 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Family Wellness-Early Learners Promotion of Nutrition, Healthy Lifestyles, and Prevention of Childhood Obesity

Concerted efforts have been made to reverse the trend in obesity among adults and children by way of programs that address risk factors, practical strategies to establish healthier eating patterns and reducing physical inactivity. It is critical to establish a culture of wellness at the earliest stages of human development to protect health and mitigating predisposition to chronic disease. Despite noted improvements in the rates of obesity, certain populations remain at greater risk for obesity, including women, African American, Latino and low-income segments of communities.

What has been done
Particularly in Burlington County, women, African American, Latino and low-income populations remain at great risk of obesity and physical inactivity. The Department of Family and Community Health Sciences (FCHS) offered a series of six workshops to child care/early learning providers and families, three targeted toward child care/early learning providers and three targeted to families. Materials were provided, (i.e. newsletters, factsheets) in parent rooms at county facilities, distributed to families upon child pick-up and at events at the discretion of the facility. Early learning providers had access to online-learning opportunities by viewing webinars created by the Department. Workshops included an introduction to FCHS, family meals, identification of a healthy plate, shopping on a budget and seasonally, getting more fruits and veggies, reading labels and food alternatives, and introducing the garden into the kitchen. Training opportunities were provided to staff pertaining to role modeling, healthy recipes, conducting tastings, and developing and implementing school wellness policies, including how to conduct a facility assessment using the "Let's Move Child Care."

Results
Self-assessments helped to identify goals toward environmental change, and resources for assessing progress with making changes. The observation of adults participating in the monthly Family Wellness Workshops/Early Child Care among adults who participated in the monthly workshops included: all participants felt family meals were important and that this practice strengthened families. A total of 23 staff participated in the workshops and 14 families were represented. Ninety percent (90%) plan to have more than one fruit and vegetable available at mealtime for their families at least half if not more of the time. At least 65% of parents stated they would have a family meal 6-7 days of the week, 75% would serve a whole grain at family mealtime, and 85% would serve a low-fat dairy item. Prior to the program, 95% of participants were not aware of how much sugar or sodium was contained in fruit juice, vitamin drinks, sports drinks, and other beverages. After the workshop, the number of participants who gained awareness increased significantly. Approximately 80% of participants were able to recall at least 3 health benefits associated with fruits or vegetables of different colors. All participants stated they would introduce a home garden or simply a small indoor/outdoor plant like a tomato plant.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food

702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Medium Term - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity. Increased use of new 'campaign' website. Improved understanding of the relationship between early nutrition and later risk for chronic disease. Understanding the process by which perilipins at the surface of lipid droplets control how much energy is released from the adipocyte at times of need. Understanding how the intestines and body uptake and process dairy fat. Identify genes, their protein product and how the proteins influence the way the body processes fat.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food, Nutrition, Health and Wellness

As is the case nationally, adults in New Jersey are at an increased risk for developing diabetes, high blood pressure, heart disease, and other chronic illnesses while challenged with increasing health care costs. Moreover, employers are faced with challenges in managing health care costs for their employees.

What has been done
Workplace wellness programs have shown an increase in wellness knowledge and behavior of employees and encourage adoption of healthier lifestyles. The Department of Family and Community Health Sciences (FCHS) has responded to this need by providing online programs, webinars, and other technical assistance for employers and their employees. Get Moving Get Healthy NJ Workforce (GMGHNJ Workforce), initially piloted in Atlantic County, has been adopted

in several additional counties in the state. Get Moving Get Healthy NJ Workforce was created as a means of engaging employees in a walking program that takes existing knowledge of healthy lifestyle and physical activity and improves the retention of learning after the program. Employees are encouraged to wear a pedometer to track daily activity and walking steps online. The 52-week online program is provided to employees who volunteer to participate in a project to raise awareness of the positive impact on healthy lifestyles.

Results

In 2015 GMGHNJ Workforce reached 18 employers around the state. A follow-up survey was completed by 479 employees resulting in the following data (note - some employee groups that began the program in 2015 have not completed the series, so their follow-up data has not be reported at this time.) Question #1 - Increased knowledge of Body Mass Index: 53% increased knowledge of Body Mass Index 31% reported a Body mass Index of 26 or higher after the weekly focus lesson Question #2 - increased the number of steps taken per day: 80% increased their knowledge of the number of steps taken per day 4% increased their steps to the recommended 10,000 steps per day Question #3 - Have you: 52% improved physical condition 59% lost some body weight 41% lost some inches around the body 33% improved physical appearance 51% fit better in clothing 40% improved level of energy 35% improved sleep 55% improved diet 67% increased consumption of fruit 72% increased consumption of vegetables 32% decreased level of stress 40% increased level of exercise 21% Used strategies to prevent disease Question 4 - Rate your level of physical condition before workplace wellness program 4% Poor, 17% Fair, 48% Good, 30%, Very Good, 4% Excellent. After the workplace wellness program 15% Poor, 34% Fair, 38% Good, 13% Very Good, 1% Excellent. Population demographics 79% female 21% male Age Range: 9% between 20-30, 17% between 31-40, 26% between 41-50, 29% between 51-60, 18% 60+.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #3

1. Outcome Measures

Long Term - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Neural consequences of dietary excess during adolescence

Adolescence is a critical period of development. The increased availability of fatty and sugary foods in recent decades is an environmental factor that has certainly contributed to the obesity epidemic in the United States. The full impact of an obesogenic diet during adolescence on adult behaviors and neural function is unknown. Obesity and other eating pathologies are so difficult to treat because improper stress and anxiety-related behaviors often trigger overeating episodes and eating distress.

What has been done
Based on their previous studies, NJAES researchers are examining the effectiveness of an intermittent caloric intake strategy for weight loss in obese mice. Clinical studies indicate alternate day, intermittent fasting (IMF) protocols result in meaningful weight loss in obese individuals. To further understand the mechanisms sustaining weight loss by IMF, researchers investigated the metabolic and neural alterations of IMF in obese mice to determine how an obesogenic environment during adolescence influences feeding behavior and brain systems involved in controlling appetite and stress reactivity and to understand the long-term influences of adolescent dietary conditions, and how to improve the impact of dietary influence during critical periods of development.

Results
After 4 weeks, the mice following the intermittent fasting protocols of the high fat and low fat diets had significantly lower body weights than the high fat diet alone. Body fat was also lower (40-52%) in all diet interventions. Lean mass was increased in the IMF-LFD (12-13%) compared with HFD and IMF-HFD groups. Oral glucose tolerance AUC was lower in the IMF-HFD (approximately 50%), whereas insulin tolerance AUC was reduced in all diet interventions (22-42%). HPLC measurements of hypothalamic tissue homogenates indicated higher (55-60%) norepinephrine (NE) content in the anterior regions of the medial hypothalamus of IMF compared with ad libitum fed groups, whereas NE content was higher (19-32%) in posterior regions in the IMF-LFD group only. Relative gene expression of NPY in the arcuate nucleus was increased (65-75%) in IMF groups. The novel findings indicate that intermittent fasting produces alterations in hypothalamic NE and NPY, suggesting an involvement in the counter regulatory processes of short-term weight loss are associated with an IMF dietary strategy (Gotthardt et al, Endocrinology.

2015). The NJAES researchers continue to examine the gene expression profile in the pontine and hypothalamic areas of obese-prone and obese-resistant rats.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Health Finance Education- MEDIUM TERM - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many New Jersey residents have health and personal finance "issues" including diabetes, overweight and obesity, low household savings rates, and high household debt and bankruptcy rates. There are also many ways that health affects personal finances and personal finances affect health (e.g., physical symptoms and poor health care associated with financial distress). A need exists to teach consumers about health finance topics (e.g., health insurance, long-term care, financial cost of unhealthy behaviors) and encourage the adoption of behavior change strategies that can be simultaneously applied to improve health and increase wealth.

What has been done
RCE Extension Specialists wrote monthly Small Steps to Health and Wealth? (SSHW) financial

messages that are archived at http://njaes.rutgers.edu/sshw. These consumer-focused messages are also available to media outlets and Extension agents nationwide. RCE Specialist and FCHS Agent, publicized the online Personal Health and Finance Quiz to help users assess their daily health and financial practices and to collect data for research about relationships between health and financial behaviors. The quiz was launched in July 2014 and data for statistical analyses was pulled in July 2015.

Results

Almost 1,500 people took the Personal Health and Finance Quiz in its first 18 months and received personalized feedback. As noted above, data collected from the quiz were analyzed and are being published. The quiz is believed to be the only publicly available (versus proprietary tools developed by employee assistance programs and workplace wellness firms) online self-assessment tool of individuals' health and financial practices combined. The SSHW program, developed by RCE, is being replicated by Extension colleagues in over a dozen states. Individual chapters of the SSHW workbook available online at http://njaes.rutgers.edu/sshw/ have collectively had thousands of page views. The YouTube videos developed to describe the SSHW program and the SSHW workbook have collectively had almost 1,500 views.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management

Outcome #5

1. Outcome Measures

The Greenwood Avenue Farmers Market (GAFM) - MEDIUM TERM - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity. Increased use of new 'campaign' website. Improved understanding of the relationship between early nutrition and later risk for chronic disease.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Trenton has been identified by the Rutgers Center for State Health Policy as the city with the highest prevalence of childhood overweight and obesity (47.3%) among the five cities studied. 31.4% of Trenton residents live at or below the poverty level; 17% of households with children 3-18 years old often or sometimes do not have enough food to eat; 24.7% have no motor vehicle access; and 86% are Black or Hispanic. Trenton's food system consists primarily of corner stores and fast food chains, with one seasonal farmers market in the city catering to state workers, and another on the outskirts, neither easily accessible from many residential neighborhoods. As a result, the need for access to healthy food and in particular, Jersey Fresh produce is evident.

What has been done
As with any farmers market, the core purpose is to provide access to local, affordable, healthy foods. The Greenwood Avenue Farmers Market (GAFM), opened in June 2015, following a year of planning, research and grant writing. Every Monday June through October, the Market offered various food vendors including local farmers, a bakery, a small local grocer providing tropical fruits to meet the needs of the Hispanic community as well as the community at large. NJAES educators and community based volunteers provided cooking demonstrations and food tastings. Recipes were coordinated with the New Jersey Department of Agriculture's seasonal availability guide and the participating farmers' crop availability to ensure that the ingredients were available for purchase, thereby encouraging consumers to prepare the foods at home. Selected recipes were simple and affordable. The GAFM is unique in that it also provided nutritional counseling, health screenings for blood pressure, blood glucose, HIV and vision, and BMI readings through the generosity of the Trenton Health Team, local health providers, Horizon Blue Cross Blue Shield, and the City's IMPACT van, YMCA offered physical activities for children and adults. The market also featured special exhibits such as sun safety, Affordable Care Act counselors and special festival days.

Results
Approximately 1200 consumers visited the Rutgers Cooperative Extension tent (75/week x 16 weeks). Consumer surveys, gathered through convenience sampling (n=21) collected opinions of the recipes and the likelihood of consumers preparing them at home. Of the sixteen recipes demonstrated, satisfaction ranged from 78%-100% and the likelihood of preparing the recipes at home ranged from 83%-100. Data was also collected by partners using a variety of metrics. They report 3940 market customers; 467 health screenings; 100% voucher redemption valued at $4850 through SNAP, WIC, Senior Farmers Market Nutrition Program, and other programs. This is very noteworthy as research reports that EBT use at some farmers markets remains underwhelming. Vegetables were the most frequently purchased product; and freshness and quality were valued most by customers. The market was visited by distinguished guests and was frequently visited by TV and print media and has a social media presence.

4. Associated Knowledge Areas

KA Code	Knowledge Area

701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #6

1. Outcome Measures

Hunterdon Diabetes Care - Community Access to Resources and Education - MEDIUM TERM - Individuals incorporate skills/change behaviors related to: Increased adoption of healthy food practices. Increased consumption of fruits, vegetables, whole grains and low-fat dairy. Increased participation in family meals. Increased participation in physical activity. Increased participation in family-related physical activity.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increasingly health education is moving away from traditional medical settings, (such as hospitals and doctor's offices) and into the community, as experts recognize the need for additional channels of access to these services. This is particularly true for diabetes related outreach. Unfortunately, once people with diabetes receive basic disease-specific education, they often feel left alone to manage their chronic disease. In addition, some individuals may face significant barriers to accessing traditional education, such as those with limited health insurance or non-English speakers. In addition, there appears to be an overall lack of awareness and underutilization of available services on the part of consumers, and may be magnified among certain sub-groups such as older adults and minorities. An unexpected consequence of this trend towards more community based programs may be an increase in inter-agency competition and lack of collaboration.

What has been done

In Hunterdon County there are several organizations offering community-based diabetes education programs so a focused, county-wide diabetes community collaboration was formed,

namely Hunterdon Diabetes CARE- Community Access to Resources and Education. This collaboration aims to increase communication among all stakeholders in the county who are involved with diabetes treatment, education and outreach, and to increase consumer access to these resources. The two target audiences of the project include, members of the diabetes clinical sector including physicians and other health care providers who treat people with pre-diabetes or diabetes; and 2) adult consumers who are diagnosed with diabetes, pre-diabetes, or who are at risk for either of these, as well as their families and caregivers. There is a particular focus on the emerging Latino population in the county, due to their elevated risk for type 2 diabetes as well as presumed lack of access to medical resources, compared to the predominant population. To reduce disparities in diabetes care and outcomes for Latinos and older adults, and foster communication and more effective diabetes outreach. Rutgers Cooperative Extension's role is to provide leadership, evaluation tools, and evidenced-based diabetes education/treatment and health promotion strategies to the Team, which includes the local hospital-based, certified diabetes education center, the local FQHS/dental clinic, the local supermarkets, the YMCA of Hunterdon County, the Hunterdon Help-Line, the United Way of Hunterdon County, and Hunterdon Prevention Resources. As a result "referrals" between community-clinical programs has increased and a social media campaign via Facebook has been implemented to make consumers and providers more aware of existing programs and resources.

Results

As a result of the collaboration the "Team" has been accepted into the national Bristol Meyers-Squibb/Morehouse School of Medicine Partnership for Diabetes Health Equity Learning Collaborative, which features a 3-Element model (clinic, outcomes, community) to close the gap in diabetes related outcomes for minority populations. As one of only 7 teams in the country, the Learning Collaborative will assist in improving clinical care, systems, and processes; bolster community partnerships and collaborations; and ensure effective data collection and analysis to drive rapid quality improvements. There has been an increased communication and collaboration among community stakeholders, due to regular monthly meetings and exchange of program participant data; increased communication has resulted in collaboration on new programs, including planning/implementation of a Stanford Diabetes Self-Management Program and 2 health screenings conducted in the community; a formation of a collaborative Diabetes Care Facebook page to promote diabetes awareness and resources. Team members provide monthly posts and content. Collaborative formation of two monthly type 2 diabetes support groups. Creation of a system of data sharing and "referrals" among community and clinical partners to increase responsiveness to at risk populations. Even though the collaboration is in its infancy, small positive results are being seen. In 2015 a total of 17 consumers with diabetes were referred and enrolled in a community-based diabetes education program. Launch of a clinical partner outreach effort with brochure to inform physicians and other healthcare providers of available community programs for their patients. To date there has been focused outreach to a total of 14 primary care practices to increase awareness of diabetes related education resources in the community. Physician referrals to the hospital-based diabetes education program have increased by 32 patients. The team continues to invest in methods to strengthen stakeholder collaboration, and to educate and encourage physician referral to readily available diabetes education programs and resources.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management

Outcome #7

1. Outcome Measures

Beneficial and Adverse Effects of Natural Chemicals on Human Health and Food Safety - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is a major risk for diabetes mellitus, cardiovascular disease, and some types of cancer. Safe and effective treatment options for obesity are limited. Extracts from the immature fruit of Citrus aurantium (Bitter Orange) are often used as a weight loss supplement, but are reported to produce adverse cardiovascular effects.

What has been done
NJAES researchers are investigating the antiobesity effects of raspberry ketone. Raspberry ketone has purported lipolytic effects. By expanding the examination to include raspberry ketone a determination can be made as to whether the C. aurantium + R. rosea lipolytic effects are similar in their mechanisms of action. Future experiments will also examine naturally derived similarly structured (i.e., phenyl ethanolamine-like) compounds to examine how the influence food intake and body weight loss.

Results
Post-hoc testing revealed that raspberry ketone suppressed food intake, compared with vehicle, at all measured time points ($p < 0.05$ for all). There was no difference in kaolin intake between raspberry ketone doses and vehicle. In order to determine whether raspberry ketone act on the

central controls of feeding, the neural activation by c-Fos immunoreactivity following acute dosing was examined. The focus was on two brain regions,the hindbrain and hypothalamic structures. Data is forthcoming and will be submitted for a peer reviewed publication.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #8

1. Outcome Measures

Identification and mechanism of antioxidative, anti-inflammatory and antidiabetic phytochemicals in foods - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Diabetes is one of the leading causes of death in the United States. The number of people with diabetes has been increasing dramatically, and is expected to reach 366 million worldwide by 2030. Type 2 diabetes, affecting more than 90% of diabetes patients, is strongly associated with oxidative stress and is characterized by insulin resistance. There has been a strong need for safe and effective hypoglycemic agents due to side effects from anti-diabetic drugs.

What has been done

NJAES researchers are working to identify and understand the health promotion phytochemicals in foods and natural resources, and provide guidance so that individuals and families are able to make informed, science-based decisions about their health and well-being. They have sought natural phytochemicals from fresh and processed foods to prevent the formation or trapping of reactive species. The chemical and molecular mechanism for their health beneficial properties was studied.

Results
NJAES researchers found that PMFs have anti-inflammatory, anti-obesity, liver protection and antidiabetic properties. They have also found that a popular anti-aging herb, Polygonum multiflorum has a very good anti-diabetic property. It is believed that this research will help the citrus industry to have value added to their products and American consumers can utilize this information to prevent obesity as well as diabetes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #9

1. Outcome Measures

Feeding practices, energy intake, and physical activity as related to childhood weight status - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
NJAES researchers seeking to identify the age at which physical activity may begin to provide an insulating role against excess weight gain, as well as explore maternal feeding practices that have been identified in the literature as tied to childhood obesity. Research targets low-income minority children and their mothers, and builds directly on this researcher's previous NJAES projects.

What has been done
NJAES researchers have been studying a cohort of black and Latina mothers, tracking their feeding behavior along with the energy intake, activity level, and growth of their infants. The proportion of infants (40%) determined to be at or above the 85th percentile of weight-for-length at 3-years for age and sex was sustained at 4- and 5-years. That is, the 40% of children who were previously shown to be overweight in terms of weight for length, remained overweight, based on BMI-for-age at 4- and 5-years.

Results
Further analysis of the data collected during the first year revealed that mothers who were rated the highest in terms of their sensitivity and responsivity when their infants were 3-months-old were likeliest to be authoritative (fair but firm) in their parenting style at 3-years. And as had been reported earlier, the children of mothers who were authoritative in their caregiving/feeding style when their children reached 3 years of age had the lowest BMIs at ages 3 and 4. In contrast, children whose mothers were classified as indulgent or uninvolved had the highest BMIs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #10

1. Outcome Measures

Assessing and addressing individual and environmental factors that influence eating behavior of young adults - LONG TERM - Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Young adults are at a uniquely increased risk for weight gain because of rapidly changing social situations that influence eating and exercise behaviors. Despite extensive efforts to promote weight management, these efforts only reach a small proportion of the population at risk and even effective programs promoting individual behavior change may have limited effectiveness in environments that promote weight gain.

What has been done
NJAES Researchers are involving the community directly in the research process in order to help the community gain awareness of and interest in the issues that must be addressed to successfully prevent obesity in young adults. This research project is refining and validating assessment tools and developing a prototype Healthy Campus Index that can be used for planning and evaluation at both the personal and environmental levels of the socio-ecological model. There were periodic meetings with the Rutgers community and student leaders on campus to be congruent with the tenets of the PRECEDE-PROCEED model. Beta versions of the software apps for bikeability and walkability, for restaurants/dining halls and food stores as part of the campus environmental assessment survey were tested and refined on multiple campuses. NJAES researchers built their research project on an integrated set of activities that used established research techniques (the PRECEDE-PROCEED model for community-based participatory research) with communities of young adults to basically to develop instrument(s) and strategies to assess and evaluate individualized factors associated with eating behavior and health outcomes; refine and validate environmental assessment instruments for evaluating environmental factors that influence eating behavior and health outcomes; exploring mechanisms of interaction between the identified individualized factors and environmental factors in influencing eating behavior; and to develop a Healthy Campus Index that can be used by higher education institutions around the nation to determine the how supportive their campuses are of promoting healthy weight among their students as well as identify areas of strength and areas needing improvement so that campuses can make meaningful changes that better support young adult health.

Results
The researchers conducted an analysis of the Young Adults Eating and Active for Health [Y.E.A.H] project to assess the effect of cognitive load on student health outcomes and presented research at a professional meeting and submitted a manuscript to a peer reviewed journal. They also created and implemented expanded survey on cognitive load effects on health behaviors and

assisted in refining data repository for data sets generated by this project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #11

1. Outcome Measures

Union County Senior Meals Program: Farmer's Market for Seniors-Long Term-Individuals experience: Decreased overweight and obesity for youth/adults. Decreased risk factors for nutrition-related health problems and chronic diseases that are affected by diet and physical activity for youth/adults. A clear and comprehensive understanding of the genetic and physiological mechanisms of obesity and related chronic diseases. Pharmacological and/or medical treatments to alleviate the effects of obesity and related diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Seniors in urban areas of Union County lack access to fresh fruit and vegetables. Local farmers markets in the community and at senior housing assist seniors in purchasing and consuming fresh produce in their diets June to November each year.

What has been done
The Union County Division on Aging Congregate Meals Coordinator plans and schedules a Senior Farmers Market each year at Senior Housing, Community Centers, and Senior Centers throughout the county. The goals of the Farmers? Market Program are: 1) to provide fresh, New

Jersey grown fruits and vegetables to seniors who are nutritionally and economically at risk, 2) to support New Jersey agriculture, and 3) to offer nutrition education regarding the health benefits of increased fruit and vegetable consumption.

Results
Union County Freeholders, NJ Department of Agriculture and the Senior Meals Coordinator along with Rutgers Cooperative Extension FCHS Educator, SNAP-Ed Supervisor have worked together to maintain a Farmers Market for Seniors for over 15 years. Elizabeth, Plainfield, Roselle, Rahway, WIC in Elizabeth have supported bringing Fresh Produce to Farmers Markets at various sites in Union county fostering a collaborative effort of Rutgers Cooperative Extension, county and city agencies with NJ farmers. The FCHS Educator, Senior Meals Coordinator and SNAP-Ed staff help to provide nutrition education along with distribution of vouchers for produce at the participating markets. Vouchers ($20) for free produce for seniors were distributed in Union County. Three farmers visited 9 towns to deliver produce to Union County senior residents. Nutrition education was provided by SNAP-Ed at the limited resource sites and SNAP-Ed assisted with distributing vouchers to seniors. In FY 2015? - Twelve thousand $5 vouchers worth a total of $60,000 were given to eligible seniors in Union County to purchase Jersey Fresh fruits and vegetables as part of the WIC Senior Farmers Market program. Seniors get a maximum of 4 vouchers @ $5 each or a total of $20 per senior. Transportation to the farmer?s markets was provided by the county paratransit system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

4-H Youth Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
806	Youth Development	100%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	0.0	1.0	0.0
Actual Paid	19.0	0.0	0.0	0.0
Actual Volunteer	3519.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
383182	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1944165	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
584702	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Positive Youth Development:

• Employ Essential Elements (belonging, independence, mastery and generosity) as the basis for life skill development and related workforce development skills.

- Utilize Experiential Education Model (Experience, Share, Process, Generalize, Apply).

Provide opportunities for youth to:
- Feel and believe that they are cared about by others (Attachment, Belonging, Connection)
- Feel and believe they are capable and successful (Achievement, Mastery, Competence)
- Know they are able to influence people and events (Autonomy, Power, Confidence)
- Practice helping others through youth's own generosity (Altruism, Purpose, Contribution)

Subject matter:
(USDA/NIFA Mission Mandates)
Science, Engineering, Technology (includes:science literacy, animal science, plant science, environmental science, life sciences, etc) Citizenship (includes youth engagement, community youth development, community service, character development, civic engagement, etc) Healthy Lifestyles (includes chemical health, mental and emotional health, foods & nutrition, physical health and safety, etc).

2. Brief description of the target audience

- School Age Youth (K - 13, one year out of high school) and their Parents
- 4-H Volunteers (adult and youth)
- Teachers/Educators/other Youth Development Educators
- School Age Child Care Providers
- College Students (interns, collegiate 4-H)
- Other Extension Professionals and University Partners
- Communities: Stakeholders and Non-Profit, Social Service, Government Agencies
- Under-served and Under-represented Audiences

Delivery modes:

- 4-H Clubs and Related Activities
- 4-H Afterschool (clubs and short-term programs)
- 4-H School Enrichment
- 4-H Special Interest
- 4-H Camping (day camps and overnight camping)
- 4-H Mentoring and Individual Study

3. How was eXtension used?

Faculty participated in the development of collaborative educational products.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	38012	0	63554	193587

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	4	0	4

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,and publications.In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Youth increase awareness, knowledge, attitudes, and skills related to essential elements, workforce development, life skill development, and relevant subject matter. Volunteers increase knowledge and awareness of practices fostering positive youth development, including youth/adult partnerships. Youth development professionals and stakeholders increase awareness and knowledge of problems and solutions supporting positive youth development, including: policies that need to be addressed,community resources and support.
2	Medium Term - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
3	Long Term - Youth demonstrate mastery and competencies needed to become engaged by assuming leadership positions in communities; developing and implementing action plans to address community needs, and becoming productive members of the workforce. 4-H youth are engaged partners in decision making regarding RCE programming including but not limited to 4-H youth development programming. 4-H alumni and volunteers become engaged citizens by assuming leadership positions in communities. Youth development professionals and stakeholders influence decision makers in policy development related to youth development needs and issues.
4	New Jersey 4-H goLEAD Youth Leadership Institute - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
5	New Jersey Lindley G. Cook 4-H Camp - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
6	NJ 4-H Public Speaking Program - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
7	Professional Development for Informal Science Educators - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and

	other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
8	4-H is For You! - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
9	Discover the Leader in You! 4-H Conference - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
10	2015 Passaic County 4-H Teen Community Service Week - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
11	Mentor Network - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.
12	4-H Science, Engineering and Technology Program - LONG TERM - Youth demonstrate mastery and competencies needed to become engaged by assuming leadership positions in communities; developing and implementing action plans to address community needs, and becoming productive members of the workforce. 4-H youth are engaged partners in decision making regarding RCE programming including but not limited to 4-H youth development programming. 4-H alumni and volunteers become engaged citizens by assuming leadership positions in communities. Youth development professionals and stakeholders influence decision makers in policy development related to youth development needs and issues.

Outcome #1

1. **Outcome Measures**

   Short Term - Youth increase awareness, knowledge, attitudes, and skills related to essential elements, workforce development, life skill development, and relevant subject matter. Volunteers increase knowledge and awareness of practices fostering positive youth development, including youth/adult partnerships. Youth development professionals and stakeholders increase awareness and knowledge of problems and solutions supporting positive youth development, including: policies that need to be addressed,community resources and support.

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Morris County 4-H Science-sational Day - To demonstrate the value of 4-H promoting Science, Engineering & Technology (SET) skills.

What has been done
A one-day science conference for youth in grades K-6 was held, Morris County 4-H Science-sational Day, with the goal of increasing youth knowledge and interest in science, strengthen skills in inquiry based learning, and introduce available 4-H programs and opportunities throughout the year. Youth participated in an energizing general session then visited three of twelve workshops providing hands-on science experiments. Workshops were presented by adult and teen volunteers from the community and included topics such as chemistry, engineering, biology and physics.

Results
One-hundred eighty youth from 37 towns participated in the 2015 in this event. 134 youth participants indicated on end-of-program evaluations their reaction to the day's programs. 62 parents indicated their reaction to the program through an online survey immediately following the event. 94% of youth viewed the event positively and 88% reported a stronger interest in science because of their participation in the program. 76% of youth reported learning more about 4-H programs and opportunities. 94% of parents reported their child enjoyed the event and 81% reported their child shared something they learned.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Medium Term - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth Urban Farm Club - Urban youth often lack opportunities to gain a firsthand understanding of where their food comes from and the food system that feeds their community. Youth and volunteers in the most urban areas of Essex and Hudson counties were engaged in local community garden sites while learning skills in gardening, animal husbandry, and community service.

What has been done
The Youth Urban Farm Club recruited youth and volunteers through the Master Gardeners, the Rutgers Veterans Environmental Technology Solutions program and local community garden sites in Essex and Hudson counties. All volunteers were trained with resources and skills to lead positive youth-development programming. Youth were recruited through schools, community groups and 4-H members' word of mouth. Youth selected the community garden sites where they wanted to volunteer and signed a program agreement stating their obligation to complete 30 hours of service while maintaining specific attitude and reliability commitments. Six community garden sites were selected based on their flexibility to provide space for youth learning activities, their need for help maintaining the garden, and the availability of hyper local volunteers. Work site roles were established to meet the needs of the garden and its surrounding community. Upon completion of the program, youth and adults were recognized for their achievements in gardening, horticulture and community service at the annual county level 4-H Achievement Ceremony.

Results

Eighty percent of youth surveyed indicated they learned a lot about where their food comes from as a result of participating in the program - 100% of youth surveyed indicated they learned something new or different as a result of participating in the program - 14 adult volunteers dedicated over 250 hours to lead YUFC - 26 youth from 7 different cities dedicated over 780 hours to help build and maintain local community garden sites - 200 short term volunteers dedicated over 400 hours to help build and maintain local community garden sites - 850 pounds of fresh produce was reported to be donated to local community centers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Long Term - Youth demonstrate mastery and competencies needed to become engaged by assuming leadership positions in communities; developing and implementing action plans to address community needs, and becoming productive members of the workforce. 4-H youth are engaged partners in decision making regarding RCE programming including but not limited to 4-H youth development programming. 4-H alumni and volunteers become engaged citizens by assuming leadership positions in communities. Youth development professionals and stakeholders influence decision makers in policy development related to youth development needs and issues.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New Brunswick 4-H Youth Development- Latino youth in New Jersey and New Brunswick in particular, are at great risk due to their poverty and challenges with educational achievement. National research indicates that 29% of early adolescents do not have the opportunity to access community youth programs and that 4-H is typically less prevalent in poor neighborhoods (U.S. Department of Education), which demonstrates that there is a clear need for focused 4-H programming in poor urban neighborhoods.

What has been done

The New Brunswick and Newark Urban 4-H programs provide high context, club-based positive youth development programming to Latino youth in the urban, at-risk communities of New Brunswick and Newark, NJ. Youth in these communities take part in traditional 4-H club programs, and special interest programs working in collaboration with schools and community and cultural organizations. 4-H youth members experience mastery in project areas clubs that fit their interests, develop independence through 4-H leadership, organization and decision-making skills training and opportunities, and demonstrate generosity in club and community-based service learning experiences. This community program is enhanced through the inclusion of Rutgers University students as volunteer leaders, trainers, and mentors. Community-based adults and AmeriCorps and AmeriCorps VISTA volunteers provide support as volunteer leaders and program resource personnel.

Results

In 2015 the New Brunswick 4-H program continued to demonstrate opportunities for 4-H youth to become fully integrated into county, regional and state level 4-H programs through clubs, special interest and after-school programs in the areas of robotics, arts, dance, leadership, science, environmental education, food and fitness, citizenship and gardening. In 2015, there was an increase in Rutgers University students who requested to complete department internships and practicum courses with the 4-H program. Many special interest programs were run in partnership with local organizations and requests for educational programs provided by 4-H have increased. An ongoing partnership with New Brunswick High School has continued to provide up to 15 students serving as interns with the 4-H program annually and assisting with program development and program promotion. New Brunswick 4-H social media sites and websites have successfully been utilized and traffic on these sites has increased. New Brunswick teens served as camp counselors for a county 4-H day camp for the first time in 2015, and teens help plan and run county level fundraisers and events such as the 4-H Haunted House and Project GIFT service learning event. New Brunswick 4-H teens also served as representatives on the North Jersey 4-H Teen Conference planning committee and attended state level 4-H science programs. The New Brunswick 4-H Teen Council and the County 4-H Teen Council have begun to work collaboratively on many programs (another long term goal of the program). Results of end of program evaluations indicated that youth self-reported increases in communication, leadership, and organizational skills as a well as an increased ability to work in a team.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

New Jersey 4-H goLEAD Youth Leadership Institute - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Citizenship is one of the 4-H Mission Mandates and community service is an integral part of every 4-H member's experience. Until a few years ago there were no regional or statewide 4-H educational programs offered to middle school aged youth focusing on leadership and citizenship, despite the fact that more than 25% of our statewide membership are in grades 6-9. It was evident that a programming gap exist; therefore, this was one of the programs created to meet the needs of our clientele.

What has been done
The New Jersey 4-H goLEAD Youth Leadership Institute, which utilized the goLEAD approach, provided an opportunity for 4-H members in grades 6-8 to build their leadership skills as well as enhance their knowledge about how to plan and conduct service projects in their own communities. Two 4-H faculty completed a 2-day facilitator training workshop on the goLEAD curriculum. Program participants learned how to reflect on the impact they are having on their community. goLEAD (generationOn's Leadership, Education, and Development program) is an innovative approach to equip middle and high school aged youth with invaluable 21st century skills that will allow them to change themselves and the world through service and is a program of Generation On, a global youth service movement igniting the power of all kids to make their mark on the world. The goLEAD Institute was held on campus in July 2015 for two-days. In addition to teaching youth about service learning, these 4-H members were also exposed to the college/university experience, such as staying in a dorm, eating in the dining hall, and attending conference workshops in the Cook Student Center. The NJ 4-H goLEAD Youth Leadership Institute participants was designed for youth participants to: 1) learn about the goLEAD approach to service - leadership, project planning and management. 2) learn about the 4-H Citizenship Mission Mandate and the importance of community service. 3) learn about community mapping and how to identify community needs 4) learn how to set goals, plan and conduct a service project in their community.

Results
The target audience consisted of 28 youth in grades 6-9. There were 19 girls and 9 boys who completed the program. Twenty-one percent of the participants represented diverse audiences. Participants expressed great satisfaction with the program. They expressed appreciation for the program content as well as for the excitement in participating in an on-campus program. Evaluation results demonstrated the impact of the program: 90% of the participants indicated that they "Strongly Agree" or "Agree" that as a result of their participation in the conference they have a greater interest in leadership. 100% of the participants indicated that they plan to use what they

learned and 89% plan to share what they learned. 93% of the participants rated the program as "Excellent" or "Very Good." 93% "Strongly Agree" or "Agree" that they expect to get more involved in 4-H service projects. 90% of the participants indicated that they "Strongly Agree" or "Agree" that as a result of their participation in the conference they have a greater interest in leadership. 90% of the participants indicated that they "Strongly Agree" or "Agree" that they have a greater interest in community service. Participant Comments: Favorite aspect of the NJ 4-H goLEAD Youth Leadership Institute/Lessons Learned: They taught me lessons that I can use in life. Sharing new ideas and points of view with others. Being able to meet new people and express your ideas and desires. I learned a lot. I am leaving as a better leader, better communicator, and better citizen. I learned how to greet new people and work with them to make the best possible outcome. A follow-up survey is being planned for spring 2016 to capture the individual impact members may have had on the community over the last year, and the NJ 4-H goLEAD Youth Leadership Institute will be conducted again on June 29-30, 2016 at Rutgers University.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

New Jersey Lindley G. Cook 4-H Camp - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lindley G. Cook 4-H Camp provides youth with a safe environment for fun, hands-on residential outdoor educational experiences; fostering independence, leadership development, respect, tolerance and positive self-esteem. This is accomplished under the guidelines of 4-H and Rutgers

Cooperative Extension principles and missions. The focus of the camp is on social education and encouraging an atmosphere rooted in both respect and kindness. These needs are only more crucial as the new generation of 21st century campers who, through cell phones, technological devices, and social networks are simultaneously further connected and more secluded.

What has been done
Since 1951 Lindley G. Cook 4-H Camp's main goals are to provide a weeklong experiential program to all youth of New Jersey, which promotes 4-H and its curriculum. The camp has provided outdoor opportunities to 4-H and non- 4- H audiences since its inception. Lindley G. Cook 4-H Camp builds independence and self-confidence in our campers. We provide a challenging yet nurturing setting, where youth "learn by doing" in our hands on learning environment based on the philosophy of 4-H.

Results
Seven-Hundred One children attended the summer camp program in 2015 for a total of 903 camper weeks. (a 11% increase from 2014). 347 of the campers were female, and 354 were male. 637 campers were from New Jersey. The campers were from a variety of residential settings. Cities > 50K People 75 Suburbs > 50K People 147 Town < 10K People 88 Town 10K - 50K People 242 Farm 17 16.17% (146) of our camper weeks were occupied by campers in 4-H clubs. 100% of the parents surveyed would have their children come back to camp next year. 100% of the campers surveyed said that they would like to return to camp in the summer of 2015. 65% of the campers in 2015 were returning campers from 2014. 67% of the counselor and coordinator staff had previously been campers here at Lindley G. Cook. One counselor said she returned to be a staff member because "I want to work at 4-H so I can grow our camp spirit with my love for the people and land of LG Cook. I want to do for current campers what I felt in summers past: I spent my 50 non-camp weeks of the year thinking about my counselors who thought I was so special and cool. Then, after a few summers at camp, I realized that I WAS special and cool, and brought that happiness and confidence with me away from camp. Now, it's my turn to show all of my campers how special, funny, cool, and wild they are." Camper evaluations were conducted online after the campers participated in a week of camp. The Campers were asked what they liked best about camp. Here are a few of their responses - "Everything I need to say right now is thank you. Thank you for setting up such a wonderful place to keep me emotionally and physically healthy. Thank you for letting me meet so many different people. Thank you for letting me experience something amazing." "If it weren't for 4H camp, I wouldn't be the person I am to this very second. 4H camp is a life-changing experience that alters your perspectives on the world and on life in general in a positive way." "So yet again thank you for changing my life. And let this message speak for many other campers as well." -"I had an amazing week just as expected. I love meeting up with old friends and meeting new ones. I also loved having some of my friends become junior counselors and being able to be at camp with them just like old times." "Camp is my favorite place in the world. I cry every year at the end and talk about it nonstop during the year. It makes me extremely happy to show other people how amazing camp is and I'm extremely grateful to have something so amazing in my life." Several parents wrote notes of appreciation and positive comments on their evaluations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

NJ 4-H Public Speaking Program - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are 16 identified skills that employers believe are workplace basics and public speaking skills are ranked number one among the skill sets of professionals.
Developing public speaking skills is an important part of being a strong leader, it increases self-esteem and the ability to accept feedback, and expands skills for researching, planning, preparation, and performance.

What has been done
All NJ 4-H counties conduct a 4-H Public Speaking or Presentations program for their members and prepare them for the state level competition. Implementing a standardized evaluation form at the county and state level provides a means of assessing impact on 4-H members learning and practicing these valuable life and workplace skills. The objectives include: Developing leadership talents and work toward character development and effective citizenship; Recognizing the value of obtaining all available information on a given topic; Organizing their ideas and present them in a logical order; Emphasize the major points of a presentation through the use of visuals, technology, and/or examples; Expressing themselves clearly and convincingly; Developing a pleasing personal appearance before an audience and develop confidence; Listening to the opinions of others.4-H Public Presentations are held at the county level in the spring of each year and in June for the state level held at at Rutgers University. Counties use the 4-H Member Guide: How to Make a 4-H Public Presentation to conduct workshops and to train volunteers to help members at the club level.

Results

All 4-H members, grades K-13, are encouraged and eligible to participate at the county level and senior members enrolled in grades 8-13 during the current 4-H year and who receive a score of excellent on a county presentation are eligible to attend the state event. Members that start young and participate annually are more likely to apply for other leadership experiences - such as their county 4-H Ambassador, Equestrian of the Year, and national 4-H recognition trips. 4-H alumni who participated in 4-H Public Speaking when they were younger, come back to tell us that this was their most important 4-H life skill that they learned.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

Professional Development for Informal Science Educators - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While STEM education is a national priority, not all out of school educators (4-H, afterschool programs, etc.) have the background and skills to effectively create and conduct programming.

What has been done
The series of workshops highlighted here addressed four topics pertinent to preparing out of school educators to engage in STEM education: 1) The Project WET (Water Education for Teachers): STEM and Beyond workshop provided a day-long opportunity to learn about water as an integrating topic for STEAM (Science, Technology, Engineering, Arts, and Math). 2) The "What Kind of Scientist RU?" workshop highlighted the multiple ways scientists identify, think about, and

solve problems both qualitatively and quantitatively. 3) Understanding and Using the Six Strands of Informal Science Education introduced participants to the six research-based strands of informal science education that will help prepare youth to be users of science in multiple capacities and how to use them to improve extant programming. 4) The Environmental Problem-based Learning workshop helped afterschool educators develop skills in directing youth through environmental inquiry that led to plans for where to situate a wind farm in the state of NJ.

Results
The targeted audience was out of school educators including: 4-H faculty and staff, nature center staff, afterschool program educators, museum educators, and Master Gardener s. These participants work with youth and the general public in a variety of out of school settings. Based on evaluations from the four workshops, the participants were satisfied with the programs, with the presenter receiving an average of 4.7 on a 5 point scale from poor (1) to excellent (5) and the programs receiving an average of 4.6 on the same scale. Based on program evaluations, participants reported increases in knowledge on all measured components. For example, in the Project WET workshop, on the workshop goal of using water topics to teach multiple subjects, participants' ratings of how much they knew before and after increased 58.3%, and their knowledge of the science of water increased 29.6%. In the Six Strands of ISE workshop, participants? report of knowledge of the traits of informal science education increased 45% and their understanding of how to use the strands to improve their programming increased 32%. In addition, 56% of participants reported that they will use the knowledge they gained to educate youth and the public, and 28% said they would use it for staff training and curriculum development.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

4-H is For You! - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Youth in military families may change schools up to 7-10 times before they graduate from high school. While they are leaving one location and transitioning to a new location, it is difficult to participate in school activities, plays, band, etc. 4-H can be a place where they feel a sense of belonging wherever their location.

What has been done

The following events were planned/implemented by 4-H faculty: (1) Family Night Coffeehouse events at three Armory locations-12 current clubs (non-military) showcased their projects, 60 Guard/Reserve families attended. Adults participated in presentation while youth participated in hands onproject activities. (2) Day camp at Armory-2 days-programs included Healthy Living, Winter Habitats for Animals, Snow Globe makers (Cloverbud age group) - 42 youth attended (3) O?League Sports-STEM series of six programs - 22 youth participated (4) Sewing workshop (3 hours) - 12 youth participated (5) Teen lock-in- Healthy Living program- 40 teens participated (6) Army Reserve-Bring Your Child to Work Day-Healthy Living-85 youth participated (7) Summer Camp Prep- Presentation for the 34 Guard/Reserve youth registered to attend L.G.Cook STEM Micro Camp in June, 2015 (8) National 4-H Science Challenge-Motion Commotion, 20 youth participated (9) Text Talk Act (Mental Health Awareness) - National 4-H project- 21 teens gathered at Armory, accessed round table discussion by cell phone. (10)December Holiday Camp at two armories-Healthy Living-73 youth; Yoga for Kids-20 youth.

Results

Parents have made commitments to volunteer and partner with 4-H staff to offer more programs. The Army Youth Coordinators have assumed the role of marketing 4-H and distributing program information to service branch families in both National Guard and Reserve. Youth participants demonstrate life skills learned in clubs and special programs such as: Four teens have been trained and are working as Health Ambassadors, one youth attended National 4-H Healthy Living Summit in Washington, D.C., another youth obtained funds from Leaders Council and is attending 2016 Leadership Washington Focus, three newly appointed volunteers (one Army National Guard, two Army Reserve), eleven youth joined currently established clubs, one newly established Cloverbud club meeting at Armory, future Action Plan: (1) "Fun 4 Guards" club (4th & up) starting STEM project February, 2016. (2) Obtained Leaders Council funding to send youth to compete at National Engineering Challenge at Purdue. (3) Upcoming Army Reserve Mother/Daughter and Father/Son nights scheduled 4-H hands on activities. (4) National Guard teen lock-in scheduled at Armory. (5) O-League starting new 4-H STEM club in spring, 2016, with two new adult volunteers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

Discover the Leader in You! 4-H Conference - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Leadership is an essential life skill to develop in both youth and adults. Leadership development enables individuals to initiate qualities, which can make them a leader and guide others to be more productive. In today's world, human productivity and success are a result of leadership skills and abilities. The unpredictable challenges of the future emphasize the need for effective leaders. Although every young person has some leadership potential, the skills necessary to be a leader do not necessarily develop in the natural course of life.

What has been done
In an effort to provide opportunities beyond county programming to engage middle school youth in leadership and personal development, as in 2014 the "Discover the Leader in You" 4-H Conference was planned and implemented in Spring 2015. The conference included large and small group interactive and hands-on activities focusing on leadership and personal development.

Results
Sixty-nine (69) 4-H members in grades 6-8, two teen 4-H members and three 4-H staff representing 18 counties (Atlantic, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hunterdon, Middlesex, Monmouth, Morris, Ocean, Passaic, Salem, Somerset, Sussex, Union and Warren) participated in a full day (5.5 hours) leadership conference. The purpose/objectives of the program were to provide an opportunity for program participants to: - Develop an understanding of leadership and who is a leader. - Identify qualities and characteristics of effective leaders. - Develop an understanding of leadership skills and characteristics. - Increase their awareness about the seven leadership life skills (understanding

self, communicating, getting along with others, learning to learn, making decisions, managing, and working with groups). The evaluation methods for this program included an End-of-Program Evaluation. Evaluation results for the 2015 conference are as follows: - 96% of the program participants indicated that as a result of participating in the conference they learned ?a lot? about leadership. - 96% learned "a lot" about leadership skills and characteristics. - 98% indicated that they plan to use what they learned. - 86% plan to take on more leadership roles in their 4-H club and/or county 4-H program. - 100% of the participants rated the program as "Great" or "Good". - 81% of the participants indicated that they "Strongly Agree" or "Agree" that as a result of their participation in the conference they have a greater interest in leadership. 82% of the participants indicated that they "Strongly Agree" or "Agree" that as a result of their participation in the conference they feel comfortable taking on a leadership role. - As a result of participating in the Discover the Leader in You! 4-H Conference, eight youth applied and were selected to attend Leadership Washington Focus at the National 4-H Center in July 2015. - It has been reported by county 4-H staff that program participants have utilized and implemented knowledge and skills learned at the Discover in the Leader in You! 4-H Conference. - As reported by 4-H parents, 4-H volunteers and 4-H staff, program participants thoroughly enjoyed learning about leadership and developing valuable life skills. Two 4-H members set the goal of running for a club officer position and were elected president of their clubs. One 4-H member set a goal of coordinating a countywide community service project and effectively took on this leadership role.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #10

1. Outcome Measures

2015 Passaic County 4-H Teen Community Service Week - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Urban communities in Passaic County tend to have lower graduation rates and higher rates of poverty and unemployment - all contributing to educational deficits. It is important to provide urban 4-Hers an opportunity to take on leadership roles in identifying the needs and ways they can help to make change in their community.

What has been done
Beginning in May 2015 urban teens from the Passaic County Teen Crusaders 4-H club begin planning for their annual teen community service week, which occurs in August. Teens who participate are able to helps those in their communities, learn new things, and make connections with others interested in the area of service; therefore, teens work together to decide as a group on the service activities and learning opportunities in which they will participate. Teens are responsible for planning and implementation of the week. Additional assistance in the planning and implementation was provided by 4-H staff. There is no cost and transportation is provided.

Results
Teens complete an evaluation at the end of the service week. A total of thirteen teens participated in Teen Community Service week during 2015. Eleven teens completed evaluation forms- 85% response rate. Teens were asked to rate each of the following: N = 11 % of Teens who selected Very Good & Excellent # of teen volunteers 64% Length of program 64% Activities 91% Locations 73% Overall Experience 82% 100% of the teens who participated felt that their work throughout the week had an impact on the people/organizations they were working with. Some of the teens commented : "I learned that everyone appreciates my help." "We helped the farmer prepare food for the farmers market. The residents at Preakness enjoyed our company." 64% of the teens felt that their work had an impact on the community as a whole. "Volunteering helps those suffering from hunger in our community, and we educated our youth." 82% of the teens who participated are interested in participating in next years service week and are also interested in helping to coordinate. Teens said they enjoyed volunteering, BINGO at Preakness, working on the farm and working with all the animals at the Sussex County fair. They believed that they gained knowledge and improved skills in all of the following areas: teaching kids, agriculture, farming, multi-tasking, teamwork, cooperation, patience, and communication.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #11

1. Outcome Measures

Mentor Network - MEDIUM TERM - Youth apply knowledge, attitudes, skills, and behaviors needed to become competent, caring and contributing citizens by: taking on leadership roles in their youth organizations and schools, and working in partnership with adults in a variety of settings. Youth and adults demonstrate effective partnerships through increased youth participation on advisory committees and other governing bodies. Volunteers and youth development professionals apply practices fostering positive youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mentoring matters in positive youth development. Youth with mentors are more confident and have fewer behavioral problems. Atlantic City and Pleasantville have numerous mentor programs recruiting from the same audience base, with little to no resources, and in many instances limited training and/or experience with positive youth development.

What has been done
The Mentor Network was initiated to offer a continuum of community-based services, to pool resources, and provide on-going training for directors and mentors. Directors of local mentor programs and recruited volunteer mentors convene monthly from January through June in a collaborative learning relationship that provides the foundation of a positive mentor program, training of mentors, and increasing family involvement. Its primary goal is to help mentors acquire the essential The youth development framework, as described by Roth, Brooks-Gunn, Murray and Foster (1998), includes (a) program elements that present youth with new roles and responsibilities, (b) support for youth, and (c) a focus on enhancing internal assets and competencies. Competencies needed to effectively work with youth. Using materials and curriculum from the Youth and Families with Promise, Connect Curriculum, and the Essential Elements of Positive Youth Development, six 1.5 to 2 hour sessions were conducted on building relationships, communication skills, asset development, and providing positive experiences. Each session also provided time for groups to share problems, successes, upcoming events, and current issues.

Results
In its initial year, those involved have been very pleased with the network and the sharing of ideas, events, and resources. Two groups 4-H was introduced to as part of the network recruited and sent teens to the RU Summer Science Camp once they became aware and several groups pooled resources for buses for college trips rather than each getting a bus and not filling it as happened in past. Mentors have expressed they feel better prepared for their role and know there is a network out there to help with any problems they might encounter. n=21; 8 males & 13 females BEFORE AFTER % CHANGE I enjoy working with youth. 3 3.45 13.16% I feel confident about myself. 3.36 3.91 16.3% I can organize youth activities. 2.78 3.44 23.7% I enjoy teaching/helping others. 2.55 3.09 21% I feel like I have made a difference in the world. 2.8 3.4 21.4% I believe mentoring is worthwhile. 2.91 3.55 21.9% I have good skills to relate with youth. 3.18 3.91 22.9% I understand the needs of youth. 3 3.7 23.3%

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #12

1. Outcome Measures

4-H Science, Engineering and Technology Program - LONG TERM - Youth demonstrate mastery and competencies needed to become engaged by assuming leadership positions in communities; developing and implementing action plans to address community needs, and becoming productive members of the workforce. 4-H youth are engaged partners in decision making regarding RCE programming including but not limited to 4-H youth development programming. 4-H alumni and volunteers become engaged citizens by assuming leadership positions in communities. Youth development professionals and stakeholders influence decision makers in policy development related to youth development needs and issues.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The President's Council of Advisors on Science and Technology forecasts the need for approximately one million more college graduates in STEM fields than expected under current assumptions over the next decade to fulfill anticipated jobs (PCAST, 2013). To meet this goal, the United States will need to increase the number of students who receive undergraduate STEM degrees by about 34% annually over current rates. Therefore, there is a need to recruit and retain students from a variety of backgrounds into STEM fields. In addition, a National Academies report (2007) articulates that personally consequential and authentic inquiry is essential to develop interest in, motivation for, and identity with respect to science and the development of a career path in science. Effective STEM programs employ a combination of both training processes that are sequential and active, with program content that is focused and explicit.

What has been done
4-H County Agents have designed and implemented programs that highlight the cutting edge science at Rutgers to inspire and educate NJ young people about STEM careers. Several 4-H signature programs are: 4-H Rutgerscience Saturdays, 4-H Climate and Environmental Change

Teen Summit, Science of Soil Summit, and the 4-H Summer Science program. 4-H Rutgersscience Saturdays are geared toward middle school age youth (grades 6-8) and designed to enrich young people's interest and competency in science, technology, engineering and mathematics by having direct interaction with Rutgers University faculty, graduate, and undergraduate students. The program offers middle school aged young people the opportunity to engage in hands on activities and demonstrations that highlight a wide variety of STEM disciplines offered at Rutgers University. The program is a combination of demonstrations, tours, field experiences, and hands on activities focused on a different STEM theme. Since 2009, the program has offered programs in topics such as geology, entomology, oceanography, food sciences, and environmental sciences. The Climate and Environmental Change Summit is a multi-day on campus event for middle and high school students designed to increase knowledge and understanding of climate change science through interaction with Rutgers University scientists. Using an action planning process, youth develop community service projects to demonstrate their knowledge of climate change and their creativity in addressing sustainability issues. The 4-H Summer Science program designed to enrich young people?s interest and competency in science, technology, and communications by having direct experiences with Rutgers University faculty, graduate and undergraduate students. This five-day program creates and supports 4-H Science, Engineering & Technology (SET) Ambassadors who share their experience, new knowledge, and understanding of SET topics and campus life with other students in their community through employment and/or volunteer opportunities through local 4-H offices. The youth posted a blog about their experiences with the Summer Science program at http://coseenow.net/summerscience/. Now in its fourth year, the 4-H Summer Science program is maturing into a vibrant STEM program that engages students in learning what it means to be a scientist. The Science of Soil program (SOS) focuses on getting middle school age youth involved in citizen science related to soil health. The program starts with a two day professional development for the educators/leaders. 4-H Agents and staff facilitate a series of Video Teleconferences (VTCs) with the students and selected Rutgers scientists. The students ask questions of the scientists and ultimately develop a poster that they present at an on campus event in the spring. Finally, the 4-H Education team also has several National Science Foundation grants where 4-H Agents and staff engage educators and their students in polar science research. Polar ICE brings together a group of collaborating colleagues from three key institutions: Rutgers the State University of New Jersey (RU), Monterey Bay Research Institute (MBARI), and California State University Monterey Bay (CSUMB). Polar ICE pairs educators and scientists in partnerships that are win-win. Scientists are afforded a productive way of contributing to public education and share their research and understanding of the changes in climate, food webs, and human culture in the Polar Regions. Educators have the opportunity to share their knowledge of science communication and effective practices in reaching young audiences. Together educators and scientists create excitement and contribute to the necessary skills required to meet 21st century workforce needs.

Results

Since 2009, the 4-H Agent and staff conducted formative evaluation on 4-H Rutgerscience Saturday programs to improve the program quality and interactions with Rutgers scientists. From these evaluations it is known that young people are motivated to attend 4-H Rutgerscience Saturdays because they are interested in fun and engaging hands on activities taught by interesting scientists. Approximately 58% of youth have attended more than one 4-H Rutgerscience Saturday program annually. The 4-H Department has partnered with nonprofit youth groups to bring large numbers of underserved youth to 4-H Rutgerscience Saturday programs and with the hope of expanding programming opportunities for these groups to improve young people's identity as someone who can become a scientist and participate productively in the science community. Data for the Climate Change Teen Summit shows the average values of the student self-report assessments both before and after the Climate and Environmental Change

Teen Summit. Students reported significant (Wilcoxon Signed-Rank test p>0.0004) improvements in their ability to work as part of a team, work in adult-youth partnerships, be a leader, serve their community, and develop plans of action. In the 2015 Summer Science cohort, young people were asked what they think about science through a series of item statements about the characteristics of science. Table 1 (n=60) shows positive shifts in young people's perception of what science is and what scientists do. Participants indicated they strongly agree that: Science is for everyone and is useful to all (not for only highly trained people)- Science builds on the knowledge of their peers/others - Science is dynamic and subject to change based on new evidence - Science contributes to our understanding of the natural world. Scientists are creative people For our Polar ICE program: These outreach components provided both a deep dive connection into the content and process of science for almost 1,000 teachers and students as well as connected over 7,000 people throughout the globe to the collaborative. Thus far with polar science education efforts have reached: 22 Science Teachers from grades 6-9 and their students (~950) participated in the year-long comprehensive partnership with the science team. ~7,000 science interested. Members of the general public participated in the 2- hourlong video broadcasts from the penguin colony. How and Why Successful: These outreach components provided both a deep dive connection into the content and process of science for almost 1,000 teachers and students as well as connected over 7,000 people throughout the globe to the collaborative research being conducted down at Palmer Research Station. The teachers and students felt a part of the research mission and were extremely invested in the scientists' work and findings. The participants of the live video broadcasts were able wit witness a live penguin colony and have their questions answered in real time about the birds, ecosystem, and polar research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Global Food Security and Hunger - Agricultural Viability

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
205	Plant Management Systems	20%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		20%	
215	Biological Control of Pests Affecting Plants	20%		20%	
601	Economics of Agricultural Production and Farm Management	20%		20%	
604	Marketing and Distribution Practices	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	65.0	0.0	36.0	0.0
Actual Paid	30.0	0.0	18.3	0.0
Actual Volunteer	4847.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
711773	0	1190977	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
3601892	0	5232670	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
260647	0	415427	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Identify critical programmatic foci/needs based on Extension and stakeholder assessment. These can be broadly defined under three areas:

- Production BMPs (nutrient, pest, waste/by-products management, water quality and quantity, energy)
- Financial BMPs (marketing, labor, risk management, policy e.g. farmland preservation)
- Ag Systems (sustainable ag, organic ag, new crops and use/alternative)

Develop an inventory of local (county based), regional and statewide programs designed to meet these needs; identify team members and their roles.

Create a multi-task effort to generate and share research-based information with clientele through demonstrations, educational meetings and workshops, certification programs, trainings, development of recommendation and decision making guides, etc.

2. Brief description of the target audience

Stakeholders (broadly defined to include producers, processors, marketers, end-users, policymakers, legislators).

Commercial agriculture producers and end-users (such as marketers, processors, consumers, etc.).

Municipalities and other governmental and non-governmental agencies, etc.

3. How was eXtension used?

Faculty participated in answering "ask the expert" questions, participation in Horse Quest CoP, learn professional sessions and the development of collaborative educational products,

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	85146	62033	38870	0

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

Patent Applications Submitted

Year:	2015
Actual:	24

Patents listed
201400070
201300191
201100303
201200098
201300151
201200123
201300344
201300351
201300368
201300381
201300356
201300428
201300249
201300430
201300431
201300432
201300437
201300461
201300479
201300478
201400346
62/188,271
RU 2015-145
RU2013-058

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	70	105	175

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,and publications.In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Increases in knowledge and skills of agricultural and horticultural industry professionals will occur relating to: Nutrient management Pest management Waste/by-products management and utilization Improving water quality and conserving water Conserving energy Marketing skills Labor management Risk management Policy e.g. farmland preservation Sustainable ag and organic ag production methods New crops and use/alternative crops
2	Medium Term - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
3	Long Term - New Jersey's agriculture will remain a viable and important industry. New Jersey residents will recognize the importance of agriculture's contributions to societal well being (open space, quality of life) and will support the agricultural industry socially, politically and economically.
4	Forest Stewardship - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
5	Horticultural Evaluation, Marketing Potential for Spanish Padron Peppers in New Jersey - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
6	Sustainable Improvement of Coastal Plain Soils - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of

	improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
7	Nuances of Marketing Ethnic Specialty Vegetables and Herbs - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
8	Farm Management - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
9	Sustaining Agriculture at the Urban Fringe: Summary of agricultural and food policy initiatives - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
10	New Hybrid Varieties of Processing Tomatoes for New Jersey - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.
11	Effects of Rotational vs Continuous Grazing Systems for Horses on Environmental Quality, Animal Health, and Production Cost - LONG TERM - - New Jersey's agriculture will remain a viable and important industry. New Jersey residents will recognize the importance of agriculture's contributions to societal well being (open space, quality of life) and will support the agricultural industry socially, politically and economically.

Outcome #1

1. Outcome Measures

Short Term - Increases in knowledge and skills of agricultural and horticultural industry professionals will occur relating to: Nutrient management Pest management Waste/by-products management and utilization Improving water quality and conserving water Conserving energy Marketing skills Labor management Risk management Policy e.g. farmland preservation Sustainable ag and organic ag production methods New crops and use/alternative crops

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Medium Term - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

NJ Animal Science Programs - New Jersey is a state with a rich history of agricultural roots; however, New Jersey is becoming an ever more urbanized state. Youth interested in learning agricultural practices, especially related to large animals, have increased difficulty finding that information. The 4-H Animal Science program provides youth with options such as 4-H Goat

Project, Equine Science, etc.

What has been done

In 2015, the 4-H Department Liaison to the New Jersey 4-H Goat Project, worked with volunteers from the NJ 4-H Goat Advisory Council to plan and coordinate the NJ 4-H Goat Extravaganza (presentation contest, skill-a-thon, quiz bowl, art show, and workshop for parents/volunteers), NJ State 4-H Goat Show, NJ State 4-H Sheep and Goat Video Contest, and other educational efforts including participation in the New Jersey Junior Breeder Livestock Symposium. Members, parents and volunteers focused on youth increasing their awareness and understanding of current issues in the animal industry and the breath of career opportunities in the animal industry. Similarly, the State 4-H Equine program is comprised of several events over the course of the year: Model Horse Show is available to any horse club member regardless of ownership of a living breathing horse where youth display their knowledge of horse breeds, ability to determine the sex and age of a horse and the type of a horse; Horse Bowl is a quiz bowl type of competition where youth use buzzer boards to answer questions related to physiology, breeding, feeds, nutrition, styles of riding, tack, coat colors or diseases; Horse Judging and Hippology are competitions where youth utilize their equine knowledge to place a class of horses as a Horse Show judge would do as well as use skilla-thon stations, slides and quizzes to test their equine knowledge. Those competing in Judging also use their public speaking skills to justify why they placed a class of horses the way they did by giving oral reasons to a judge. The State 4-H Equine Presentations contest encourages youth to research a subject and speak on it to an audience. The State 4-H Horse Show is a culminating event for those youth who have access to a horse and ride in their county shows. Youth in this event have earned the right to be here by competing on the county level and being judged as excellent or very good in their particular class (es) for some of these youth who board their horse it is the first time they are solely responsible for the care of their horse. It can be quite a learning experience for them.

Results

In 2015, 47 4-H members from six counties exhibited 137 goats. In 2015, the NJ 4-H Goat Advisory Council coordinated the small ruminant track of the Junior Breeder Livestock Symposium. Each year, 4-H members participating in state level educational programs complete a survey with a 1-5 Likert-type scale (1-Strongly Disagree to 5-Strongly Agree). Based on 322 surveys from the nine years between 2006 and 2014, youth self-report that they are gaining knowledge and skills of goat care and management practices, but also teamwork, communication, and leadership skills. - 88% improved teamwork skills. 87% gained knowledge of goat care and management practices. 86% gained the skills necessary to safely care for their goat (s). 82% improved communication skills. 77% improved leadership skills. 59% increased understanding of current issues in the animal industry. 57% became more aware of career opportunities available in the animal industry. Youth also reported (in an open-ended response) the two most important things they learned or gained as a result of their involvement in the 4-H goat project. 69% indicated the proper care and management of their goat (s). 28% indicated showmanship skills. 21% indicated information about goat products and uses. 13% indicated knowledge of breeds and types of goats. 13% indicated leadership skills. 10% indicated record keeping skills. 10% indicated public speaking and communication skills. 10% indicated gains in personal responsibility. 26% indicated the development of some other type of life skill - including organizational, social, teamwork, and goal setting skills. From those in the top 10, a team of 4 youth were prepared for the Eastern National Round Up competition. Our state winning Individual Presentation also came in 10th overall in that same competition. Horse Judging and Hippology- 66 youth from 10 counties participated in this state competition in 2015. Our State 4-H Horse Judging team competed at the Eastern National 4-H Round up and came in fourth place over all. In 2015 there were 269 horse/rider combinations from twelve counties competing in three days of

classes. All of those participants 200 completed an evaluation asking them to list at least 1 thing they learned from this experience and how they will use what they learned. 30% indicated they will use the equine knowledge that have gained from this experience in their career (several indicated they wish to be a veterinarian in the future), 30% indicated they learned to work as a team 20% indicated they learned a great deal about the anatomy of the horse, 20% indicated they will use this information in college, 15% indicated they gained valuable communication skills.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #3

1. Outcome Measures

Long Term - New Jersey's agriculture will remain a viable and important industry. New Jersey residents will recognize the importance of agriculture's contributions to societal well being (open space, quality of life) and will support the agricultural industry socially, politically and economically.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Coordinated Wine Grape Variety Evaluations in the Eastern USA -
The wine industry is in need of information about the performance of both traditional global cultivars that have not been widely grown in this region, some of which may be minor cultivars with specific niche potential for New Jersey vineyards (e.g. Albarino), as well as emerging cultivars from breeding programs. The economic viability of vineyards is being enhanced by the expansion of the choices of cultivars to be produced. For operations that attract agritourists the increased diversity of grape cultivars adds to the variety and therefore interest in their wines and

their operations. As part of a multistate research project, the results of this study are being compared to and validated by results from similar plantings in other areas. This synergy will add to our understanding of the value as well as the limitations of applying results from other locations to our situations in New Jersey. The long-term impacts also include reducing the environmental impact of producing wine grapes by identifying disease and pest resistant cultivars, and facilitating breeding by increasing our understanding of genotype x environment interactions.

What has been done
The vineyard that was established at Rutgers Agricultural Research and Extension center has begun to yield important data for the industry regarding performance of some very promising cultivars for New Jersey. This year four grower educational sessions have been presented covering grape cultivars for New Jersey that were informed by results from this study. Information for new and beginning growers was presented at the NJ Atlantic Coast Agricultural Convention in a day-long format. Early field results have been augmented with the results from cold winters that revealed differences among cultivars that have been brought to the attention of the industry stakeholders.

Results
This project has changed the understanding and awareness of the target audience with regard to the suitability of some previously untested wine grape cultivars for New Jersey. Furthermore, the sensitivity of wine grapes to some phytotoxic agents has been revealed during the course of the project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #4

1. Outcome Measures

Forest Stewardship - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Almost one hundred and twenty thousand landowners own approximately 1.3 million acres of forestland in New Jersey, yet less than 15 percent of those owners actively manage their forestlands. Because of increasing developmental pressures, the increasing value of the state's forests for open space, water, wildlife, quality of life and traditional forest products, and the increasing threat of invasive species, it is more important than ever that these private lands are actively and sustainably managed.

What has been done
Five presentations, field days, evening workshops and Tree Farm Day were planned and conducted primarily targeting private woodland owners and master gardeners. Topics included southern pine beetle, emerald ash borer, sirex wood wasp, viburnum leaf beetle, and thousandcanker disease, farmland assessment, tree identification, avian habitat, timber stand improvement, timber salvage, and forest management plans. The fifth NJ Woodland Stewards program was completed, training volunteers to promote forestry. Backyard Forestry in 90 Minutes is a new program primarily targeting homeowners and landowners owning less than 5 acres. RCE Specialist co-authored an 84-page book, "My Healthy Woods: A Handbook for Family Woodland Owners Managing Woods in New Jersey," targeting non-managing woodland owners. Five on-line newsletters were published for woodland stewards and one newsletter for Forest Stewardship woodland owners was published.

Results
Approximately 170 landowners and 60 master gardeners attended the programs conducted on forest stewardship. Participants express overall satisfaction with the program, with most suggesting future program topics and many attending more than one program annually. One presentation on invasive species, was made by request to a master gardener audience.Presenting pertinent, readily adapted/applied management information and alternatives can help provide incentives for landowners to sustainably maintain their open space and woodlands through active forest management. With the average size of forestland ownership in New Jersey of 15 to 20 acres, some 2,550 to 3,400 acres have benefited from more knowledgeable landowners, subsequent better management, and a higher likelihood of remaining forested. The fifth NJ Woodland Stewards program graduated 16 volunteers. The potential impact of the new volunteers is significant: each volunteer is expected to spend 30 hours during the following year promoting forestry in NJ. At the current federal volunteer rate of $20.85/hour, their efforts will be valued at over $10,000. An average total of 360 people attended Backyard Forestry

Minutes. Attendees will be surveyed in 2016 to assess changes in knowledge and awareness.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #5

1. Outcome Measures

Horticultural Evaluation, Marketing Potential for Spanish Padron Peppers in New Jersey - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Evaluation is needed to determine feasibility of growing Padron peppers native to the Gallicia region of north western Spain to South Jersey environments and the marketing potential of peppers that currently sell for 10 to 15 X more money than the peppers currently grown.

What has been done
RCE faculty and Ag staff are growing plants that developed into a randomized block study to test adaptability to New Jersey climate, study the prescribed levels of fertility namely nitrogen that the plants need, and to test market the acceptability of these peppers to consumers via existing farm markets in the area, and the price sensitivity in selling these specialty peppers was addressed.

Results
Growers see the opportunity for improving profits in a new crop area that they did not know existed. The study test marketed the peppers at 6 prominent local farms at different price sensitivities which resulted in sales for $6 to $9 per pound. At national web sited these peppers retailed for $17.95 per pound and at Whole Foods they sold for $4.99 per 1/4 pound. Growers have reported already obtaining seed for this coming season to do their own test markets.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #6

1. Outcome Measures

Sustainable Improvement of Coastal Plain Soils - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year **Actual**

2015 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Coastal plain soil farms require a soil improvement toolbox outside of cover crops, manures, and longer rotations. Municipal collected un-composted leaf applications are part of the solution. Coarse, low organic matter soils comprise 60% of NJ. These soils, and the farms on them, form the backbone of NJ's $1 billion commercial farming. If they lose productivity, the farmers on them lose viability and sustainability.

What has been done
Three field demonstrations using surface leaf mulching on organic white potato, sweet potato, and lima bean were completed by NJAES faculty and Ag staff and results outreached at events and blogged. For incorporating leaves, field events and workshop trainings were held. A signature accomplishment was NRCS NJ inclusion of municipal leaves under their Mulching Standard Code 484 for EQIP cost-share eligibility as a result of SARE PDP.

Results
Soil organic matter increased, reducing incidence of soil borne disease and demand for spraying to combat disease. Soil water holding capacity increased, reducing irrigation water demand. Thousands of tons of community organic waste streams are beneficially reused on agricultural fields that would otherwise cost municipal taxpayers money to manage and compost.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #7

1. Outcome Measures

Nuances of Marketing Ethnic Specialty Vegetables and Herbs - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Growing ethnic populations of first- and second-generation immigrants in the Mid-Atlantic Region and along the East Coast offer farmers marketing opportunities to provide fresh produce native to these groups' homelands. Asian, Hispanic and African populations are growing at rapid rates in the region, and specialty groceries and restaurants are increasing to serve ethnic foods to both the ethnic populations and the general public. Providing the fresh produce common in these cuisines is an additional niche for fresh produce growers.

What has been done
RCE faculty and Agricultural staff have worked with farms in each of the participating states establishing appropriate crops and market connections for the ethnic immigrant communities in each state. New and existing farms have begun/expanded production of African, Hispanic, and Asian crops based on opportunities presented through this program.

Results
Participation includes existing vegetable growers and new/beginning farmers, including recent immigrants, exploring alternative markets. Local participation includes several existing vegetable growers, one new recent immigrant farmer, and several beginning farmers. All have shown positive returns on ethnic crop enterprises added to their new or existing operations. Objectives are: - To characterize the size, growth patterns, and produce preferences of major ethnic populations of the East Coast. - To determine production characteristics and economic potential of selected ethnic vegetables. - To facilitate coordinated production of selected ethnic vegetables by growers in several East Coast states to create a year-round supply of consistent quality and quantity. - To identify and evaluate production systems for specific ethnic crops that have potential marketablilty in the MidAtlantic region. Program Design & Content - Grant funded studies of Ethnic communities and consumers, purchasing habits and food selections - Identification of potential crops that can be grown successfully and profitably in Mid-Atlantic and East Coast regions - Evaluation of specific crops and production systems suitable for local farms Program Delivery & Educational Materials - Field demonstration-research trials - NJAES, Journal and regional/national popular press publications such as http://www.growingproduce.com/vegetables/how-to-be-successful-growing-ethnicvegetables/1/#/BlackoutGallery/64236/4/ ? Ethnic Crop summaries presented at farmer

NY) - Updated and increased resources available on worldcrops.org website. A recent refugee immigrant from Liberia was able to purchase a small farm and expand his PYO operation with assistance of RCE and USDA Farm Service Agency based on collaboration with the project in previous years and has been featured in national media from NY Times, Reuters, NPR via FI2W.org, and on the USDA's Blog. Conference held in late 2014 led to contacts with wholesale buyer-shipper-distributors at the Philadelphia Wholesale Produce Terminal and other regional food businesses looking to source more locally produced ethnic crops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #8

1. Outcome Measures

Farm Management - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are over 1500 women in New Jersey who identify themselves as primary operators of their farms. It is imperative in order for them to succeed that they are well informed on risk management and farm business management.

What has been done

RCE specialists and Agricultural staff have completed 5 years of Annie's Project. Annie's Project New Jersey is tailored to New Jersey farmers and differs from Annie's Project in other states in five key areas: 1) the focus on creating a farm business plan throughout the training, 2) the use of social media education and adoption for marketing and business development, 3) the use of social media tools to assist the participants in networking that is sustainable and interactive, long after the course is completed, 4) using a unique combination of in-person education and distance learning opportunities to expand the audience within the program, and 5) recording the distance learning sessions for asynchronous education of participants and additional women farmers following the completion of the live course. Courses were offered in different parts of the state to reach women who couldn't spare the time to spend 6-8 weeks taking the more detailed, traditional course. This concept was taken abroad per Rutgers' mission, Jersey Roots, Global Reach. Later that year the concept was taken to Turkey where it became Suzanne's Project. In 2013 Suzanne's Project went to Guyana. Suzanne's Project was tailored to local conditions and included business management, technical topics and computer literacy. In 2013, an added an International Service Learning component called Empowering Turkish Women Farmers. Five students went abroad to live on farms in Boztepe Turkey to develop case studies for future Suzanne's Project classes. In 2014, Annie's Project for Greenhouses was offered, and in 2015 Estate Planning was offered in three locations in New Jersey.

Results

Annie's Project New Jersey has resulted in scholarly deliverables as well as positive changes in the lives of program participants. In addition to serving as a resource for farmers in New Jersey, these resources are being used in other states. The project has been widely reported in the news media in New Jersey and in Turkey. Several of these presentations have been published in proceedings of the conferences, and the project team is working on publishing the results in professional journals with particular emphasis on follow-up impacts. In addition to extensive courses, we have also created webinars. A new group that was added were U.S. veterans who are interested in started agricultural businesses. This program has been modified for local conditions and taken to Turkey and Guyana where it has received equally positive results, local support, and tremendous local press.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #9

1. Outcome Measures

Sustaining Agriculture at the Urban Fringe: Summary of agricultural and food policy initiatives - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Programs to protect farmlands through the acquisition of agricultural conservation easements (often called purchase of agricultural conservation easement, or PACE, programs) have been created in 29 states. Three other states have authorized such programs. Collectively, these programs have permanently protected nearly 2.6 million acres of farmland. NJ is a leader in farmland preservation, evidenced by the fact that 31 percent of the state's remaining farmland base is protected under conservation easements. Research on the outcomes of these programs (i.e., uses of land, transitions to new owners, effects on farm businesses), as well as landowner behavior and perceptions of program participation post-preservation is limited. Therefore, little is known about the program's impact on the profitability, structure, adaptations, and demographic characteristics of NJ farms. Filling this knowledge gap will provide useful information for program administrators charged with operating PDR programs, policy makers, and farmers. Research and Extension work in this area can also inform the future of these policies. Commercial agriculture's economic viability is increasingly influenced by factors beyond the control of the farmer. Some measures suggest that farm viability is becoming more constrained, particularly among smaller family farms. Agritourism offers farmers the opportunity for product/service diversification, expansion of farm income, and other ancillary benefits. However, agritourism is a new business paradigm for many farmers, requiring educational resources needed to successfully plan and

transition operations. Areas of particular importance include farm safety, liability management, employee training, and marketing.

What has been done

Extension scholarship is actively integrated into policy discourse via service on the NJ State Agriculture Development Committee. A new Land Link website for the state of New Jersey (http://njlandlink.org/) was created to facilitate access to farmland by those seeking properties to lease or purchase. The website allows users to enter custom-queries to search for farm properties aligning with their search criteria. In addition, the RCE Agritourism Working Group remained active in 2015 and continued to perform on-farm site assessments of marketing, farm safety, and liability management practices. A significant regional "train-the-trainer" grant awarded by Northeast SARE was successfully completed. The project website, "Extension Training for Agritourism Development," (http://agritourism.rutgers.edu/training/) is hosted within the NJAES website, remained an important outreach resource for training and educational tools and information developed as part of the NESARE project and broader RCE programming. Overall project impact statistics were compiled in 2015 for final reporting to NESARE. From late 2013 through 2015, the multistate program team delivered 31 workshops, conference presentations, educational sessions at state or regional agricultural conventions, in-service trainings, webinars, and other training events. More than 1,450 farmers, Extension professionals, and agricultural service providers were trained or presented with educational resources. An Extension team, formed under the auspices of an Agritourism Working Group, performed five farm visits in 2015 to provide tactical assessments and guidance on safety, liability management, marketing, and other aspects of agritourism business operations.

Results

Research findings continue to be of interest to/requested administrators of state and county farmland preservation programs. This research is relevant to current policy discussions in NJ and other states related to the succession of farmland to new and young farmers, deed of easement interpretation, and (related) the development of right to farm protections for emerging farm-based activities. Web Activity Metrics (2015): The new Land Link website (http://njlandlink.org/), launched in April 2015, had 7,831 page visits. The site is now actively promoted by NOFA-NJ, NJ Department of Agriculture, and NJ State Agriculture Development Committee. Summative impact statistics for the NESARE-funded "Development of Extension Programming to Support the Advancement of Agritourism in the Northeast" project. Through August 31, 2015, 24 project participants that they had used project training and/or disseminated project materials to an estimated 1,681 farmers in their service areas. Training participants further reported that changes in marketing practices were the most common outcome observed (reported by 313 farms), followed by improvements in farm safety practices (n=207 farms), liability or risk management strategies (n=190 farms), and employee training procedures (n=126 farms). Web Activity Metrics (2015): The "Extension Training for Agritourism Development" web page (http://agritourism.rutgers.edu/training/) had 6,931 page views. Program materials are routinely requested/used by Extension personnel, agricultural service providers, and farmers from across region and nation. Several thousand print materials derived from the website were distributed in 2015 at various training programs, agricultural conventions, and farm visits. More than 220 farms registered on the VistNJFarms.org website. The site had 101,217 page views. Day-to-day management of the site (e.g., farm registrations, event postings, etc.) is now under the NJ Farm Direct Marketing Association. Plans for developing a mobile device version of the website began in late 2015 and will be executed in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area

205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #10

1. Outcome Measures

New Hybrid Varieties of Processing Tomatoes for New Jersey - MEDIUM TERM - Productive agricultural land is stabilized to meet the needs of the agricultural industry and the needs of people of NJ. Agriculture remains a relevant and viable economic sector as profits increase (through reduced costs and/or increased or new sales or revenue streams). Measurable reductions in environmental impact (clear and adequate sources of water, reduced waste, reduced soil losses, reductions in non-point source pollution, etc.) will occur through the adoption of improved and sound management practices. Overall state environmental quality will be enhanced by agriculture, such as through the utilization and recycling of biowastes generated by the non-ag sector or the enhancement of air quality. The products of NJ agriculture will add to the nutritional quality of New Jerseyans food supply.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Tomato processors in the mid-Atlantic U.S. are forced to use varieties developed in the western U.S. that are not adapted to climate and growing conditions. These non-adapted varieties are more susceptible to disease pathogens that plague the mid-Atlantic, but are absent in the western U.S., severely reducing crop quality and profit potential for growers and processors.

What has been done
New hybrid varieties of processing tomatoes have been developed from recurrent selection in the mid-Atlantic U.S. region. These varieties were developed using conventional, and not molecular/GMO, technologies. Grower/cooperators were provided with seeds of the new varieties, that were produced in small (2-5 acre) test plots.

Results
Of 162 new candidate hybrid varieties, two have ultimately been selected for larger-scale increase and production on substantial (>100 acre) production farms. The seeds are made available to growers at a lower cost than commerciallyavailable seeds (55% less) and the yields and quality are on par with the best commercial varieties. It is anticipated that these two varieties will out-perform the commercial products during more stressful, moist years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #11

1. Outcome Measures

Effects of Rotational vs Continuous Grazing Systems for Horses on Environmental Quality, Animal Health, and Production Cost - LONG TERM - - New Jersey's agriculture will remain a viable and important industry. New Jersey residents will recognize the importance of agriculture's contributions to societal well being (open space, quality of life) and will support the agricultural industry socially, politically and economically.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Grazing livestock on pasture is an effective way to meet nutritional needs if done properly. However, it is important to understand the needs of the pasture vegetation and soils as well as those of the grazing animals. This interaction has been studied in many livestock species, but data is lacking for horses. Equine recommendations cannot be extrapolated from other livestock

data because horses exhibit different grazing behavior, such as biting plants closer to the ground and choosing plants more selectively than other species.

What has been done
RCE Specialists and agricultural staff have been grazing the horses on the newly renovated pasture systems since August 2014. Since the grazing started samples have been taken either monthly or once per season (spring, summer, fall, and winter - only if not snow covered). The grazing and sampling continues for another year and will end August 2016

Results
The results of this project have the potential to influence the pasture management decisions of many of these operators. From an economic perspective, teaching farm owners how to reduce costs through rotational grazing can impact the sustainability of individual businesses, which together helps the entire industry remain stable. This study will be the first to tie together soil, vegetation, horse health, and productivity in one experiment to discover the full effects of pasture management. Horse farm owners will benefit from the evidence pertaining to which grazing system is more efficient and cost-effective. With the first year of the study completed a pasture walk for stakeholders was held in July. The participants came with their pasture related questions. Evaluations from the surveys showed that participants knowledge of the topics presented increased significantly changes to their farm management because of something they learned at the program. The project team for this study is involved with a regional USDA project called NE1441: Horses and the Environment. This five-year multi-state project will incorporate the best regionally available data about animal use, feed, manure storage and disposal, pasture/cropping management, soil and environmental quality, erosion control, and site characteristics to meet the goal of minimizing negative environmental impacts of equine operations on soil, water, and air quality. Participating states include NJ, VT, MA, SD, MD, LA, MN, CT, NC, MI, and PA.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

No external factors to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Climate Change - Home, Garden and Environment

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%		20%	
111	Conservation and Efficient Use of Water	20%		20%	
131	Alternative Uses of Land	20%		20%	
205	Plant Management Systems	20%		20%	
721	Insects and Other Pests Affecting Humans	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	10.0	0.0
Actual Paid	14.0	0.0	4.1	0.0
Actual Volunteer	1048.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
310337	0	287342	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1563549	0	1407007	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
260445	0	350062	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Identify critical programmatic foci/needs based on Extension and stakeholder assessment broadly defined under two areas:

- Environmentally sound gardening/lawn care
- Home horticulture-lawn, garden and grounds management
- Commercial horticulture - professional management and maintenance
- Environmentally sound household, structural pest control
- Home pest control-termites, carpenter ants,, etc.
- Human-heath related pest control-bed bugs, mosquitoes, ticks, etc.
- A school IPM program will be developed to train end-users sound management techniques,

Develop an inventory of local (county based) and regional and statewide programs designed to meet these needs. Identify team members and their roles. Create a multi-task effort to generate and share research-based information with clientele, including research, demonstrations, educational meetings and workshops, certification programs, trainings, etc. Research on plant cultivars that exhibit increased disease ans insect resistance , as well as reduced need for fertilizer and irrigation water, will lead to reduced dependence on chemical control of pests and disease, lessening the impact on the environment.

2. Brief description of the target audience

Stakeholders:

- Homeowners and residential clientele
- Commercial horticulture professionals (management and maintenance)
- Commercial pest control operators
- Public health officials
- Local environmental commissions or others that have interest in these areas
- Municipalities and other governmental and non-governmental agencies, including Parks Commission, Public Health, Mosquito Commission, schools, etc.
- Volunteers (trained via Master Gardener Program, Environmental Stewards Program), youth and others who can support and benefit from these efforts
- Underserved and underrepresented audiences

3. How was eXtension used?

Faculty participated in the development of collaborative educational products and answering "ask the expert" questions.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	24030	25307	0	0

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

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	16	6	22

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,publications. In addition a trained volunteer teaching base will be developed.Quantitative reports of participation data will be collected.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Increased knowledge and improved decision making skills of professionals and volunteers (Master Gardeners and Environmental Stewards) working in commercial horticulture professions (management and maintenance), commercial pest control operators, public health officials, municipalities and other governmental and non-governmental agencies. Increased number of trained youth and adult volunteers, and measurable impact of their assistance on clientele. Increased number of certified pest control operators. Increased number of youth and adult clientele utilizing Extension information and service to improve their own and others knowledge and decision making skills.
2	Medium Term - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.
3	Long Term - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
4	Rutgers Environmental Stewards - SHORT TERM - Increased knowledge and improved decision making skills of professionals and volunteers (Master Gardeners and Environmental Stewards) working in commercial horticulture professions (management and maintenance), commercial pest control operators, public health officials, municipalities and other governmental and non-governmental agencies. Increased number of trained youth and adult volunteers, and measurable impact of their assistance on clientele. Increased number of certified pest control operators. Increased number of youth and adult clientele utilizing Extension information and service to improve their own and others knowledge and decision making skills.
5	Rutgers VETS - MEDIUM TERM - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.
6	Safe Practices for Urban Gardening Program - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.
7	Sustainable Residential Landscapes in Cumberland and Salem Counties - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed

	based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.
8	North Jersey Horticultural Symposium Tree Day - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.
9	Sustainable Landscapes Program - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.
10	Investigation of Factors Affecting Bioaerosol Collection and Generation - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
11	Improved Prediction of Atmospheric Fine Particle Concentrations and Human Exposures in the Eastern US - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
12	The Chemical and Physical Nature of Particulate Matter Affecting Air, Water and Soil Quality - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
13	Surveillance of Adult Mosquitoes and Mosquito-Borne Arboviruses - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
14	Management of Annual Bluegrass on Golf Courses: Improved Practices for Maintenance, Pest Control, and Viable Techniques for Transition to More Desirable Grasses - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
15	Understanding Soil Respiration and Its Temperature Sensitivity in New Jersey Pinelands - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
16	Lag Times and Boom-bust Dynamics in Populations of Exotic Species - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
17	Spatial Evolutionary and Ecological Vicariance Analysis: The Climatic, Soil Type, and Host Niches of Taxonomic Diversity - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
18	Using Genomics and Experimental Evolution to Understand the Response of Eukaryotes to Changing Environmental Conditions - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

19	Conservation, Management, Enhancement and Utilization of Plant Genetic Resources - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.
20	Outdoor Recreation, Parks and Other Green Environments: Understanding Human and Community Benefits and Mechanisms - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

Outcome #1

1. Outcome Measures

Short Term - Increased knowledge and improved decision making skills of professionals and volunteers (Master Gardeners and Environmental Stewards) working in commercial horticulture professions (management and maintenance), commercial pest control operators, public health officials, municipalities and other governmental and non-governmental agencies. Increased number of trained youth and adult volunteers, and measurable impact of their assistance on clientele. Increased number of certified pest control operators. Increased number of youth and adult clientele utilizing Extension information and service to improve their own and others knowledge and decision making skills.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Medium Term - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Green Infrastructure Education and Implementation Program - Recent weather events have illustrated the need to handle intense weather events by decreasing the risk of flooding and subsequent flood damage. To enhance municipal flood resilience, a state-wide educational training program is necessary for municipalities on practical tools for stormwater plan review, inventorying and evaluating existing stormwater infrastructure, as well as identifying opportunities and needs for new infrastructure to maximize flood control and water quality benefits. New Jersey municipalities need tools to help them incorporate their needs for stormwater infrastructure and flood control into a mitigation plan. Additionally, educational initiatives for schools are needed to help schools implement green infrastructure practices on the school grounds in various communities.

What has been done

In addition to the "Stormwater Management in Your Schoolyard" program already developed and implemented by RCE Specialist and Water Resources staff (program working with K-12 students and teachers to educate the next generation on green infrastructure while implementing practices that help better manage stormwater runoff.) This team used the methodology that targets key community groups and the strategic location of demonstration projects to educate and reach out to communities to create change through "The Green Infrastructure Education and Implementation" program. This program developed statewide educational programs to present to municipal officials, expanded on the "Stormwater Management in Your Schoolyard" program to six (6) schools, included constructing demonstration green infrastructure projects on municipal and school grounds , development of a series of workshops educate key community groups. A series of three training courses were offered as part of a stormwater management and green infrastructure education effort for a variety of audiences. In conjunction with the series of training courses, a series of demonstration projects were funded to help illustrate the assessment, implementation, and impact of targeted green infrastructure. The RCE Water Resources Program staff continued to use its "Stormwater Management in Your Schoolyard" program to introduce green infrastructure in schools, particularly in combined sewer overflow (CSO) communities. This educational program was used to educate future generations about green infrastructure. While this is a tremendous educational opportunity, this program also resulted in the construction of demonstration green infrastructure projects at participating schools to help manage stormwater and reduce the occurrence of CSOs.

Results

Nine (9) demonstration education projects were constructed with over 1,000 school children educated. Four (4) workshops were delivered on stormwater management resulting in an increased knowledge. An online eLearning tool was developed to provide access to stormwater plan review material for all New Jersey municipalities. Outreach was conducted to 565 municipalities provided connection with resources - Private, federal, and municipal funds were leveraged to support future work (six (6) additional contracts).

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #3

1. Outcome Measures

Long Term - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Master Tree Stewards- School grounds in Union County are in need of more trees to provide shade (protects against skin cancer), to help fight asthma (filter particulate matter out of the air), and to add beauty and usher in the seasons.

What has been done
In 2015, 4-H trained 45 students from 30 different schools in Union County on how to plant and care for trees. These 45 students proceeded to plant $2,000 worth of shade trees on their school property. In the process of planting and caring for the trees, an additional 1,000 students became involved in the program.

Results
As a result, $3,000 worth of trees were planted. Publicity for the importance of planting trees was generated in several Union County communities. Youth increased their awareness of how to improve the environment. The 45 youth attended training and involved many other youth in their schools.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems

721 Insects and Other Pests Affecting Humans

Outcome #4

1. Outcome Measures

Rutgers Environmental Stewards - SHORT TERM - Increased knowledge and improved decision making skills of professionals and volunteers (Master Gardeners and Environmental Stewards) working in commercial horticulture professions (management and maintenance), commercial pest control operators, public health officials, municipalities and other governmental and non-governmental agencies. Increased number of trained youth and adult volunteers, and measurable impact of their assistance on clientele. Increased number of certified pest control operators. Increased number of youth and adult clientele utilizing Extension information and service to improve their own and others knowledge and decision making skills.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Environmental issues are among the most serious problems faced statewide and nationally. A six year NJDEP study concluded that the top four environmental issues in New Jersey were 1. land use change, 2. indoor pollution, 3. invasive species and 4. outdoor air pollution. It is clear that a well formed and thought out extension program is the missing link that could improve efficiency and relevance of environmental research carried out at NJAES and speed improved policy and technology adoption and access to environmental expertise by New Jersey citizens.

What has been done
Target audience is people interested in environmental issues who wish to learn more about the underlying science and gain skills necessary for effective action in their community. Rutgers Cooperative Extension formed a partnership with Duke Farms Foundation to create a statewide Environmental Stewardship certification program. Cooperators include the NJDEP, NJ Audubon, the Association of NJ Environmental Commissions, and a rapidly expanding list of environmentally related organizations from government, academia and the non-profit sector. An advisory council was formed to guide the Rutgers Environmental Stewards program which consisted of internal and external stakeholders. Regional instruction locations were established. As of 2013 regional classes have been conducted for nine years providing 1260 hours of training

to 352 students. To support promotion and management of the program a web site was created, http://envirostewards.Rutgers.edu. The site functions as both a promotional tool to attract students and serve them as an educational resource. Since 2006 lecture notes and presentations have been shared through the site, primarily for current students, but also as a way for prospective students to assess the quality of the program. Student comments and impacts are also featured on the site. Since 2012 classes have used the Rutgers Sakai system to share information, resources and comments and improve student to student networking. A catalog of volunteer opportunities for intern projects was developed with help from external collaborators. Students were counseled to help either match them up with existing intern opportunities or guide them to find and propose their own intern project. A structure of forms and administrative tools to help facilitate the program was developed. Curricular Objectives of the program: Provide a grounding in environmentally related science and leadership for citizens interested in environmental issues but without formal scientific education. Provide them an avenue to get involved making meaningful contributions to improving NJ's environment through the programs 60 hour volunteer internship, which compliments the 60 hours of classroom training and field trips. Graduates will be knowledgeable in the basic processes of earth, air, and water, and biological systems. They will be aware of the techniques and tools used to monitor and assess the health of the environment. They will have an understanding of the research and regulatory infrastructure of state and federal agencies operating in New Jersey that relate to environmental issues. They will have an introduction to group dynamics and community leadership. They will recognize the elements of sound science and public policy based on that science. They will have some sense of the limits of the current understanding of the environment. Graduates will use their knowledge to foment positive change in their community. With its stated purpose and goals a program structure was developed which included four phases: Phase 1: Environmental Education Immersion Lecture Series Phase 2: Volunteerism/Internship Phase 3: Advanced Training In Environmental Issue Resolution Phase 4: Veteran Educator/volunteer

Results

The Rutgers Environmental Stewards is a long term program that entered its 10th year in 2015. Summary data presented included: Completed Training 427 of 465 91.83% Engaged in Intern Project 214 55.30% Completed Intern Project 142 36.32% On Environmental Commission 28 7.16% Impact summaries of work conducted by the 142 Rutgers Environmental Stewards who have attained certification in the program are available on-line at http://envirostewards.rutgers.edu/CertifiedRutgersEnvironmentalStewardsImpactsandProjects.ht

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #5

1. Outcome Measures

Rutgers VETS - MEDIUM TERM - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Those that fish the Passaic River and consume their catches are being exposed to a number of contaminants associated with historical contamination of the river. Fish consumption bans are largely ignored, so a fish exchange (clean fish for contaminated fish) may be the best option for the protection of human health. Veterans in NJ are at greater risk of being unemployed than the non-veteran population. Veteran unemployment in NJ is among the highest rates nationally at greater than 10.1%

What has been done
This green job skills training program was undertaken for the veterans to grow clean fish for the Passaic River community while learning agriculture, horticulture, greenhouse management, stormwater management, and aquaponics. The hands on, experiential learning provided by working in a greenhouse, tending the community garden and neighborhood landscape, as well as implementing stormwater management practices reinforced the abstract concepts presented in lectures.

Results
The community garden and greenhouse maintained by the veterans provided nearly 5,000 pounds of vegetables to the food pantry adjacent to the facility (greens, herbs, tomatoes). 260 tilapia raised - 3 community gardens were established in the area and rainwater harvesting systems installed. Of the 12 graduates from the 2014 class: - 5 veterans found full-time jobs

landscaping, green walls - 3 started their own landscaping company 1 went back to school full-time to earn her degree in biology - 1 stayed on as the program intern for advanced training.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #6

1. Outcome Measures

Safe Practices for Urban Gardening Program - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Although the health problems associated with lead exposure are well known and lead levels in New Brunswick children have decreased, many immigrants continue to garden directly in the soil and have little knowledge of the testing and soil abatement measures necessary to create safe gardening conditions. The availability of clean soil or methods for composting and creating safe soil is limited and more effort is necessary to provide culturally appropriate education to the largely Mexican community on these topics.

What has been done

Rutgers Cooperative Extension (RCE) of Middlesex County has partnered with a number of New Brunswick based community organizations to develop a Lead-Safe Backyard Gardening Program in the City of New Brunswick. This program currently targets underserved, Spanish speaking residents. Soil testing on New Brunswick residential lots have shown high lead levels which requires increased testing and risk management strategies in order to ensure that lead is not transmitted to plants grown for consumption with the goal of the program to provide bilingual training for urban gardeners to educate them about best practices for protecting themselves from contaminated garden soil. A number of different methods are used to implement the program. - Garden Guardian/ Protector de Jardin classes are conducted in April and May in conjunction with local community organizations including Unity Square Partnership and Elijah?s Promise. The classes utilizes a train the trainer approach to recruit bilingual residents to teach their friends and neighbors about soil safety when gardening. Residents attend 2 classes where they learn about source of lead in soil, soil testing, interpreting results, remediation techniques, and composting. Piloted in 2013, 44 volunteers have provided 219 hours of volunteer service and helped educate 213 community residents about safe soil practices. - Two youth lesson plans have been developed to teach students and 4-H club members about safe soil practices and avoiding lead exposure from the soil. - In 2013 this program was expanded to include English speaking audiences in an effort to raise awareness of urban soil contamination on a more state-wide level. Thus far 172 Master Gardeners, Veterans, and community and school gardeners have been trained using the curriculum.

Results

In 2015, post evaluative surveys were used to determine participant satisfaction with the Garden Guardian training (n=18): 94% indicated they were comfortable teaching their friends and neighbors how to test their soil and stay safe working in contaminated garden soil as opposed to 25% before the training. 100% indicated they knew how soil becomes contaminated, knew how to test the soil, and knew the safe soil lead levels as opposed to 0% before the training. 100% indicated they knew methods for keeping their friends and family safe when gardening in areas with contaminated soil as opposed to 8% before the training. 100% indicated they knew how to get a child?s blood lead level tested as opposed to 25% before the training. In 2015, RCE of Middlesex in partnership with Unity Square, the main community partner on this project, conducted follow up surveys to participants of the Garden Guardian program and other lead-safe gardening educational efforts. Follow up surveys were conducted via phone to Latino gardeners in New Brunswick one year after educational sessions. Respondents reported: 85% out of 20 respondents were able to correctly name or identify the sources of lead in urban soil (i.e. chipped paint, leaded gasoline, industrialization) 58% of 26 respondents had adopted at least one best practice at home to reduce their exposure to lead in the soil including adding clean compost to their yard, started a compost bin, built raised beds, and/or wear gloves regularly when gardening. 62% of 26 respondents had continued to share the safe soil information with friends and/or family in the community. In 2015 education on this topic was provided at the Union County "Getting Your School Garden Growing" Conference in Mountainside, New Jersey. The curriculum was also presented the National Urban Extension conference in Atlanta, GA. 2015 evaluation respondents (n= 44) reported after the Union County Get Your School Garden Growing Conference: 80% would determine whether the site history of their garden was investigated and if it was a low risk or a high risk site for growing food. 81% would test the garden soil using recommendations I co-developed for low risk or high risk sites. 75% would determine if water testing was necessary at their garden site. 75% would use the water testing recommendation to developed to determine if the water was safe for garden irrigation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #7

1. Outcome Measures

Sustainable Residential Landscapes in Cumberland and Salem Counties - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The landscapes of Salem and Cumberland Counties include a mix of agricultural, urban, and suburban land uses. There are therefore a diversity of water users and a variety of non-point source pollutants to local waters. Addressing these concerns necessitates education of clientele groups not traditionally possessing a high degree of expertise in land management including homeowners and municipalities.

What has been done
In 2015, educational workshops covered water conservation with rain barrels and environmentally-friendly lawn care. In rain barrel workshops, participants were educated about the importance of decentralized stormwater management, built their own rain barrels, and then installed them at their residences or businesses. Across four workshops, there were 69

participants, with 31 rain barrels constructed. Additional outreach efforts included newsletter articles, blog posts, and tabling at local fairs.

Results
Programming successfully resulted in environmental benefits of water conservation and water pollution prevention, as well as knowledge gain and the expectation of behavior change among program participants. Fifty-seven people participated in the rain barrel workshops. Based on average installation rate of past workshop attendees, this equates to approximately 31,000 gallons per year of both improved stormwater management and potable water conserved. Workshop participants also demonstrated an increase in knowledge about stormwater management and pollution prevention. Participants in the rain barrel classes showed an increase in knowledge about using rain barrels for decentralized stormwater management, methods for conserving water at home, and specifics about using and maintaining rain barrels. Workshop participants also indicated their willingness to install other water conservation measures at their homes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #8

1. Outcome Measures

North Jersey Horticultural Symposium Tree Day - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Trees are an important living asset in urban and suburban communities, and healthy, sustainable tree cover requires specific management practices. Changes in climate, the presence of new diseases and pests all require that tree care professionals remain current with technologies, species and remedies. Implementation of updated best management practices protects environmental quality and community health. Tree care professionals are an important segment of the horticultural industry in New Jersey, members of the International Society of Arboriculture, in order to retain their certification, are required to earn continuing education credits. Many of the arborists are also licensed pesticide applicators in NJ.

What has been done
NJHS Tree Day is an all-day event that provides 5 hours of instruction by RCE faculty and staff in urban tree care, emerging diseases and pests, and pesticide safety. Topics for the annual event are explored with members of the local tree care industry and selected for presentation. Our Tree Day program evaluation/survey also provides an opportunity for participants to suggest topics for next year's program.

Results
Twenty-four percent of respondents stated that they expected to save money by implementing new practices learned at Tree Day. Forty-two percent of respondents stated that they have reduced the volume of pesticides used in their business due to new information learned at Tree Day.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #9

1. Outcome Measures

Sustainable Landscapes Program - MEDIUM TERM - - Educated youth and adult clientele, both professional and residential, utilize their newly gained knowledge and skills to implement and make changes such as: Efficient and effective pest control techniques. Proper utilization of fertilizers and other soil amendments as needed based on soil testing. Proper selection of plant materials to reduce need for chemical inputs. Reduction in the damage caused by structural pests. Reduction in

health related incidents and costs association with human health vectors (ticks, mosquitoes). Protect health and safety of school children. Enhance or maintain environmental quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New Jersey is the most densely populated state in the United States, with Ocean County home to 576,567 residents (2010 Census Bureau census figure) with a variety of land uses to support this population. Extensive urban and suburban development exists in many towns within the county. Impervious surfaces such as roof tops, driveways, roads, and parking lots alter the natural hydrologic cycle and create increased stormwater runoff in these developed areas. Associated with this stormwater are a decrease in water infiltration into the ground, a decrease in groundwater recharge, and an increase in flood frequency. There is a need to focus on preserving water quality and promoting water conservation in residential areas.

What has been done
Extension environmental agents are addressing a variety of topics such as use of native plants in home and public landscapes, residential rainwater harvesting, and stormwater management techniques with the goal of giving homeowners and community property managers the tools to fashion and encourage aesthetically pleasing, low maintenance, environmentally friendly landscapes. The program consists of: Developing a variety of methods to engage a diverse clientele with sustainable landscape topics such as rain barrels and rain gardens, and as a means to educate on stormwater management. Increasing knowledge about sustainable practices for improving water quality such as rain gardens and rain barrels. Increasing the implementation of these practices in coastal New Jersey. Increase knowledge and behavior change about other water pollution prevention practices. A long term objective is to decrease pollutant loads to restore local waterbodies, especially Barnegat Bay, to a quality supportive of their designated uses. A total of five presentations to 247 people covering seven hours of instruction were conducted in 2015, with topics ranging from native landscaping, rain gardens, watershed management, and water conservation practices. These workshops covered four hours of instruction and the hands-on activity of building a rain barrel which participants took home when completed. The workshops included construction, installation, and maintenance of the rain barrels, and were given assistance from workshop partners during the rain barrel construction. Participants were given Rutgers Cooperative Fact Sheets on the installation of rain barrels to assist them once they got the barrels home.

Results
Audience members were surveyed immediately after the presentations on their expected behavior change (n = 18): 89% of respondents said they plan on using native plants in their home landscaping, 47% of respondents plan to install a rain garden at their home Rain Barrel Workshops A pre- and post-test was administered to gauge the increase in participants' knowledge on installation and maintenance of the rain barrel, and the safe use of harvested rainwater.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #10

1. Outcome Measures

Investigation of Factors Affecting Bioaerosol Collection and Generation - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Investigation of the presence of airborne microorganisms (bioaerosols) in the ambient air is of interest due to their environmental and human health effects. In the past few years, quantitative polymerase chain reaction (qPCR) has gained popularity in bioaerosol research due to its capacity to rapidly quantify and identify microorganisms in air samples. However, there are indications that air sampling may lead to the loss of structural integrity of bacteria thus affecting

the ability of qPCR to provide accurate and reliable data. In addition, stable and reliable bioaerosol generation is another important element of bioaerosol research. While there have been advances in the development of bioaerosol generators, there is still a need for bioaerosol generators which produce high bioaerosol concentrations with minimal effects on microorganism culturability and structural integrity and are easy to operate. Any potential bioaerosol damage occurring during aerosolization would be transferred to collected bioaerosol samples. Thus, it is important to investigate the effects of aerosolization on bioaerosols, including potential effects on their membrane integrity.

What has been done
NJAES Researchers proposed a two-prong effort to improve the ability to detect and measure airborne biological agents: 1) by investigating the effect of sampling on the integrity of biological particles and, as a result, the ability to detect and quantify biological particles; and 2) to investigate the performance of common and new bioaerosol generators on the viability and integrity of bioaerosols and application of those generators in bioaerosol studies. Their research compared Collison nebulizer, Liquid Sparging Aerosolizer (LSA), C-Flow nebulizer, and a newly designed Single-Pass Aerosolizer with respect to their physical performance, and ability to preserve the culturability and structural integrity of bacteria. Escherichia coli bacteria were aerosolized at different air pressures, collected by a BioSampler and their Cell Membrane Damage Index (ID), expressed as the fraction of 16S rRNA gene copies in the supernatant liquid versus the amount of 16S rRNA gene copies in the total sample (cell pellet plus supernatant), was determined.

Results
The ID of E. coli aerosolized by the Collison and C-Flow nebulizers at 40 psi compared to aerosolization at 5 and 15 psi was significantly higher ($p<0.05$). However, the ID of E. coli aerosolized with the LSA and Single-Pass Aerosolizer did not seem to significantly depend on aerosolization pressure. The ID of E. coli collected with a BioSampler was found to positively and significantly correlate ($p=0.043$) with the presence of airborne bacterial fragments (aerodynamic size range 0.37-0.523 um) as measured by the Aerodynamic Particle Sizer. Increased loss of culturability was observed for bacteria aerosolized by the Collison nebulizer and Single-Pass Aerosolizer with increasing aerosolization pressure ($p<0.05$), while no significant change in culturability was found for the other two generators as a function of aerosolization pressure. At particle output concentration of ~100 particles/cm3, the Single-Pass Aerosolizer preserved the culturability of bacteria significantly better than the other three generators ($p<0.05$). It also exhibited a significantly lower ID ($p<0.001$) and less culturability reduction ($p=0.03$) compared to the Collison nebulizer at particle output concentrations of ~1,000 particles/cm3. It is hoped that this study will help bioaerosol researchers select a bioaerosol generator and method best suiting their studies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #11

1. Outcome Measures

Improved Prediction of Atmospheric Fine Particle Concentrations and Human Exposures in the Eastern US - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Atmospheric fine particulate matter (PM) is largely responsible for visibility degradation, adversely affects human health, and alters precipitation patterns and climate. Fine PM concentrations in most states currently exceed US EPA's health-based standards, and exposure to fine PM has a considerable impact on the heath of residents in these states. The formation of organic PM, a major fine PM constituent, is particularly poorly understood. This is a major source of uncertainty in air pollution prediction.

What has been done
Previous research has led to the recognition that 1) organic PM forms from gaseous pollutants through reactions in clouds, fogs and wet particles and 2) the transport of particulate air pollutants from outdoors to indoors is a significant source of uncertainty in human exposure estimates. The goal of this research is to facilitate the improved treatment of these processes in predictive models that are used for air quality management and public health protection. Measurements and controlled experiments will be used to validate and refine predictive models. This work aims to better understand to what extent aqueous atmospheric chemistry converts gases into new particulate matter, the chemical mechanisms, and how these processes can be successfully included in predictive models. The researchers have conducted oxidation experiments with aqueous solutions of real ambient mixtures of water-soluble gases.

Results
NJAES Researchers have identified several reactive water-soluble organic gases in ambient air, including amines, polyols and carbonyl compounds. They have demonstrated that oxidation of these ambient (cloud-relevant) mixtures produces organic acids that are frequently found in the particle phase in the atmosphere, suggesting that realistic ambient mixtures can form SOA

through cloud and fog processing. Previously understood chemistry explained only a small fraction of the SOA formed. Additional work with collaborators in Colorado, Wisconsin and Italy have also led to insights about ambient conditions conducive to SOA formation through reactions in wet airborne particles. Chemical mechanisms published by our group previously have been incorporated into global climate models and have identified SOA formation via aqueous chemistry as a significant contributor to organic aerosol burdens globally. Over the course of this research, the group has learned a great deal about people's exposure to ambient outdoor particulate air pollution while they are in their homes. People spend a large fraction of their time indoors and roughly one half of the airborne particulate matter found indoors is of outdoor origin. They demonstrated with measurements and models how the composition and concentration of outdoor ambient particulate air pollution changes with outdoor-to-indoor transport and that the fraction of outdoor particulate air pollution found indoors (F) varies considerably. The work suggests that F in a typical low income home near a major roadway in the northeast can be twice the value for a middle class home in the southwest. This variability in the fraction of ambient particulate air pollution to which people are exposed is a source of exposure error in many epidemiologic studies, leading to larger uncertainties in health effect estimates. The group furthered the development of an outdoor-to-indoor transport model and validated this model, in part, with measurements. This model can be used to estimate F and improve exposure prediction. Most recently, they have begun an effort to better understand chemistry that affects exposure to air pollutants indoors. To this end, they have made exploratory measurements (13 homes) to identify organic gases that have not previously been measured inside homes due to measurement challenges. They found that concentrations of total water-soluble organic gases (WSOG) are considerably higher indoors than outdoors. For the 13 homes sampled, more than 85% of the WSOG mass is from indoor sources and formation (averaged across homes).

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #12

1. Outcome Measures

The Chemical and Physical Nature of Particulate Matter Affecting Air, Water and Soil Quality - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recently questions concerning the environmental fate of nanoparticles arising from agricultural operations and from the manufacture, use or disposal of consumer products has arisen. Little is known about the toxicology and environmental behavior of these particles.

What has been done
NJAES Researchers are investigating the physical, chemical, and biological nature of particulate matter, including nanoparticles, derived from agricultural practices, processes, and operations and from the production, use, and disposal of consumer products, as they impact air, water, and soil quality and associated health, economic, and environmental impacts. The researchers simulated the use of various products and the released particles were analyzed using a Scanning Mobility Particle Sizer and an Aerodynamic Particle Sizer. A compact electrostatic collector was used to capture airborne particles to examine their shape and agglomeration using Transmission Electron Microscopy (TEM), while an ICP-MS method was used to investigate the presence of metals in the products. A variety of nanotechnology-enabled consumer products are commercially available and these products have a potential to release nanoparticles during their application, which can result in user exposures. This research investigated inhalation exposures to nanoparticles due to the use of various consumer products, including powders, sprays and clothing items. The group realistically simulated the use of various products and the released particles were analyzed using a Scanning Mobility Particle Sizer and an Aerodynamic Particle Sizer. A compact electrostatic collector was used to capture airborne particles to examine their shape and agglomeration using Transmission Electron Microscopy (TEM), while an ICP-MS method was used to investigate the presence of metals in the products.

Results
The research found that nanosized particles were released during the use of almost all investigated products, and the particle number concentration varied substantially depending on the product and product category. Some of the highest released nanoparticle concentrations were observed for spray products reaching concentrations as high as 10^6/cm^3. The release of submicron and supermicron particles was also observed, indicative of the release of nanoparticle agglomerates and nanoparticles attached to larger particles stemming from product matrices. Presence of various metals such as Ag, Zn, Ti and others was observed in the released particles. For nanotechnology-enabled clothing, the release of supermicron particles changed when the clothing items were washed due to the loss of integrity in product matrix. They also found that nanosized particles were released during the use of almost all investigated products, and the particle number concentration varied substantially depending on the product and product category. Some of the highest released nanoparticle concentrations were observed for spray products reaching concentrations as high as 10^6/cm^3. The release of submicron and supermicron particles was also observed, indicative of the release of nanoparticle agglomerates

and nanoparticles attached to larger particles stemming from product matrices. Presence of various metals such as Ag, Zn, Ti and others was observed in the released particles. For nanotechnology-enabled clothing, the release of supermicron particles changed when the clothing items were washed due to the loss of integrity in product matrix. If the released particles are inhaled, their largest mass would deposit in head airways, while their largest number would deposit in alveolar region. The health implications of such exposures have to be investigated in a separate study. In order to obtain relevant health outcomes, toxicological studies investigating nanotechnology-enabled consumer products should consider not just primary nano particles that were added into the products, but also their agglomerates and aggregates, including agglomerates and aggregates with particles from product matrix.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #13

1. Outcome Measures

Surveillance of Adult Mosquitoes and Mosquito-Borne Arboviruses - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New Jersey mosquitoes have been of great public nuisance and economic importance since the earliest historical record. Migrating flood water mosquitoes and domestic species have affected not only the economic development of rural and resort areas but also the great urban and

industrial centers. The problems from nuisance species continues to impact the state, but are nevertheless diminished by the sudden appearance of new mosquito-borne arboviral diseases. West Nile Virus (WNV) has become firmly established in the northeast since its unexpected appearance in New York City during the fall of 1999. Similarly, Eastern Equine Encephalitis (EEE) poses an annual public health threat to residents, tourists and the equine industry in southern New Jersey and appears in mosquito populations every year. We believe that surveillance in New Jersey alerts mosquito control agencies to epidemiological events early enough in the amplification process for intervention to help prevent human involvement. We intend to maintain and improve the surveillance tools currently available.

What has been done

The objectives of this project are: 1) Conduct surveillance for mosquitoes. 2) Conduct surveillance for endemic mosquito-borne arboviruses (EEE & WNV). 3) Conduct surveillance for exotic mosquito-borne arboviruses in New Jersey. 4) Fulfill the mandates of Title 26 of the New Jersey Health Statues. This project will affect all New Jersey residents by monitoring and assessing the threat posed by mosquito-borne diseases. The project further provides for and encourages environmentally sound, scientifically based, and professional control by county mosquito control districts, and meets state mandates for mosquito control. The group conducted surveillance for mosquitoes in all 21 counties of New Jersey. We conducted surveillance for endemic mosquito-borne arboviruses (EEE & WNV). The group also conducted surveillance for exotic mosquito-borne arboviruses in New Jersey.

Results

This surveillance is part of the Experiment Station's mission and requirement to meet the mandates of Title 26 of the New Jersey Health Statues. The group is pleased that out project impacts New Jersey residents by monitoring and assessing the threat posed by mosquito-borne diseases. Through their efforts, they provide and encourage environmentally sound, scientifically based, and professional control by county mosquito control districts, and meets state mandates for mosquito control. They have offered six training courses for mosquito professionals over the 12 month period. They have done individual county site visits to assist local mosquito control officials in improving and updating their programs, they report monthly at the State Mosquito Control Commission.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #14

1. Outcome Measures

Management of Annual Bluegrass on Golf Courses: Improved Practices for Maintenance, Pest Control, and Viable Techniques for Transition to More Desirable Grasses - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Annual bluegrass (ABG) is a highly invasive weed on golf courses where it frequently becomes the dominant species despite attempts to suppress it. As a result, superintendents usually resort to managing it instead of more pest-tolerant bentgrasses. The annual bluegrass weevil (ABW) and anthracnose basal rot (ABR) disease, caused by the fungus Colletotrichum cereale, have become the most severe pests of ABG. Their control often depends heavily on pesticides. Extensive pesticide use has resulted in insecticide and fungicide resistance. There is an urgent need to gain a better understanding of the biology, and pathogenesis of ABR, develop improved IPM tools for more effective pest management, learn how stresses affect ABG and its sensitivity to ABR, and how to either mitigate these stresses or find ways to transition to more desirable/sustainable grasses. These finding will be used to establish a final "proof of concept" study (2013-15) to show the effect of best management practices (BMPs) on ABR, fungicide effectiveness, and ABG quality. New fungicide, biological and biorational products, and application strategies will be studied. Practices that delay or reduce the potential for fungicide resistance will also be assessed. The tolerance/resistance of ABG and bentgrass varieties to ABR will be evaluated in the greenhouse and field. Diagnostic methods will be developed for better ABR detection. The effects of environmental stress on ABG and its susceptibility to ABR will be determined. A survey will be conducted (yr 1) to assess industry practices for the suppression/transition of ABG to more sustainable grasses. Cultural techniques (e.g., use of overseeding species; cultivation; soil fertility), alone or in combination with novel biocontrols and herbicides to reduce/eliminate ABG in favor of more desirable turfgrass species will be studied. Tolerance/resistance of ABG and bentgrass species varieties to ABR will be evaluated in the lab and field. The impact of project findings will be assessed via outreach programs and stakeholder surveys (yr 5). Expected outcomes: 1). Improved exchange of information among turfgrass

scientists in the U.S. and Canada. 2). Increased knowledge of practitioners for the control of ABR and ABG. 3). BMPs adopted by turf managers including new biological, biorational, cultural and chemical control techniques. This will result in practitioners having: (a) a better understanding of the management of ABG and ABR; (b) more effective control strategies for ABR that are cost-effective and reduce reliance on chemical inputs; (d) optimal programs for ABG maintenance, and (e) optimal methods for ABG suppression, elimination, and transition to more desirable grasses. Adoption of this information by practitioners will result in reduced pesticide inputs, cost savings, and improved plant health.

What has been done
During 2015, treatments with a soil pH > 6.0 had less than 10% anthracnose severity through mid-July compared to turf plots with lower soil pHs which had up to 37% disease severity by 17 July.The group also collected data from a trial to study the genetic ability of bentgrass to compete against annual bluegrass.

Results
Disease severity increased in all treatments as the 2015 season progressed; however, anthracnose remained most severe in plots with a pH < 6.0. Regression analysis of soil pH with disease data over the entire season indicated a critical soil pH value between 6.0 - 6.5; turf grown at lower soil pH had more severe anthracnose. Calcium (gypsum) applications alone had little effect on anthracnose severity in 2015, while comparative rates of limestone (= quantity of calcium) significantly decreased disease severity throughout the season. Additionally, observations of turf quality and color indicate a soil pH of 6.0 - 6.5 will enable the maintenance of healthy annual bluegrass putting green turf. Results of the data of the genetic ability of bentgrass indicate colonial bentgrass and some cultivars of creeping bentgrass can compete with annual bluegrass in mixed stands. Rolling strips across cultivar plots were initiated during 2015 to expand assessment to include the condition of compacted soil. Results (BMP recommendations) have been distributed to the golf course industry through research reports published by the United States Golf Association and TriState Turf Research Foundation. The most recent BMP recommendations are also posted on the Rutgers Center for Turfgrass Science website.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #15

1. Outcome Measures

Understanding Soil Respiration and Its Temperature Sensitivity in New Jersey Pinelands - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding Soil Respiration and Its Temperature Sensitivity in New Jersey Pinelands Soil respiration is an integrated indicator of belowground biological activities, soil quality and ecosystem productivity. Temperature sensitivity is a scaling factor which describes how soil carbon pool will responsed to future climatic change. Examining the spatial and temporal variation of soil respiration and its temperature sensitivity is critical to understanding the carbon dynamics in the forest ecosystem. In addition, the proposed study will improve our estimate of carbon sequestration in our forest ecosystems, which will lead to new carbon-oriented forest management strategy and allow the U.S. to claim carbon credits in the international climate change negotiations.

What has been done
NJAES Researchers set out to (1) identify critical factors controlling soil respiration in a typical forest in New Jersey pinelands; (2) find the spatial and temporal variation of soil respiration and its temperature sensitivity and the factors controlling the temperature sensitivity in the ecosystem; and (3) develop a generalized temperature sensitivity (Q10) model to scale up the chamber measurements of soil respiration to ecosystem and regional scale.

Results
Field experiments were set up to measure soil respiration using an automatic chamber system which was fabricated by the researcher. Unfortunately, the system was damaged by Superstorm Sandy in 2012. However, the group did discover that soil temperature, moisture, and organic carbon content controlled the soil respiration in New Jersey Pinelands. The spatial and temporal variations of soil respiration were high in NJ Pinelands with the maximum respiration in summer and minimum in winter. Soil temperature was negatively correlated with the temperature sensitivity of soil respiration (Q10), while soil moisture was positively correlated with the Q10. The researchers developed a non-linear model to estimate soil respiration in the NJ pinelands and the results on soil respiration and its Q10 model have been used to improve an ecosystem model (Biome-BGC) in estimating carbon sequestration in NJ pinelands. Although the proposed study was focused on major forest ecosystems in New Jersey, the results can be applied to other regions with similar climate and forest types. Scientifically, the proposed study will provide critical knowledge in three areas. First, it will improve climate models in predicting future atmospheric CO2 concentration and global temperature by including both positive and negative feedbacks of terrestrial ecosystems. Second, it will improve ecosystem models in quantifying major ecosystem processes such as carbon dynamics by considering the variation of temperature sensitivity rather

than a constant Q10. Third, it will provide new knowledge to understand how different factors control soil respiration and belowground carbon dynamics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #16

1. Outcome Measures

Lag Times and Boom-bust Dynamics in Populations of Exotic Species - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Under human influence, species are being transferred between regions faster and farther than at any other time in Earth's history and, in some cases, have caused enormous changes to recipient ecosystems. Despite considerable advances in our understanding of how exotic species spread and establish self-sustaining populations, our ability to forecast when and where they will exert strong ecological impacts remains weak. Given that the consequences of exotic species invasions provide the impetus for management, and effective prioritization of management resources depends on accurate forecasts of the potential damage of an invasion, a predictive understanding of impact should be a central goal of invasion ecology. However, predicting which exotic species will produce impacts and under what circumstances has proven difficult. Part of the difficulty in prediction is the complicated underlying dynamics of the exotic population itself, and how these dynamics relate to the species' impacts.

What has been done

NJAES researchers are exploring the prevalence of complex population dynamics in exotic species, and in the process developing new statistical tools for identifying these dynamics. Researchers are also seeksing to explore the mechanisms behind some of these dynamics using exotic birds as a model system.Detecting rapid and substantial population declines (collapses) is of considerable importance to many applied ecological fields. Published definitions of a population collapse describe a decline in abundance over time (e.g., 90% decline within 10 years or less). The research group developed a flexible, rigorous method to account for uncertainty in the magnitude and period of a collapse, and provided a way to estimate the probability of a collapse having occurred. Using Bayesian approaches they quantified uncertainty in the maximum abundance obtained in a time series and the time step in which this maximum is realized. They then use this estimate of uncertainty as a way to set a confidence interval around a specified percentage decline from the maximum, and as a way to acknowledge uncertainty in how many time steps it took for the decline to occur. They use this method to evaluate the prevalence of collapses among declining native Hawaiian birds, and show a high probability that six of 12 have declined by >90% within 10 years. A particularly vexing phenomenon within invasion ecology is the occurrence of spontaneous collapses within seemingly well-established exotic populations. They assessed the frequency and degree of collapses in 68 exotic bird populations in North America. Following other published definitions, they define a 'collapse' if these populations have declined in abundance by 90% or more within the span of 10 years.

Results

The procedure of detecting population declines advances current methods for identifying collapses within time series of abundance data by explicitly and transparently accounting for uncertainty in the key component of any definition of a collapse; the maximum abundance. The researchers show that 44 of these 68 exotic bird populations have exhibited declines within their time series, with 24 of these 44 having declined into a collapsed state. Additionally, 17 of these 24 species have declined to near extinction (percent decline > 99%). The group compared the severity and duration of declines across all 44 declining populations according to taxonomic Order and geographic region. Neither variable explained substantial variation in these metrics. Their results indicate that collapses may be more common among exotic species than expectations suggest, and that incorporating the probability of collapse into management considerations can transform decisions regarding when to enact control or eradication measures. They also suggest that applying our approach to other taxa and locations is crucial for improving understanding of when and where collapses are likely to occur.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #17

1. Outcome Measures

Spatial Evolutionary and Ecological Vicariance Analysis: The Climatic, Soil Type, and Host Niches of Taxonomic Diversity - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This project examines the ecological and evolutionary divergences within several large plant and fungal groups, investigating the association of their ecological niches, reflected by climatic variables, soil types, host plants (for fungi), and other nonorganismal features, over large-scale biogeographic expanses. The research will specifically address how some species have conserved climate niches and constrained distributions, while others have diversified ecologically and spatially over short or long times.

What has been done
NJAES researchers work with methodological developments for the SEEVA analytical methods, including new programming in R, data and results graphing, and interpretations of results for the Ophiognomonia dataset continued through intensive collaboration among the research team. Weedy plant research in urban areas have continued through data during summer 2015 in Rutgers University parking lots as well as field trials of Daucus carota focused on life cycle adaptation analysis.

Results
The research team has developed a new stable and innovative way to evaluate quantitative character variables, deal with correlated characters, and have provided a new graphic and tabular output to present research results from the SEEVA-R software (beta version available, to be released in 2016). The data analysis of the Ophiognomonia project is finished and the paper on this project will soon be submitted.Additional research projects have focused on weedy plant biodiversity and population evolution with respect to various microenvironments in urbanized areas, and the development and evaluation of educational materials to enhance botanical and "Eco-Evo" education goals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #18

1. Outcome Measures

Using Genomics and Experimental Evolution to Understand the Response of Eukaryotes to Changing Environmental Conditions - LONG TERM - - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Since the time of Darwin, biologists have strived to understand the mechanisms underlying phenotypic variation. The long held traditional view in genetics was that heritable change consists of propagated modifications in genes (DNA) that impact expression of the phenotype (proteins). However, it is now known that eukaryote molecular biology operates at multiple informational levels that extend beyond the genome. The output of protein-coding genes is greatly enhanced by alternative splicing and modulated by cellular regulatory networks. In addition to DNA sequence, heritable traits may be propagated through patterns of epigenetic variation, such as DNA methylation and histone modification. Non-coding small RNAs (sRNAs) act as key regulators of epigenetic phenomena that modulate gene expression. Different sRNAs may also exert genome-wide repression of transposable element (TE) activity. Disturbance of such regulatory networks (e.g., caused by stress or a changing environment) may elicit TE mobilization, rearranging the genome and creating variability that impacts the epigenome, transcriptome, and proteome. These data suggest that ecological adaptation may be driven by short-term epigenetic changes that over

time can have significant evolutionary implications for species phenotypes and distributions. To understand better the connection between genome functions and environmental perturbation, here we propose research in two fields: 1) microalgal adaptation and evolution, and, 2) elucidation of the basis of the coral symbiosis and origin of coral biomineralization.

What has been done

The broadly halotolerant green alga Picochlorum strain SENEW3 has a highly reduced nuclear genome of 13.5 Mbp that encodes only 7,367 genes. It was originally isolated from a shallow, mesophilic brackish-water lagoon that experiences extreme changes in temperature, light, and in particular, salinity (freshwater to 3-fold seawater). We challenged Picochlorum cells with high or low salinity shock and used transcriptomic and chlorophyll fluorescence analyses to elucidate tolerance to salinity fluctuation. The transcriptome analysis showed that one-half of the coding regions are differentially expressed in response to salinity changes. In addition, a significant number of co-expressed genes (usually from different metabolic pathways) are co-localized in the genome, forming 2-10 gene clusters. Whereas the overall salt stress response in Picochlorum SENEW3 is similar to that in other salt-tolerant algae, the "operon-like" structure in this species likely contributes to rapid recovery during salinity fluctuation. Reef-building corals provide a significant source of ecosystem-based services that stabilize coastlines and provide habitat for a rich diversity of flora and fauna rivaling that of tropical rainforests. To understand their ecological success, the group analyzed genomic information from twenty stony coral species that contain dinoflagellate symbionts.

Results

The researchers work regarding algal genomics and stress tolerance elucidates how evolutionary forces play out in a streamlined genome. Picochlorum SENEW3 relies on a broad array of adaptations from the reliance on horizontally transferred adaptive genes, to co-localization of stress response genes and a robust photosystem II to deal with a fluctuating environment. These attributes make Picochlorum SENEW3 of great biotechnological interest.Regarding the ecological success of reef-forming corals, identified genes that encode the proteins responsible for the precipitation and aggregation of the aragonite skeleton on which the organisms live, and revealed a network of sensors that coordinate responses of the host animals to temperature, light, and pH. Furthermore, the researchers discovered a variety of stress-related pathways that allow the host animals to detoxify photo-oxidative products generated by their intracellular photosynthetic symbionts. Some of these genes arose through horizontal gene transfer and comprise at least 0.2% of the animal gene inventory. This analysis elucidates the evolutionary strategies that have allowed symbiotic corals to adapt and thrive for hundreds of millions of years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #19

1. Outcome Measures

Conservation, Management, Enhancement and Utilization of Plant Genetic Resources - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

American chestnut, once a dominant member of regional forests, was virtually eliminated by the non-native fungal disease, Chryphonectria parasitica. American chestnut (Castanea dentata) was a great shade tree, a valuable timber species, annually produced plentiful and sweet tasting seeds, and provided habitat and food for many animal species. Breeding efforts by The American Chestnut Foundation have produced hybrid trees that are 15/16 American and 1/16 Chinese chestnut (C. mollissima), combining American chestnut form, height and nut quality with Chinese chestnut blight resistance. These have been planted in experimental plots and are being monitored for relative performance and growth. Additional goals of the project are to identify hybrid families with the best performance in forests, to educate the public about the devastating effects of invasive pests, and to inform land managers about the potential of chestnut restoration and ecological restoration in general. Blueberries (Vaccinium spp., family Ericaceae) are not only an important agricultural crop in the United States, but are also important native shrubs found in northeastern hardwood forests. The New York Metropolitan Flora Project has found that nearly all members of the heath family (Ericaceae) in the New York metropolitan area have been sharply decreasing in range size, indicating a decrease in abundance as well, over the past 100 years. Additionally, due to morphological, ecological, and genetic differences within the genus, the taxonomy of Vaccinium, and highbush blueberry in particular, is not well established. This research will examine the highbush blueberry species complex to determine taxonomic differences, if any, as well as ecological differences between diploid and tetraploid cytotypes within the species. Applications of these findings are critical to the ecological restoration community and to the agricultural community to determine which genotypes for improving the nation's natural resources and agricultural stocks are needed. These investigations will assist in determining the cytotypes most useful for sustainable and resilient restored populations of this important wetland species, as well as inform commercial and home growers of the best cytotypes

for local conditions. Additionally, these studies will add to our understanding of the putative ecological advantages of polyploidy, which occurs in about 50% of angiosperm species worldwide.

What has been done
NJAES researchers are planting hybrid chestnut trees in forest gaps at Duke Farm, Hillsborough, NJ to determine if forest gaps, created by removal of non-native species, provide a viable re-entry location for chestnuts back into northeastern forests. The goal of the research is to cooperate and participate as a key element in the NPGS, a coordinated national acquisition and management program of plant germplasm valued for agricultural, horticultural, environmental, medicinal and industrial uses in the NCR and throughout the U.S., secondly, to contribute to understanding of plant-environment interactions, including risk assessment and communication of characteristics that differentiate a species' ability to adapt and whether it can serve as an economically viable crop or potentially become invasive in specific environments. Finally, to educate students, scientists and the general public regarding plant germplasm issues.

Results
The American Chestnut experiment continued apace. Many of the trees a quite large, some at 4 m height. During this growing season the group maintained the plots, freeing the trees from invasive vines and other plants which were thriving in the sun gaps. This fall for the first time seeds were produced on some of the plants showing that are planting sites and methods have succeeded through the reproductive stage of the species. They have started analyzing the summer's data to understand the differences among the genetic stocks used in these tests and how they correlate with the gap size which is a main thrust of this project's hypotheses. The black cherry trees have also done well. This species was installed in the gaps to help improve management techniques, mechanical and chemical control of invasives. This work is continuing and also will be analyzed later in the winter. The new blueberry genetics work has also moved forward well. The researchers are testing for ecological differences between diploid and tetraploid plants. Field phenology data was collected from natural populations in NJ during the spring flowering season and marked differences between the two types were found. This suggests that gene flow between the cytotypes is restricted. The group now has three years of data on field flowering phenology and this is being written up for publication this winter. In addition greenhouse tests were done inoculating both genetic stocks with mycorrhizae as a formal test to see whether the tetraploids respond differently with mycorrhizal enhancement. Tests were also initiated in the greenhouse with different pH soils and different watering regimes. These data are now in hand and will be statistically analyzed later in the academic year

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

Outcome #20

1. Outcome Measures

Outdoor Recreation, Parks and Other Green Environments: Understanding Human and Community Benefits and Mechanisms - LONG TERM - New Jersey's residents will reside, work and play in a healthy, safe, and sound environment-in their homes, gardens, schools, parks and workplaces.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Citizen science programs pose excellent opportunities for the public to engage in authentic science learning. These programs fall under the umbrella of public participation in scientific research and have been shown to result in science content learning gains and development of scientific reasoning skills. In addition to these traditional STEM learning gains, citizen science projects promote positive community engagement, self-efficacy among volunteers with respect to environmental action, and increased motivation to engage in environmental learning. A number of claims have suggested, however, that simple engagement in outdoor activities and environmental recreation might equally contribute to these individual and community level literacy gains.

What has been done
During a previous project period, NJAES researchers carried out surveys to judge attitudes about the environment and gauge the knowledge and literacy toward the environment, with a focus on park and green space use. Individuals living in six townships near Rutgers University were mailed paper surveys with pre-stamped return envelopes. Those individuals were chosen by random sampling from the online white pages listings for the six focal townships. 75 surveys were sent to each township, totaling to 450 surveys sent. There were 74 completed returns fairly evenly distributed across the townships. All surveys were kept anonymous and no identifying information was asked of participants. In the most recent project period, the data was analyzed and a series of in-person surveys were conducted. In this project, NJAES researchers are surveying environmental learning among individuals who are and who are not engaged in a citizen science projects. They are targeting a land management citizen science project as well as individuals who engage in recreation on restored landscapes. In response to the following goals of the multistate project: "(1) Identify mechanisms by which parks and other green environments support human, health, environmental literacy and community vibrancy, which outcomes they enhance,

and the relative contributions of the various mechanisms. b. Substantiate and extend the evidence for the role of park and outdoor recreation services in promoting environmental literacy among youth, and document the long-term influences of early lifespan connections with nature. c. Substantiate and extend the evidence for the role of park and outdoor recreation services in promoting community vibrancy and resilience." This research proposes to survey environmental literacy of adult citizen scientists who will address park use across the lifespan. This data will be used in an adaptive model of socio-ecological resilience to determine if a link between environmental knowledge and resiliency works.

Results

The survey data have allowed the researchers to broadly characterize different types of park and greenspace users. There is a strong correlation between education and financial status. The data suggests that environmental literacy is correlated with amount of education, visitation to regional or national parks, trust in local groups and print media. Environmentally-literate individuals were less likely to trust large scale institutions and, most of all, large corporations. Environmental literacy did not scale with science knowledge or personality features such as optimism. Environmentally-literate individuals were likely to own pets and prefer less urban/suburban environments. These individuals tended not to use local parks. Additionally, if an individual preferred an urban environment, they were more likely to trust government. By and large, respondents listed issues of health and society as being more important that environmental quality. Most of the respondents did not seem aware of phrases such as ecosystem services or security. Pet ownership correlated with local park use and with sense that they are living in a community. Individuals who owned pets were more likely to prefer less urban environments. If an individual felt that they were living in a community-driven town, they were more likely to be aware of local issues. Certain townships had more respondents relating to community than others. Education level tended to correlate positively with annual income and these individuals tended to live further from local parks, yet were more likely to rate local parks highly, though they may not regularly visit these. Individuals living near local parks tended to view less quality in these parks and linked these characteristics with distinct preferences for certain park features and motivations for use. Local parks tended to correlate more with community engagement and pet ownership. Individuals in this context tended to prefer safety and cleanliness. People living further from parks, tended to seek park activity, such as hiking or, in some cases, engaging with water features. This means that different people from similar locations would be more or less likely to engage in projects, depending on the type of project, and may be engaged different ways. This data provides insight into how groups and stakeholders may engage in environmental education or citizen science, such as working with community on a local level and perhaps engagement with data and larger park improvement projects. Furthermore, spatial analysis indicates park exposure and distance are important variables in determining the types of activities in which people may engage. This research's characterizations have implications for how to engage the public in place-based education projects involving climate change or public health issues such as obesity, and through what means to engage citizens. Persons living the same distance from the same park may have different conceptions green space based on a number of these factors and can therefore play an important role community engagement. Regarding the in-person surveys, the researchers chose three strands to focus on with respect to publications. First the group focused on question framing and tested the hypothesis that the nature of the terminology of the questions being asked of park goers had an effect on responses. This finding is important because different results from different literacy assessments; is suggesting that knowledge structures in these literacy domains are fragile. Second, the questions focused on park goer identity. The findings generated 6 individual identity types about which the researchers developed a series of environmental action and park use hypotheses. Lastly, they looked at spatial characteristics of the parks under investigation, and identified both demographic and proximity measures that may enhance the ability to predict which individuals will use parks and when.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
205	Plant Management Systems
721	Insects and Other Pests Affecting Humans

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Global Food Security and Hunger - Integrated Pest Management

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
216	Integrated Pest Management Systems	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	13.0	0.0
Actual Paid	15.5	0.0	5.5	0.0
Actual Volunteer	386.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
168128	0	674858	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1556279	0	1214390	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
84322	0	480942	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research
- Develop new and novel techniques for pest management and pest detection

Delivery

- Provide IPM information to a wide variety of stakeholders
- Employ new methods for delivery IPM information

Education

- Conduct IPM educational programs for stakeholders
- Conduct IPM educational training for university students
- Conduct IPM educational training for Vo-Ag and FFA students
- Conduct IPM public awareness campaign

Extension

- Work with communities, schools, businesses to help them meet their regulatory responsibilities on pesticide application
- Help growers develop scouting programs to identify pest populations before significant plant damage occurs.
- Develop pest management options to be used in an integrated or rotational program.
- Identify indicators to help growers anticipate pest problems.
- Develop monitoring techniques and population damage thresholds for selected pests.
- Provide scientifically sound advice to state regulatory bodies on pest management and pesticide issues
- Create a multidisciplinary program comprising of faculty, staff, volunteers, industry partners and government officials
- Investigate IPM methods to help growers produce top quality crops, limiting or reducing production costs.
- Evaluate all pest and crop management practices into a set of commercially used methods. These include the use of: pesticides, economic/aesthetic threshold levels, resistant cultivars, optimum horticultural practices, environmental monitoring, pest scouting, and fertility monitoring and recommendations.

2. Brief description of the target audience

- Municipalities
- Pesticide applicators and their employers
- Commercial pesticide applicators
- State Dept. of Environmental Protection
- Staff and students who gain valuable scientific experience
- Industry partners in agriculture and related commodities
- Consumers
- NJAES Faculty and Staff involved in pest management research/outreach
- Farmers
- Commodity groups
- New Jersey residents
- School faculty, staff and children
- NJAES researchers
- Secondary and university students
- Governmental agencies
- Environmental organizations
- Agricultural, landscape, fine turf and other related industries

3. How was eXtension used?

Faculty participated in answering "ask the expert" questions, developing collaborative educational products and the development of professional development sessions.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20185	24583	2549	0

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

Patent Applications Submitted

Year: 2015

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	35	23	58

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,publications. In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Develop improved IPM delivery methods. Develop detection, monitoring and sampling methods that reliably predict pest levels. Develop novel management methods for a wide variety of pests. Develop IPM training for secondary and university students. Improve public awareness about IPM Determine the effectiveness of pheromones for mating disruption of pests. Greater understanding of entomopathogenic nematode species'effects on pests. Evaluation of the effectiveness of natural pesticides and crop management to reduce pests. Determine which types of plants attract pests to be used as a pest control method.
2	Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
3	Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.
4	IPM for Landscape Contractors- MEDIUM TERM - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
5	NJ Pesticide Safety Education Program (PSEP)/Integrated Pest Management (IPM)- Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
6	Developing and Evaluating Reduced-Risk Management and Phenology Programs for Fruit Pests- Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for
7	Upland Fruit (Tree Fruit and Grape) Integrated Pest Management (IPM) Delivery- Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

8	Blueberry Integrated Pest Management Delivery- Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.
9	Turfgrass Entomology Program - Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

Outcome #1

1. Outcome Measures

Short Term - Develop improved IPM delivery methods. Develop detection, monitoring and sampling methods that reliably predict pest levels. Develop novel management methods for a wide variety of pests. Develop IPM training for secondary and university students. Improve public awareness about IPM Determine the effectiveness of pheromones for mating disruption of pests. Greater understanding of entomopathogenic nematode species'effects on pests. Evaluation of the effectiveness of natural pesticides and crop management to reduce pests. Determine which types of plants attract pests to be used as a pest control method.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Observational Field Scouting Training Program-Field and forage crop producers are in need of current and relevant IPM information during the growing season. IPM scouting reports are one method that farmers learn of pest management issues within the region. Commercial farmers can gain valuable knowledge by knowing what insect pests and diseases are in the area. Unfortunately, for some farmers the cost and time associated with obtaining IPM information is prohibitive.

What has been done

The master gardener program trains volunteers to assist Cooperative Extension in the delivery of horticultural programs and information to the general public. This assistance has typically focused on home gardening and landscape information. There are however, master gardener volunteers whose interests are more centered on learning about and assisting with commercial agricultural programs. A Master Gardener Crop Scout Training was established to teach master gardeners how to scout commercial field crops for pests and then shared with farmers in the area to help them better manage their crops. A small group of master gardeners were provided 3 hours of weekly hands on IPM field training over a 26 week period. Participants were initially provided with 3 hours of classroom training about the basics of IPM. IPM insect monitoring traps were placed across a farm. A small lab was established with a microscope, insect collecting equipment and reference books. During this time, participants where taught how to scout and identify pests within the various crops, crop production and management practices were observed and explained to participants to provide a greater understanding of how agricultural commodities are produced, and information collected from the scouts has been shared with the field and forage crop community via the NJAES Field and Forage Crop Blog. Additionally a master gardener IPM scout blog has been developed to share information gathered and learned through the program with other master gardeners and a community garden information board has been to further share information gained from weekly scouting efforts.

Results

Survey results from participants indicated that 57% of have remained with the program 2 or more years, 29% have participated for 4 years, 93% of participants rate their experience with the program as excellent to very good. All participants strongly agree that the program has increased their understanding of IPM and Agriculture. 93% of participants report that they strongly agree that the program has increased their confidence in their ability to address master gardener helpline questions. The blog that has been produced from the program has been accessed over 5,000 times. Communications with agricultural stakeholders have indicated the information provided by the program has been useful.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Bat House Distribution Program-Medium-Term - North American bats are declining tremendously from White-nose Syndrome and wind turbine development. Despite recent media attention and an estimated economic value of U.S. bats at $23 billion annually as insect regulators, these animals are still commonly considered pests. Some bats have adapted well to humans and use manmade structures at roost sites, both as maternity colonies and hibernation sites. Pest control companies routinely perform bat exclusions, evicting bats from roosts and preventing their return. Evicting bats may indirectly result in mortality. Bat exclusions are routinely performed as a strategy to resolve human-wildlife conflict. While state guidelines are in place to prevent direct mortality of bats through separating mothers from pups or trapping bats inside the structure, evicting bats from their roost can cause severe stress or mortality, particularly when evening temperatures are low and insect food resources are scarce. In addition, bats evicted from dwellings will return annually, either finding a new access point to the historic roost or establishing a new roost in a neighboring dwelling. This behavior perpetuates a continuous roost establishment-bat eviction cycle, displacing rather than resolving the conflict.

What has been done
The project is an expansion of an existing Rutgers Cooperative Extension wildlife management program. NJAES extension specialist and staff are building 150, double-chambered bat houses, which can support 80 bats each. The Specialist continues to communicate with pest control companies through presentations at their annual meetings, displays at pest management events, direct marketing, and education and outreach materials and is partnering with 12 pest control companies with a goal of additional partnerships with 38 additional companies (total of 50) by December 2016. RCE connects with homeowners through our "Got Bats" program, which allows individuals to call RCE directly or complete an online form describing their bat issue. If the homeowner elects to install a bat house, one is provided. In return, it is requested that the homeowner enroll in our summer bat monitoring program.

Results
This initiative will increase the humaneness of bat exclusions through the provisioning of immediate shelter and thermal refuge for evicted bats; resolve bat-human conflicts for the long-term through the establishment of publically acceptable alternative roost sites; and forge a win-win situation for bats, bat excluders, and homeowners. In 2015, outreach was provided to >275 homeowners and pest control operators and 24 bat houses, providing habitat for up to ~1,900 bats.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Urban pests such as termites, bed bugs, cockroaches, ants, flies, ticks, rodents, etc. cause billions of dollars of commodity loss, structural damage, and a number of diseases. They are also nuisance pests when they enter homes. Pesticide applications for controlling urban pests pollute the environments, pose health risks to human and pets, and lead to insecticide resistance development. The public needs more effective, environmentally safe methods to reduce pests and pesticide use, and minimize health risks associated with pesticide applications. There is also a constant need to educate the public in preventing and reducing pest infestations.

What has been done
A RCE specialist conducted an evaluation of various interventions on low level bed bug populations. A bed bug control program was conducted in apartment buildings. Two experiments were conducted to evaluate the effects of various interventions on low-level bed bug populations in occupied apartments.

Results
It was found that that many of the small populations of bed bugs were eliminated without any professional treatment and only a small percentage escalated in number over a period of 4-10

months. The presence of the traps throughout the apartments represented a mass trapping approach and contributed to the decline of bed bugs in low-level infestations. These findings suggest that low-level infestations can be eliminated without insecticide applications and highlights the importance of early detection, and a threshold-based approach to bed bug management, by which the treatment protocol is based upon population size. The results of the study have important implications that should be considered in the development of bed bug management programs in multiunit housing communities, particularly those at risk for high infestation rates. Extension meetings reached 1,000 people directly. Field research and demonstrations reached 750 homes. Greater than 80% reduction in pest population or pesticide use was achieved in field studies. Research findings were adopted by pest management professionals and apartment managers, and pest management professionals. At least three housing authorities are adopting the IPM techniques identified from our studies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

IPM for Landscape Contractors- MEDIUM TERM - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In Bergen and other highly suburbanized counties there has been too much reliance on chemical pesticides and high nitrogen/phosphorous fertilizers in the maintenance of lawns and landscapes

and ballfields. Each landscape contractor can represent 25-85 residential and commercial properties, which represents 12-60 acres of landscape. The result has been many tons of chemicals applied, often unnecessarily and at the wrong time (ie when target pests are not present). As a greater result, the quality of air, water, soil, and beneficial organisms has been compromised, along with raising strong concerns about human health, as well.

What has been done

RCE faculty are part of a small team coordinating the yearly North Jersey Ornamental Horticulture Conference and delivers training to over 600 professionalsevery January. The 3-day program attracts the state's best arborists and tree experts, landscape contractors, and turf/ballfield/parks managers. A full day of training is tailored to the themes of Turf Day, Tree Day, Landscape Day. This program is the oldest, continually offered program within the NJ Cooperative Extension System. 2015 marked the program's 54th year. It remains, as always, highly relevant and user-friendly, with timely updates from experts on the topics presented. IPM tactics are promoted for all pest problems discussed. And IPM tactics are promoted to grow and maintain strong, pest-resistant landscapes, gardens, town greens, school ballfields, and parkland.

Results

Professionals in the allied green industries, including: arborists, landscape contractors, tree experts, turf managers, golf course superintendents, parks supervisors, school IPM coordinators, independent contractors in shade tree consulting. Participants appreciate the dollar savings that often come with implementing IPM programs, as less is spent on fertilizer and amendments, as well as on chemical pesticides. Also, survival and plant health improves with less spent on damage repair and replacement costs. Many have been attending this particular training program for their entire career, and rely on us for unbiased, research-based information and technology. Tree, Turf, and Landscape Contractors represent large and stable industries in Bergen and adjacent counties. Their combined economic significance is huge. Evaluations indicate that as a direct result of this training: 89 of 90 participants believe they will make more informed pest management decisions; 73 who attended in the past have changed their pest management practices, applying IPM tactics and relying less on chemicals, testing soil 54 report using 10-30% less chemical pesticide 35 reported saving money as a result of applying IPM tactics as presented in the training, and fewer replacement costs Others report keeping their NJ DEP pesticide license as an important outcome of the training (71); improved communication with clients (56); better able to train employees (59); overall adoption of IPM tactics (66).

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

NJ Pesticide Safety Education Program (PSEP)/Integrated Pest Management (IPM)- Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best

time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Currently in New Jersey there are 15,000+ certified applicators registered with the New Jersey Department of Environmental Protection (NJDEP) - Pesticide Control Program. Of these, approximately 3,000 are private applicators. To remain certified New Jersey law requires that private and commercial applicators accumulate at least 12 hours of recertification training divided between CORE (4) and CATEGORY (8) classifications during a five-year period.

What has been done
During FY15 the IPM programs coordinated by Rutgers Cooperative Extension encompassed production agriculture in the areas of blueberries, nurseries, greenhouses, tree fruit, and vegetables. Research conducted by faculty and staff connected to these various programs is helping to increase the adoption of IPM and at the same time reduce our reliance on pesticides as the sole pest management tool being used. PESP: Approximately 25,000 applicators were recertified by this program in 2015. In addition, New Jersey initially certifies an average of 2,000 commercial applicators each year. New Jersey also registered approximately 2,200 commercial pesticide operators in 2015. Since these registrations must be renewed each year, this group of applicators requires yearly training. Training in both areas is provided by New Jersey?s PESP program. New Jersey's PESP program currently utilizes 24 different manuals to provide initial training to both private and commercial applicators. Since pesticide information and technology are constantly changing, various manuals require both major and minor revisions on a regular basis to maintain the competency level of applicators. This program provides training to school employees and master gardeners so they understand the proper use of pesticides and the issues surrounding their use. Work was done to develop management strategies for use against the brown marmorated stink bug (BMSB) in vegetables and tree fruit. The vegetable IPM program was able to impact more acreage through the use of their website that tracks weekly European corn borer, corn earworm and BMSB population changes in the state. The state was seen on ~7,000 acres of blueberries, 500 acres of nursery stock, 10 greenhouse acres, 8,600 acres of peaches, 2,500 acres of apples, 100 acres of peaches and 27,500 acres in vegetables. The vegetable and fruit IPM programs faculty and staff also conducted research evaluating the impacts of the brown marmorated stink bug (BMSB) in their programs and participated in the

BMSB working group.

Results
During 2015, farmer, commercial applicators and the general public were educated about the benefits and hazards of pesticide use. In addition, they were provided with information about how to properly handle pesticides and protect themselves the hazards presented by their use of these materials. Because of this they were better able to protect themselves and the environment from the hazards of pesticide use. Growers in each of the IPM programs offered by Rutgers Cooperative Extension were provided data and the number and intensity of pests attacking their crops. At the same time, program staff discussed with enrollees the options available to control these pests. Because of these interactions farmers were better able to make informed decisions regarding their pest management options resulting in high quality crops and protection of the environment because of less pesticide use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Developing and Evaluating Reduced-Risk Management and Phenology Programs for Fruit Pests-Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fruit growers in and around NJ, particularly tree fruit are facing changes in management practices due to increased labor costs, the threat and impact of invasive species, changing chemistries and a public demand for "safer" produce.

What has been done
RCE faculty and agriculture staff are addressing current and emerging grower needs by insecticide testing, research trials on grower-farms evaluating alternative tactics which will reduce insecticide inputs and conducting a state-wide survey of key grape insects and virus symptoms, evaluation of attract-and-kill in apple orchards for BMSB, evaluation of trap crops in organic farms for BMSB and native stink bugs. At the Rutgers Agricultural Research and Extension Center (RAREC) faculty are primarily evaluating biological control of BMSB, natural enemy community attraction to insectary plantings, population responses to pheromone traps for BMSB, and biological control of plum curculio. This information is delivered to growers through the development of short videos, online factsheets, web articles, social media, traditional extension meetings during the winter and the spring. The backbone of the research and extension program lies in farm visits and conversations with stakeholders to identify needs, priorities and production practices.

Results
Short-term outcomes are a reduction in insecticide use and conservation of natural enemy services on-farm. Long-term metrics include identification of key pests, validation of DD models and incidence of disease in grapes. In tree fruit additional long-term metrics include conservation of pollinators and natural enemies and cost-savings to growers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Upland Fruit (Tree Fruit and Grape) Integrated Pest Management (IPM) Delivery- Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New Jersey fruit growers produce commodities that are susceptible to more than two dozen arthropod and disease pests. Management of this pest complex can cost producers up to $500 or more per acre. Production costs are high due to labor, fertilizer and energy costs, and pesticide costs. Pest management costs have increased due to label restrictions on old products and the introduction of newer more expensive pesticides. While customers continue to demand high quality clean fruit, they are also aware of pesticide use, and want an assurance of safe food with little to no pesticide residues.

What has been done
An integrated crop management (ICM) program was delivered to commercial fruit growers who produced apples, peaches, nectarines, and grapes. The program demonstrated reduced risk methods that included the use of mating disruption and ground cover management as tools to replace insecticide use for Oriental fruit moth, tarnished plant bug and stink bugs and two species of peach tree borers. Degree-day pest phenology models were updated, and proper use was advised to growers. Pesticide use records were collected at the end of the season to measure the program impact on pesticide use. Demonstrations were conducted on commercial farms to encourage use of alternative practices. Alternative practices include use of mating disruption and reduced risk pesticides. Weekly field scouting forms the program core and data source for newsletter articles, and from which pest management recommendations were made, with nutrition and nematode management included at specific times of the season. A broadcast fax service was used in Hunterdon and Gloucester Counties to advise of timely pest events and supplement the Plant and Pest Advisory Fruit Edition Newsletter. Growers and industry personnel were trained throughout the season and at several annual winter meetings. Primary participants included 24 tree fruit growers in northern counties and 17 growers in southern counties.

Results
Growers return every year to the program, even though they pay participation fee for program support. During 2015 primary participants in northern counties contributed just over $19,000 for programming on 445 acres. Growers in southern counties supported the program with over $36,000 on farms which managed over 3,500 acres of tree fruit. Grape IPM programming involved a pilot program with 8 participants In southern counties, where the bulk of commercial peaches are produced, 75% of growers used alternative, ?reduced risk? insecticides, and 80% of growers used reduced risk fungicides. Program participants reduced pesticide use by 26-80% compared to standard spray schedules, depending on the practices used. Other IPM practices included grower use of degree day based pest models, reducing insecticide use by 40% compared to standard calendar spray methods. Laboratory tests where over 75% of areas

sampled were shown have sufficient to excessive phosphorous levels, which led to decreased phosphorous use on those sites.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Blueberry Integrated Pest Management Delivery- Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Blueberries are a unique agricultural commodity, since they are one of only several native foods in commercial production in the US. In New Jersey most blueberries are grown in the ecologically sensitive "New Jersey Pinelands," which is characterized by porous soils with high water tables, which are subject to vertical movement of a number of agricultural chemicals. The pest complex on blueberries is extensive, with pests attacking virtually all parts of the plant and pest management requiring up to 12 pesticide sprays per year. Pest management strategies need to deliver high quality fruit with minimal insecticide residues.

What has been done
An integrated pest management (IPM) program was delivered to commercial blueberry growers. The program employed seasonal field scouts who collected weekly pest management data. The program reached all blueberry growers in New Jersey, but collected farm specific data on those farms participating in the scouting program. Results of scouting data were summarized in 2 statewide newsletters (The Blueberry Bulletin and The Plant & Pest Advisory-Fruit Edition ?Now

on a Web Blog format). Results were also transferred to growers with farm visits, seasonal update meetings, and a broadcast fax system. The program collected data on insect and disease pests as well as fertility levels through soil and plant tissue sampling. Based on the scouting results, pesticide recommendations were made to all growers. A research/demonstration component demonstrated and refined the use of alternative pest management practices such as the use of trapping methods for determining treatment timings for blueberry maggot, and mating disruption for Oriental beetle.

Results

Through demonstrations, articles, county reports and other outreach, public awareness on IPM was improved. Growers participated in an IPM program, and maintained high fruit quality while minimizing pesticide use. In 2015, this included 43 growers who grew 5000 acres of blueberries or about 66% of the state acreage, and about 75% of the state production. Some growers spent as much as $250/A for pesticides while the average IPM participant spent $140/A. The average grower using IPM practices saved about $100/A. New pest management practices such as mating disruption and whole farm GIS based monitoring were used. Small plot research/demonstration trials for Oriental beetle mating disruption continued to show that Oriental beetle could be managed with mating disruption in place of soil applied insecticide. Sixty-six percent of NJ blueberry acreage to be under IPM practices. During 2015, 348 samples were taken for combined monitoring of plant fertility and nematode levels. Soil and plant fertility tests demonstrated that about 75% of fields sampled had sufficient to high levels of soil phosphorous. In 2012, the spotted wing drosophila developed as a serious invasive pest in blueberries nationwide. While this is a serious threat to IPM programming, adjustments were made in 2015 to help protect the blueberry industry while minimizing conventional OP and carbamate insecticide use. While insecticide applications averaged just over 11 applications per field, OP and carbamate use was minimized to under 50% of total applications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #9

1. Outcome Measures

Turfgrass Entomology Program - Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the USA (in New Jersey), turfgrass in its many forms, covers > 30 million (0.9 million) acres and is a $45 billion ($0.8 billion) industry. The most wide-spread, destructive, and difficult to control turfgrass insect pest in New Jersey and the Northeastern USA are several species in the white grub complex. Due to the implementation of the Food Quality Protection Act of 1996 and local legislation, fewer and fewer insecticides are available for the control of these pest. The number of annual bluegrass weevil populations with resistance to insecticides continues to be on the rise. There is a dire need for the development of alternative control agents and control strategies.

What has been done
NJAES researchers are developing sustainable control options for the annual bluegrass weevil and non-destructive monitoring/prediction tools for the weevil based on semiochemicals that may also be developed into control tools. Faculty are studying the aspects of its biology and ecology relevant for the development of better management tactics and investigating tolerance/resistance to annual bluegrass weevil feeding among different bentgrass species/cultivar, and the extent of insecticide resistance, insecticide resistance mechanisms, insecticides and weevil stages affected. Faculty and agricultural staff are developing effective ways to monitor the resistance. b. Development of sustainable control options for turfgrass lepidopteran pests-They are testing commercial products based on different entomopathogenic nematode species for control of black cutworm and sod webworm larvae in turfgrass and have found that sequential applications and modifications of irrigation patterns but not species combinations, can further improve nematode efficacy. c. Development of Steinernema scarabaei as a curative and long term white grubs control agent. They continue to explore the biology and ecology of this species and test new insecticidal compounds. They are collaborating with the chemical industry to test new and safer insecticides for the control of white grubs, annual bluegrass weevil, and black cutworm.

Results
NJAES faculty have instructed professionals through numerous extension related phone calls, emails, and publications. These efforts increase the ability of turfgrass managers and homeowners to effectively manage turfgrass insect pests while reducing hazards to health and environment. The non-chemical annual bluegrass weevil control options are emerging from our research will give valuable alternatives to the present heavy use of insecticides. Observations on the feeding behavior of adults, the onset of egg-laying, and diapause parameters already show that superintendents can reduce the number of adulticide applications in spring. Faculty are developing a better understanding of the scope of insecticide resistance in the annual bluegrass weevil and are developing better tools for monitoring resistance. This will help scientist and industry develop better ways to curb the development of resistance and help superintends to better manage susceptible and resistant weevil population. Testing of new insecticides will allow more accurate recommendations and will help close the gap in efficacy that presently available insecticides leave by being less effective against some white grub species, the annual bluegrass weevil, and the black cutworm.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Global Food Security and Hunger - Aquaculture

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
135	Aquatic and Terrestrial Wildlife	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.8	0.0
Actual Paid	3.2	0.0	3.2	0.0
Actual Volunteer	114.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
24286	0	135297	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
418659	0	628707	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
56657	0	360081	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Investigate the genetic mechanisms for disease resistance and improved quality in economically important shellfish

• Create a dynamic and cooperative partnership with faculty, staff, businesses, regulatory/advisory

councils and the government to research best management practices and discover effective solutions and management practices to address threats to NJ aquaculture as well as investigate opportunities to increase the quality and quantity of the aquaculture harvest.

- Collect and analyze data on how communities and businesses are affected by the aquaculture industry management practices.
- Examine the presence of unhealthy levels of contaminants in aquaculture products.
- Determine best techniques for shellfish hatcheries on and off shore.

2. Brief description of the target audience

- Aquaculture related businesses and employees
- State Department of Environmental Protection
- State Department of Agriculture
- Industry partners who learn ways to improve or protect their harvests
- Communities who depend on aquaculture-related revenue
- NJAES faculty and staff involved in water research/outreach
- Consumers of aquaculture products, including recreational fishing

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	96	3009	225	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	9	18	27

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,publications. In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected.

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Knowledge of seasonal variations for shellfish diseases. Create census data on communities involved in aquaculture. Determine the level of pollutants in economically important fish species. Develop markers and maps of important genetic traits. Knowledge of shellfish hatchery techniques that decrease time for growth to market size.
2	Medium Term - Identify spatial and temporal relationships between patterns of shellfish diseases in NJ and environmental correlates. To develop disease-resistant strains of shellfish. Develop superior disease-resistant and larger genetic lines of shellfish.Measure the impact of communities on the aquaculture industry. Knowledge of the feasibility of off-shore shellfish farming.
3	Long Term - Clear and comprehensive understanding of community, environmental, genetic and physical regulators of aquaculture quality and quantity. A safe and secure aquaculture industry that can meet consumer demands for high-quality products and also be environment friendly and economically viable. Creation of superior aquaculture products that will be of high demand outside NJ.
4	Sustainable Fisheries: From Case-Studies to Global Meta-analysis- Long Term - Clear and comprehensive understanding of community, environmental, genetic and physical regulators of aquaculture quality and quantity. A safe and secure aquaculture industry that can meet consumer demands for high-quality products and also be environment friendly and economically viable. Creation of superior aquaculture products that will be of high demand outside NJ.
5	Characterizing the physical environment of the coastal ocean and its relationship to ecosystem indicators-Long Term - Clear and comprehensive understanding of community, environmental, genetic and physical regulators of aquaculture quality and quantity. A safe and secure aquaculture industry that can meet consumer demands for high-quality products and also be environment friendly and economically viable. Creation of superior aquaculture products that will be of high demand outside NJ.

Outcome #1

1. Outcome Measures

Short Term - Knowledge of seasonal variations for shellfish diseases. Create census data on communities involved in aquaculture. Determine the level of pollutants in economically important fish species. Develop markers and maps of important genetic traits. Knowledge of shellfish hatchery techniques that decrease time for growth to market size.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #2

1. Outcome Measures

Medium Term - Identify spatial and temporal relationships between patterns of shellfish diseases in NJ and environmental correlates. To develop disease-resistant strains of shellfish. Develop superior disease-resistant and larger genetic lines of shellfish.Measure the impact of communities on the aquaculture industry. Knowledge of the feasibility of off-shore shellfish farming.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Global Fisheries Sustainability - Fishing activities of recreational and commercial fishermen are restricted by perceived low abundance of some fish species and by uncertainty in population status of fish species relative to management goals.

What has been done
An Extension Specialist worked with recreational and commercial fishing groups to explain the workings of stock assessment models used to assess status of fish populations. In addition, the Specialist did collaborative research with (primarily recreational for hire, i.e., charter boat) fishermen to understand the abundance and size and age distribution of black sea bass. As a member of the mid-Atlantic Fishery Management Council's Scientific and Statistical Committee the Specialist provided advisement to the federal fishery managers about the status of fishery resources.

Results
Fisheries are managed within federally prescribed bounds. The Specialist contributed to the evaluation and advance a novel data poor stock assessment method which resulted in an increase in the quota for black sea bass.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #3

1. Outcome Measures

Long Term - Clear and comprehensive understanding of community, environmental, genetic and physical regulators of aquaculture quality and quantity. A safe and secure aquaculture industry that can meet consumer demands for high-quality products and also be environment friendly and economically viable. Creation of superior aquaculture products that will be of high demand outside NJ.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Aquaculture is one of the fastest growing sectors of agriculture with exponential growth struggling to meet a growing demand largely filled by imports. Shellfish aquaculture routinely confronts problems of disease and mortality. These diseases often operate in open systems where both aquaculture and fisheries occur and are significantly influenced by many ecology factors. Clearly, understanding disease dynamics and how disease can be controlled to minimize losses is vital. Successful strategies will lead to increases in aquaculture and fisheries production as well as improvements in the protection of human health. A major impact was the establishment of a molluscan shellfish health advisory panel for the East Coast of the US to help develop a standard, science-based management system for shellfish transfers. The panel has already been called upon to resolve issues in the northeast and midAtlantic. Each objective contributes valuable information to the management of shellfish resources. Two direct contributions were the dissemination of information on the management of the Delaware Bay oyster fishery, and initiating the development of a shellfish health management plan for the East Coast molluscan shellfish industry. Understanding ecological aspects of shellfish pathogens to improve management - The ability to detect pathogens, predict their presence, and control their impact is of paramount importance to the management of shellfish populations (wild or farmed) in New Jersey and elsewhere. It follows that by enhancing our understanding of host-pathogen-environment interactions we can identify potential control points and develop new or improve existing strategies to lessen the negative impacts of these pathogens. Successful strategies will lead to increases in aquaculture and fisheries production as well as improvements in the protection of human health.

What has been done

Multiple studies were conducted on various aspects of shellfish pathogens. Data from the Delaware Bay oyster disease monitoring program were reported monthly to the industry and incorporated into the annual fall oyster stock assessment to help determine management strategies including setting the annual harvest quota. Host density and community composition were examined as critical factors affecting parasite transmission dynamics in several studies. A Dupont-supported graduate student completed a master's thesis that documented how scavengers accelerate transmission. The NSF EEID program project investigated how parasite consumption as a major pathway for disease transmission is affected by competition for suspended particles. An important experiment on the viability of transmissible stages of Perkinsus marinus was conducted.

Results

NJAES researchers have provided significant insights into long-term changes in Delaware Bay oyster populations that occur as the oyster population responds to management practices, climate change and environmental variation. A major advance was the insight gained by capturing the impacts of Hurricane Irene and TS Lee that caused extensive freshwater kill across a significant portion of the population in the upper bay. Survival increased with salinity and measured the rate of pathogen inactivation over time. These results were incorporated into ongoing efforts modeling the transmission and spread of marine diseases. The research group found that the incidence of Dermo climbed with increasing per capita dose of Perkinsus marinus, but due to increased competition for suspended particles, fell with oyster density. The net result of such a competitive interaction via pathogen consumption (i.e., overfiltration) is to inhibit the spread of disease. This provides a new perspective for evaluating the observed persistence of Dermo disease in mid-Atlantic estuaries following the decline of oysters due to MSX. Can dense oyster populations overfilter Perkinsus marinus and minimize the impact of disease? The answer has important consequences for the management of oyster fisheries and oyster restoration anywhere Dermo is present. Findings were incorporated into simulations using the hydrodynamic model ROMS coupled to a benthic model to confirm the overfiltration effect over a dense oyster reef. Parasite dilution also occurs by foraging activities of other organisms present on oyster reefs. A series of mesocosm experiments demonstrated that the presence of the commensal, filter-feeding tunicate Molgula manhattensis similarly resulted in lower prevalence and intensity of Dermo disease in oysters. These results were integrated in a compartmental disease dynamic model including oysters and M. manhattensis as focal and non-focal hosts for P. marinus. Another graduate student investigated the impacts of water filtration by shellfish that have been targeted for restoration and enhancement efforts. Ecological interactions between oysters, non-host filter-feeding communities and suspended pathogens in the water column are critical to understanding patterns of disease. Shellfisheries are severely depressed from historical levels with a major factor being losses from diseases that kill shellfish. They represent a billion dollar industry in NJ's economy and are vital to a healthy coastal environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #4

1. Outcome Measures

Sustainable Fisheries: From Case-Studies to Global Meta-analysis- Long Term - Clear and comprehensive understanding of community, environmental, genetic and physical regulators of aquaculture quality and quantity. A safe and secure aquaculture industry that can meet consumer demands for high-quality products and also be environment friendly and economically viable. Creation of superior aquaculture products that will be of high demand outside NJ.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While we do not control many of the important environmental drivers of ecosystem change, fishery management has the capacity to dampen or amplify the impacts of environmental change on exploited fish populations. Understanding the relative impacts of fishing and environmental change and identifying the most effective strategies for managing fish populations in a changing climate will lead to improvements in how we manage our fisheries.

What has been done
NJAES research will build upon case studies from individual fisheries in the U.S. and other countries to examine the impacts of fishing and other changes on aquatic environments. In addition, the comparative approach will help identify those management strategies that are working and lead to their broader adoption in other locations. These comparisons involve (1) development of a new global database with information about many fish populations around the world based on information that has already been collected by U.S. and foreign fishery management agencies and (2) novel research on fish populations in the U.S., Mexico, and Mongolia which differ in their natural environments and fisheries, but share many of the same challenges, such as vulnerability to climate change and overfishing.The research team developed and maintained a global database of stocks assessments which will serve as a resource for the broader fisheries science community and support meta-analyses of fishery status and management approaches.
They have also used comparisons among fisheries around the world to understand the impacts of fishing and environmental change on fish populations and aquatic ecosystems and to identify the most successful fishery management approaches.

Results
NJAES researchers have an improved understanding of how the 2010 Macondo oil spill in the Gulf of Mexico impacted marsh food webs. This research demonstrated a wide range of oil sensitivity across marsh plants and animals and highlighted particularly sensitive species which are also critical network nodes within the food web. The research group has an improved understanding of the population dynamics of harvested marine fishes. In particular, the meta-analysis of natural and fishing-induced variability in fish population size demonstrated that many fish stocks should be expected to occasionally dip below abundance reference points even when the harvest rates have been set at sustainable levels. Thus, abundances below target levels are not necessarily a sign of overfishing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #5

1. Outcome Measures

Characterizing the physical environment of the coastal ocean and its relationship to ecosystem indicators-Long Term - Clear and comprehensive understanding of community, environmental, genetic and physical regulators of aquaculture quality and quantity. A safe and secure aquaculture industry that can meet consumer demands for high-quality products and also be environment friendly and economically viable. Creation of superior aquaculture products that will be of high demand outside NJ.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Coastal ecosystems span watersheds to the deep sea and are extremely complex. This complexity hinders planning for ocean resource management, sustainable development, energy policy, homeland security and emergency response. This lack of understanding is fueling governments around the world to build regional integrated coastal ocean observing networks. The

networks are enabled by rapid advances in technology, from satellites in space to robots below the ocean surface. These systems are built to support both basic research and the practical needs of society, from offshore resource management to the economy. Through this project I will work with the management communities to determine the best way to bring new information provided by ocean-observing systems into their decision-making.

What has been done
NJAES researcher deployed three glider missions along the New Jersey coast. The first deployment began on July 17, 2015. This glider completed a run from Sandy Hook to Cape May, totaling over 458 km, in just over 20 days. The glider was then deployed again August 2015. Like the first, the second deployment covered the entire coastal area off New Jersey in support of state water quality monitoring. A third deployment in September completed the sampling effort for this year.

Results
The coastal ocean is a highly variable system with processes that have significant implications on the hydrographic and oxygen characteristics of the water column. The spatial and temporal variability of these fields can cause dramatic changes to water quality and in turn the health of the ecosystem. While low Dissolved Oxygen (DO) concentrations are not uncommon in the coastal ocean, what is less understood is how the location and size of these low DO regions vary and what impact that variability has on ecosystem health. Therefore alternative sampling strategies are needed to continuously map these low DO areas in a way that quantifies this variability. This work applies a series of Autonomous Underwater Vehicle (AUV) deployments from Sandy Hook to Cape May NJ to address this need by mapping the subsurface DO concentration in near real-time within the near coastal ocean. The three glider missions together collected important water quality measurements along 1,424 km within the coastal waters off New Jersey. These data were reported to NJDEP in realtime throughout each deployment. Sensor calibration was conducted under the guidance of an existing Environmental Protection Agency Quality Assurance Project Plan. One of the critical parameters reported to the NJDEP was dissolved oxygen (DO). DO is a measure of the amount of oxygen in the water. This is used by NJDEP as an indicator of water quality. Very low oxygen conditions can starve species like fish of oxygen resulting in large die-offs. The glider is being used to monitor conditions so that NJDEP can get a better background on how effective DO is as a metric of water quality and also track the occurrence of dangerous low events. The research team also worked within a network of stakeholders including fisheries scientists, oceanographers, managers, social scientists, and the commercial fishing industry to build the next generation of observatory informed single species habitat models. The initial target species was butterfish in support of a planned stock assessment for this species in late 2013/early 2014. The habitat based estimate of availability developed using the approach was integrated into the catchability estimate used to scale population size in the butterfish stock assessment model accepted at the 59th NEFSC stock assessment review. The contribution of the availability estimate (along with an estimate of detectability) allowed for the development of fishery reference points, a change in stock status from unknown to known, and the establishment of a directed fishery with an allocation of 20,000 metric tons of quota. This year the same method informed the assessments of two additional species in 2015 stick assessments, bluefish and scup.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		5%	
311	Animal Diseases	5%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%		5%	
404	Instrumentation and Control Systems	5%		5%	
501	New and Improved Food Processing Technologies	10%		10%	
502	New and Improved Food Products	10%		10%	
503	Quality Maintenance in Storing and Marketing Food Products	10%		10%	
504	Home and Commercial Food Service	15%		15%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	10%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%		10%	
722	Zoonotic Diseases and Parasites Affecting Humans	5%		5%	
723	Hazards to Human Health and Safety	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.0	0.0
Actual Paid	3.6	0.0	4.2	0.0

Actual Volunteer	1869.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
107044	0	278397	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
449002	0	895381	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
115490	0	62918	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Conduct training and certificate programs for growers, producers, food workers, consumers and vendors to increase knowledge of food safety practicies.
• Design strategies, tools and processes to detect and eliminate pathogens, chemical and physical contaminants during production, transportation, processing and preparation of food.
• Invesitgate the ecology of threats to the food supply from microbial and chemical sources
• Develop technologies for the detection of food supply contaminants

2. Brief description of the target audience

• Producers
• Processors
• Retail - restaurants/vendors/supermarkets
• Department of Health
• Consumers, families, youth communites
• NJAES - faculty - staff - students
• Food manufacturers
• Schools - child care providers - food service workers

3. How was eXtension used?

Faculty have participated in answering "ask the expert" questions, development of collaborative educational products, and learn professional development products.

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	48965	9183	36361	0

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

Patent Applications Submitted

Year: 2015

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	15	22	37

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- -New methods in technologies -Educational workshops -Newsletters -Scientific publications -Patents -Website development -Extension publications -Volunteers trained -Agricultural and Industry Certifications -Train the trainer programs -Audits conducted

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Increase knowledge of viable technologies, detection prevention, intervention and control technologies and practices to ensure food safety. Increase understanding of the ecology of threats to food safety from microbial and chemical sources.
2	Medium Term - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
3	Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
4	Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption - Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
5	Luminescence Probes of Food Quality -Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
6	Engineering for Food Safety and Quality -Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
7	Nanotechnology and Biosensors-Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
8	Mycotoxins: Biosecurity, Food Safety and Biofuels Byproducts-Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
9	Quality and Safety of Fresh-cut Vegetables and Fruits-Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses

Outcome #1

1. Outcome Measures

Short Term - Increase knowledge of viable technologies, detection prevention, intervention and control technologies and practices to ensure food safety. Increase understanding of the ecology of threats to food safety from microbial and chemical sources.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Medium Term - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Improving Food Safety through Predictive Models and Microbial Risk Assessment - Food manufacturers are under a variety of regulatory, economic and environmental pressures. Retaining a strong manufacturing base is an essential component for a states economic growth.

What has been done
An NJAES researcher provides technical assistance for small and medium-sized companies, helping to keep them in business, while still assuring the safety of the food supply. While an NJAES Researcher continually assists the industry through short courses, in the current reporting year there were three different instances where one-on-one assistance had a specific and direct economic benefit to NJ companies. In 2015 the NJAES Researcher assisted NJ-based companies with a product detained by Dutch food safety authorities on import into the European Union because of contamination with a foodborne pathogen, a small snack manufacturing company whose products were turning moldy before the end of the shelf life, and a medium-sized food processing company concerned with safety and shelf stability of a condiment product. In addition to the assistance provided to NJ-based companies, as time allows, the NJAES Researcher also provide technical assistance to other states and internationally. Twenty such examples occurred in 2015 with assistance provided to companies or groups based in Washington, DC (3 organizations), Wisconsin (2 companies) Pennsylvania (1 company, but 10 separate problems), one Canadian meat and cheese company, Illinois (1 foodservice company), and two consulting companies assisting FDA.

Results
In several cases costly recalls, rework, or product destruction were avoided. In some cases federal agencies, trade associations or food processing companies were able to use risk-based decision-making to guide them in their policy discussions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mechanisms for Improving Food Quality and Safety through Understanding Membrane Resistance Properties - The microbiological safety of food is an issue of great importance to the state of New Jersey, the nation, and the world. Foodborne microbial pathogens account for an estimated 76 million cases of foodborne illness each year, which include up to 5,000 deaths. The estimated cost to the United States from foodborne illnesses associated with known pathogens is between $6.5 - $34.9 billion.

What has been done
NJAES researchers are studying the membrane fluidity of spores from various bacterial species and compare them with the known fluidities of vegetative cells (extending on their previous research project - Mechanisms and food safety applications for antimicrobial proteins from lactic acid bacteria).

Results

Since there were no published methods for determining the fluidity of spore inner membranes, NJAES researchers developed a method using fluorescent probes. Using this method, it was determined the first time the membrane fluidities of vegetative cells and spores of Bacillus subtilis (a model organism), B. cereus (a foodborne pathogen), B. anthracis Sterne (a biothreat agent), B. mycoides (an atypical Bacillus), and B. thuringiensis (a bioinsecticide) using the fluorescence of the probe 1, 6-diphenyl-1, 3, 5-hexatriene (DPH) as a metric. Cells cultured on three different media (Luria Broth, Nutrient Broth or solidified Luria Broth) had significantly different ($p<0.05$) membrane fluidities. The membrane fluidities of B. subtilis, B. mycoides, and B. anthracis Sterne vegetative cells were different from those of their spores. Further analysis revealed that the membrane fluidity of B. subtilis spores was higher than those of B. anthracis Sterne or B. mycoides. However, the membranes fluidities of B. anthracis Sterne and B. mycoides spores were not significantly different from each other. Although the mechanisms for these observations are unknown, they provide foundational knowledge about the fluidity of spore inner membranes. Knowledge of spore membrane properties could further the control of pathogenic and spoilage microorganisms in food.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption - Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The lack of knowledge of foodborne pathogen-plant interaction hinders the development of effective strategies to reduce or eliminate foodborne pathogen contamination of leafy greens and other fresh fruits and vegetables. Sanitizers and sanitizing practices presently employed commercially to reduce microbial numbers on fresh fruits and vegetables post-harvest are not adequate.

What has been done
NJAES researchers studied the influence of cell surface structures of E. coli O157:H7, such as flagella, curli fimbriae, lipopolysaccharides, or exopolysaccharides, on plant defense responses and on survival or colonization on the plant. Subsequently the study evaluated whether growth medium or exposure conditions influence the production of capsular polysaccharides (CPS) by Escherichia coli O157:H7, and whether changes in CPS impact plant defense responses, consequently affecting survival on plants.

Results
The population of an E. coli O157:H7 wild-type strain was significantly lower on wild-type Arabidopsis plants compared with that of the flagella-deficient mutant. The results suggest that the flagella, among the other pathogen associated molecular patterns (PAMPs), made a substantial contribution to the induction of plant defense response and contributed to the decreased numbers of E. coli O157:H7 wild-type strain on the wild-type Arabidopsis plant. The cell surface structures of E. coli O157:H7 have a significant impact on the induction of differential plant defense responses, thereby impacting persistence or survival of the pathogen on plants. The results of this phase of the research underscore the need to consider medium composition and cultural conditions when conducting crop challenge studies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

Outcome #5

1. Outcome Measures

Luminescence Probes of Food Quality -Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Ensuring and improving the overall quality and safety of manufactured and processed foods is a perennial concern of the food industry; consequently, instrumental techniques have long been used to monitor specific physical and chemical properties of foods and food materials that are thought to relate to the generation and maintenance of quality during processing, shipment, storage, and sale. The development of instrumental methods to monitor physical and chemical properties relevant to food quality has been an important area of research within food science

What has been done
NJAES researchers are investigating how measurements of luminescence emission from aromatic molecules can be used to monitor physical and chemical properties related to the overall quality and safety of foods. The NJAES research team has further characterized a number of GRAS luminescence probes for monitoring food quality in this reporting period; these include several flavonols (3-hydroxy flavone, quercetin, fisetin), several azo food dyes (allura red, fast green, tartrazine), and riboflavin.

Results
This work has further identified how the probes report on specific physical properties (water activity, viscosity, matrix mobility) of the food medium. The team has investigated how these and other probes are sensitive to specific food properties--structure of protein nanoparticles, mobility in amorphous carbohydrates--and novel food media--in vitro models of the gastrointestinal system--of interest to food technologists. The continued research will provide insight into the molecular basis for specific macroscopic properties of foods and component functionalities in foods; such insight will provide the scientific background to improve or enhance the physical properties, quality, and shelf-life of foods. It will also potentially lead to the development of novel sensors for food quality based on inexpensive, hand-held optical devices that are able to read luminescence signals originating from molecular dyes that are either naturally occurring in foods or are added to foods during manufacture and processing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #6

1. Outcome Measures

Engineering for Food Safety and Quality -Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With an increasing demand by consumers for fresh-like, healthy, nutritious and safe food, the US food processing industry is continually challenged. Furthermore, emerging pathogenic microorganisms, tolerant to conventional treatment methods, create a demand for improved and novel food processes. The industry must constantly redefine technology to assure wholesomeness in processed foods. Thus, new and existing technologies must meet the challenge and play a pivotal role in improving the quality of value-added food products.

What has been done
NJAES researchers studied, as a model system, HPP infusion of quercetin into cranberries in order to test whether enhanced infusion of quercetin can be achieved using HPP and to test whether the commonly accepted mechanism of cell permeabilization is operative in this system. Two systems were used in this study - fresh cranberries, cells of which are intact and frozen-thawed cranberries, cells of which are already permeabilized during freeze-thawing process. Infusion was enhanced under HPP (up to 550 MPa), when compared to infusion at ambient conditions (control), in both fresh and frozen-thawed cranberries. In addition, another research project determined if a pressure profile would develop inside a heterogeneous food system, such as a soft food with hard inclusions, during high pressure processing (HPP) that could lead to non-uniformity in microbial inactivation. Model systems consisting of a gel with a wood rod inclusion, embedded glass wool, or plaster of Paris (POP) particles were inoculated with Listeria innocua or Saccharomyces cerevisiae and subjected to HPP. Real-time measurements of the response of bacteria to HPP were also studied to elucidate the mechanisms of microbial inactivation. Studies were also performed to develop mathematical models to enhance understanding of, and optimize

food processes.

Results

The results show that pressure-enhanced infusion process is much more involved than previously postulated permeabilization-based mechanisms and is perhaps caused by both pressure-enhanced mass transport and cellpermeabilization assisted mass transport. Understanding the actual mechanisms of transport under pressure may enable to develop process guidelines that will help the food industry to develop value-added foods. In another project, the researchers investigated the effectiveness of High Pressure Processing (HPP) as an infusion technique for calcium infusion in enzyme treated baby carrots. It was found that the amount of calcium infused with HPP was significantly higher than that infused by vacuum infusion and osmotic infusion. They were able to achieve infusion of calcium up to 150 mg/serving of carrots (equivalent to 15 % RDI) without significantly affecting their texture and color. For the project determining if a pressure profile would develop inside a heterogeneous food system, using rigorous mathematical modeling it was determined that von Mises stresses and pressure gradients formed very close to the inclusions, indicating pressure non-uniformity. In a related study that focused on real-time inactivation measurements due to HPP, cell membrane damage was detected using propidium iodide during pressurization and holding time, but not during depressurization. In the mathematical models studies, numerical simulation results obtained so far show significant non-uniformity in temperature in high pressure vessels (vertical and horizontal) during HPP due to water addition, adiabatic compression heating, conduction heat loss, and natural convection cooling at the vessel wall. The temperature of water added for compression was found to have a major impact on the temperature distribution as well as on the inactivation of Clostridium botulinum. Coefficient of variance COV, which is an indicator of non-uniformity, was found to be higher for a vertical vessel as compared to a horizontal vessel of similar scale and dimensions. The experimental quantification of temperature non-uniformity using ALP (alkaline phosphates) present in milk showed significant difference in inactivation of enzyme at different locations in the vertical vessel. It was found that the non-uniformity in inactivation was dominated in the axial direction compared to the radial direction and a maximum difference of approximately 8-10% was found in the residual enzyme activity, within the vessel. The inactivation shown by the experiments followed the same trend as predicted by the numerical simulation. Our model incorporated phase change behavior, complex 3D geometry, natural convective airflow in the headspace of the box, and coupling the model with microbial kinetics was also successful. Two possible temperature fluctuation scenarios during cold chain transportation that were evaluated were (a) exposed to high ambient temperature while shifting between two cold systems for prolonged time and (b) freezer breakdown. A correlation that related maximum allowed exposure time at different high ambient temperatures (20, 25, 30, 35, 40 °C) was developed. The maximum allowable time for the freezer breakdown, before microbial spoilage of the food in the ration occurred, was around 186 hours.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

723 Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

Nanotechnology and Biosensors-Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nanotechnology is continuing to have a profound impact over our society, by bringing new technical breakthroughs in material and biological, and by creating new environmental and ethical challenges related to its implementation in many biological applications. To manage these complex issues, one will need future generations to understand the technology in order to make educated decisions concerning its use.

What has been done
NJAES researchers developed new technologies for characterizing fundamental nanoscale processes to successfully and safely exploit nanotechnology.

Results
NJAES researchers developed and presented a new concept of the "sustainable packaging technology" as the new integrated concept for the packaging that combines smart packaging materials (including nanoscale structures), sensor-based intelligent packaging and information technologies of sensor-enabled supply chain management. This unique concept allows significantly improvements in food safety, optimizes product delivery and minimizes product losses in supply chain.

4. Associated Knowledge Areas

KA Code	Knowledge Area
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies

503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

Outcome #8

1. Outcome Measures

Mycotoxins: Biosecurity, Food Safety and Biofuels Byproducts-Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fusarium Head Blight is a major problem infecting wheat and barley in the US, and worldwide. In addition to causing loss of the grain head, infection with FHB leaves contaminating mycotoxins which are harmful to human and animal health. Screens of wheat and barley accessions and wild relatives have revealed very few natural sources of disease resistance to FHB. The lack of natural FHB resistance in breeding populations creates an opportunity to engineer resistance through the expression of transgenes. A major problem is that functional assay of genes in wheat and barley is time consuming and expensive.

What has been done
NJAES researchers have developed an assay system using a model plant species that allows the properties of genes to be quickly and inexpensively tested. This approach has helped define a number of genes whose over-expression or knockout can enhance resistance to FHB.

Results
This research revealed a number of genes whose modulation can alter the course of F. graminearum infection and also revealed that several independent mechanisms are responsible for resistance to FHB. The recent development of methods for efficient gene editing in higher plants allows the full range of pathology and symptoms to be explored in a natural pathosystem. Consequently, in the past year, these researchers have aggressively adopted CRISPR and related technologies in order to effect gene mutation in Barley and Brachypodium. This work has laid the foundation for our current efforts to engineer FHB resistance in crop species. Gene targets include those identified in the moss system, as well as others selected on the basis of

published reports in other plant:pathogen systems. In worms, the researchers were able to develop a robust and user-friendly assay for DON and other mycotoxins and to delineate molecular and cellular markers induced by DON. The functional significance of genes whose expression is induced or suppressed by DON is currently being explored through the construction of knockout worms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

Quality and Safety of Fresh-cut Vegetables and Fruits-Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As consumers opt for more food choices that feature both nutrition and convenience, pre-cut fruits and vegetables have become more prevalent in the produce section of food markets. Minimal processing of fruits and vegetables reduces shelf life and makes it easier for human pathogens to infest food.

What has been done
The Rutgers component of the S-294 Multi-state project focuses on packaging technologies that prolong shelf life of pre-cut vegetables and minimize the possibility of contamination by food pathogens. Specific organic vegetables grown in the Mid-Atlantic regions of the U.S. (e.g. bell

peppers, chili peppers, bulb onions, summer squash, carrots) will be pre-cut and tested for shelf life and freedom from contamination following packaging and storage in extruded polymer films that exhibit favorable gas exchange properties. Results will be integrated into new, value-added products in conjunction with business development efforts at the Rutgers Food Innovation Center. Previously, a new packaged and microwavable asparagus spear product was developed under this multistate project. Since the new product is branded, it is more desirable to extend the availability of the product in the food distribution system for as long as possible. The mother stalk asparagus harvesting system has been shown to be an effective way to extend the asparagus harvesting season in a given location, but the resulting spears exhibit qualitative differences in pigmentation and sugar level as compared with spears harvested in a standard system.

Results

The results of shelf life/headspace experiments completed in 2015 have determined that respiration rate of spears from standard vs. mother stalk harvesting are not significantly different. Therefore, the same processing protocols and packaging materials may be used, making it economically feasible to use the mother stalk harvesting system to extend the availability of the packaged product. Evidence has been obtained during 2013-2014 that spears from the mother stalk harvesting system exhibit different respiration rates than those from traditional harvesting systems. During this reporting period, four experiments were conducted to contrast respiration rate (as determined by headspace gas composition following storage of equivalent masses of asparagus spears) is slightly higher in mother stalk than standard harvest shoots, but the differences were not statistically significant. Based on this observation, the largest asparagus grower in New Jersey will adopt the mother stalk harvesting method for approximately 5-10 acres for their packaged/microwavable asparagus spear product.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
605	Natural Resource and Environmental Economics	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	2.0	0.0
Actual Paid	3.0	0.0	1.1	0.0
Actual Volunteer	100.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
24286	0	54422	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
434800	0	309980	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	723	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Perform experiments to investigate renewable energy production.

- Develop methodologies and scientifically sound alternatives to fossil fuels
- Educate homeowners, business owners, farmers and agri-related businesses, youth and families about conservation and efficiency practices related to energy use.
- Provide education and training to enhance bio energy related job development and careers.

2. Brief description of the target audience

- University faculty, staff and students
- School aged youth
- Families
- Homeowners
- Farmers
- Agri-businesses
- State agencies and organizations
- Industry partners
- Small businesses
- Entrepernuers
- Policy and decision makers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2574	18669	1120	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	4	7	11

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- -Scientific publications and patents produced -Participants reach through direct and indeirect education -New methodologies and technologies developed

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Increase knowledge, energy efficiency technologies and conservation practices related to energy use. Explore research strategies to replace fossil fuel consumption.
2	Medium Term - Participants in direct and indirect educational methods will adopt practices to conserve energy use and reliance on fossil fuels. Business owners will create and maintain green jobs/careers as a result of bioenergy development. Newly developed plants and technologies will be adopted to enhance energy independence.
3	Long Term - Fossil fuel consumption will be replaced with biofuels. Economic development will be enhanced through an increase of jobs and careers as a result of bioenergy development. Environment quality enhanced as a result of sustainable biofuel production and utilization.
4	The Science and Engineering for a Biobased Industry and Economy -Long Term - Fossil fuel consumption will be replaced with biofuels. Economic development will be enhanced through an increase of jobs and careers as a result of bioenergy development. Environment quality enhanced as a result of sustainable biofuel production and utilization.
5	Sustainable Energy Production Using Duckweed Biomass Through Optimized Waste-to-Fuel Technologies -Long Term - Fossil fuel consumption will be replaced with biofuels. Economic development will be enhanced through an increase of jobs and careers as a result of bioenergy development. Environment quality enhanced as a result of sustainable biofuel production and utilization.

Outcome #1

1. Outcome Measures

Short Term - Increase knowledge, energy efficiency technologies and conservation practices related to energy use. Explore research strategies to replace fossil fuel consumption.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Medium Term - Participants in direct and indirect educational methods will adopt practices to conserve energy use and reliance on fossil fuels. Business owners will create and maintain green jobs/careers as a result of bioenergy development. Newly developed plants and technologies will be adopted to enhance energy independence.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Controlled Environmental Engineering - Controlled environment plant production systems (greenhouses and growth chambers) are used worldwide to produce high quality plant material (produce, floriculture, and nursery crops). Rising energy prices have made a significant impact on the profitability of many greenhouse operations. Engineering information and solutions can help growers reduce energy use and operating costs. Alternative energy sources and novel technologies need to be investigated for potential applicability and economic return. Some of the technologies involved require relatively high initial investment costs. Research is needed to determine the best possible applications before growers are able to make informed investment decisions.

What has been done
Research was conducted by RCE Specialists and staff, colleagues participating in NE-1335, NCERA-101, and NECC-1501, colleagues at Penn State University, Purdue University, Ohio State University, Michigan State University,and the University of Arizona, on the use of light emitting diode (LED) lighting systems for photoperiodic and supplemental lighting of vegetable and flowering crops. Other efforts involved the development of an online (undergraduate) course consisting of individual lectures (modules) focused on engineering and crop production issues.

Results
The research has resulted in new information that has been communicated with the other scientists, growers and industry representatives through scientific papers, presentations and trade magazine articles. Growers who implemented the information resulting from the research and the various presentations and publications have been able to realize energy savings between 5 and 25%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Long Term - Fossil fuel consumption will be replaced with biofuels. Economic development will be enhanced through an increase of jobs and careers as a result of bioenergy development. Environment quality enhanced as a result of sustainable biofuel production and utilization.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
On the Role of Buried Charge in Protein Stability - The glucose can be fermented to make ethanol and other fuels, while the short glucose chains can be made into plastics. The impacts are of two kinds. (1)Glucose, the product of cellulase action on cellulose, can be converted by microorganisms to fuels. Ethanol is the most common such fuel as present, but technologies exist and are under development to use microorganisms to convert it to fuels of higher energy content such as jet fuel. In the process of deriving fuels from cellulose we derive environmental benefits, as well, in that by replacing fossil fuels by biologically produced fuels, we reduce the carbon dioxide burden on the atmosphere. Global climate change can thus be ameliorated. (2)Because the methodology is general and can be applied to virtually any enzyme, the chemical industry will be able to replace processes that produce toxic by-products and/or that use toxic solvents by processes having few or no by-products and that use plain water as the solvent.

What has been done
NJAES researchers are addressing work on a cellulose enzyme, which breaks down cellulose to glucose and short chains of glucose molecules. The researchers are studying the increase the thermal stability of a cellulase enzyme by replacing carefully selected charged amino acids with polar but uncharged residues. The enzyme in question is CelB2, the catalytic core of CelB, a family 12 endo-1,4--glucanase from Streptomyces lividans, but the methodology, as mentioned above, is completely general and could be applied to any protein.

Results
There has been considerable progress on this research. The gene for the enzyme has been cloned into E. coli and expressed, yielding enzyme activity. Four mutants have been designed each of which replaces a charged amino acid with an uncharged but polar one of essentially the

same overall shape. Two of these are predicted to stabilize the enzyme to elevated temperature, while two are predicted to have little or no effect on thermal stability. The aim here grows out of the fact that industrial processes work better at high temperature, whereas most enzyme are inactivated. All four mutants have been cloned and the resulting proteins have been shown to be catalytically active in cutting a test material. A cellulase project required extensive molecular modeling of the enzyme's three dimensional atomic structure. The skills thereby developed have now been applied to model the biological activity of ricin and the two proteins found in some strains of E. coli that cause food borne illness. Ricin is a potential biowarfare agent. The work on it, which is a collaboration, has the potential to develop an inhibitor which would block its toxic effects. The two proteins in toxic E. coli are derived from Shigella dysenteriae. Called Shiga 1 and Shiga 2, they and ricin operate by essentially the same mechanism. The work already published and continuing is aimed at understanding the mechanism in detail so that it can be blocked. Finally, the molecular modeling skills have also been applied to cholesterol metabolism in a study of a protein defective in Nieman-Pick disease. A rare and fatal genetic disease, the insights gained from studying its defective protein are leading to a better understanding of how cells in general move cholesterol from one part of the cell to another and between cells.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

The Science and Engineering for a Biobased Industry and Economy -Long Term - Fossil fuel consumption will be replaced with biofuels. Economic development will be enhanced through an increase of jobs and careers as a result of bioenergy development. Environment quality enhanced as a result of sustainable biofuel production and utilization.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The new biobased industry, be it for food, fuel, biomaterials or other co-products, is rooted in a

sustainable and productive biomass production system. The Land Grant University system provides a unique capability to enable research for biobased products by providing a world-class research network. Replacing petroleum products with those originating from biological sources will require significant fundamental and applied research efforts.

What has been done
Using empirical, as well as conceptual tools, science-based knowledge is being developed by NJAES researchers. Numerical tools will be used to simulate a biorefinery, while statistical tools will be used to estimate parameters of interest. The conceptual framework will be used to improve our scientific understanding of the various processes and their economic implications. The research group worked on developing modeling and systems approaches to support development of sustainable biomass production and conversion to bioenergy and bioproducts.

Results
This research evolves in response to feedback as well as economic and technological reality and builds on existing knowledge of work in the biomass to energy domain. This research also benefits from collaboration with faculty at Rutgers, as well as faculty located at the University of California Berkeley, and from work with undergraduate and graduate students. More specifically, this project utilizes system analysis to support development of economically, socially and environmentally sustainable solutions for a bio-based economy. It developed integrated system models to configure, analyze and optimize bioenergy and biofuel production systems: waste to energy and biomass to PLA.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Sustainable Energy Production Using Duckweed Biomass Through Optimized Waste-to-Fuel Technologies -Long Term - Fossil fuel consumption will be replaced with biofuels. Economic development will be enhanced through an increase of jobs and careers as a result of bioenergy development. Environment quality enhanced as a result of sustainable biofuel production and utilization.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2015 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The quest for renewable energy alternatives to fossil fuels that have low carbon footprints has become a global priority. In response to the urgent call for significant decreases in Greenhouse Gas (GHG) emission, the Renewable Fuel Standard provision of the Federal Energy Independence and Security Act of 2007 requires 36 billion gallons of biofuels to be used in our nation's transportation fuel supply by the year 2022. Of these, 21 billion gallons are expected to derive from cellulosic and other "second generation (i.e. non-corn starch-based)" biofuels. Two major alternative biofuel strategies are being pursued worldwide. In the so-called second generation biofuels, technologies are being optimized for conversion of cellulosic feedstock materials into sugars for subsequent fermentation. However, cellulose is heavily fortified in plant-based feedstocks and requires significant energy input and enzyme pretreatments to aide its transformation into fermentable sugars with current technologies. With current estimated production cost of cellulosic ethanol at about 3 times that of corn-starch ethanol, it is unclear if and when cellulosic bioethanol will become economically viable. The situation with algal biodiesel, also called third generation biofuel, is perhaps even a bit worse since the scale-up of this approach has been particularly problematic. One of the major issues, for example, is the economical separation of algal biomass from the aqueous medium in which it has been growing. A recent life cycle analyses of these different biofuel feedstocks have raised significant concerns over their true environmental impact, especially for algal biofuels. In our consideration of alternative sources of renewable biomass that can be "domesticated" for energy production, we believe the Lemnaceae family of aquatic plants, commonly called duckweeds, holds great potential for the development of a commercially viable feedstock as a micro-crop for fuel production. The chief characteristics that make duckweeds ideal for waste-to-energy conversion are their rapid growth rate, easy harvesting potential, and ability to grow directly on existing wastewater sites.

What has been done

To realize these advantages of this micro-crop system, NJAES researchers has carried out research to develop new aquatic agronomic methods for deploying selected duckweed strains as a waste-to-fuel platform on local sites in New Jersey. These researchers have been focused on creating the key resource to associate phenotypes of duckweed to the genotypes in strains of interest that have been identified from their screens.

Results

Through work in the past 3 years, the research team has successfully integrated advanced technologies to produce a high fidelity reference genome for Spirodela polyrhiza, the Greater Duckweed. Analysis with the validated genome sequence demonstrated that this duckweed has the fewest number of protein coding genes in all flowering plants sequenced to date. Together with a detailed characterization of the small RNAs in this species, results now set the stage for the deployment of functional genomic approaches to characterize duckweeds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None to report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevan to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question. The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

Key Items of Evaluation

None to report.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.