2016 Rutgers Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Note - The actual amount of FTEs for each Planned Program represents the "Actual FTEs funded ONLY by one or more of the four federal funds." In previous reporting years this figure included FTEs funded by federal funds and the State Match.

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. We continue to streamline the report to focus on significant qualitative outcomes. The report reflects the work of the New Jersey Agricultural Experiment Station (NJAES). The mission of NJAES is to enhance the vitality, health, sustainability, and overall quality of the life in New Jersey by developing and delivering practical and 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 continue to be 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 remain relevant and responsive to the needs of New Jersey residents. Cooperative Extension continues to expand its programmatic outreach to fully engage new audiences, veterans and developmentally disabled, 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 and 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 concentrate 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 remains evident as we serve the needs of an environmentally, economically, geographically and ethnically diverse state. We continue to meet the needs of agricultural producers who farm on the urban fringe, youth who are challenged by circumstances such as poverty and risks that impede their success, families who are faced with workforce employment issues and a growing number of families who are food insecure. We continue to strive to implement Rutgers Cooperative Extension (RCE) educational programs to meet the needs of underserved and underrepresented audiences and reduce any real or perceived barriers to participation. Our programmatic and research efforts are highlighted:
The NJAES programmatic efforts span the scope of 4-H Youth Development and life skills to urban gardening and environmental issues. Attention is given to youth from urban communities that have lower graduation rates, higher rates of poverty and unemployment, all of which contribute to educational deficiencies. Programs provide urban 4-Hers with leadership opportunities. 4-H designs and implement

programs (i.e. CYFAR Science Pathways, Video Teleconference to Antarctica) that highlight cutting edge science at Rutgers to inspire and educate NJ young people about STEM careers.

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 the climate changes, New Jersey expects more intense storms and more annual rainfall, resulting in more flooding and higher risk for residents and businesses. Extension researchers and agents are conducting research and providing outreach in water quality, water conservation, water pollution prevention, and management of water runoff, for example Assessing Alternative Irrigation Water Sources for the Green Industry, Sustainable Residential Landscapes, Climate Change and Atmospheric Forcing of Water Quality in the Mullica River-Great Bay Estuary. Programs such as the Rutgers Veteran Environmental Technology and Solutions, a green job skills training program, provides opportunity to New Jersey veterans to grow clean fish for the Passaic River community, while learning agriculture, horticulture, greenhouse management, storm water management, and aquaponics.

Adults in New Jersey, and nationally, continue to be at risk for developing diabetes, high blood pressure, heart disease, and other chronic illnesses while challenged with increasing health care costs. RCE Family and Community Health Sciences (FCHS) Educators and NJAES researchers address these issues through various nutrition programs for the elderly, such as Chronic Disease Self-Management, lunch menu programs, and health finance education. NJAES researchers are studying taste sensitivity to the bitter compound 6-n propylthiouracil (PROP) and perilipin as it relates to the growing epidemic of obesity. The health of youth continues to be a priority with Extension faculty and staff providing on-line training and other outreach programs aiming to increase childhood obesity prevention and introducing youth to food systems and how food promotes health and good habits.

NJAES researchers continue their work on new crops and plant products and the development of ethnic greens and herbs while focusing on agricultural practices, high quality germplasm, and the nutritional and health promoting properties of the plants. Research also continues on packaging technologies that prolong shelf-life of pre-cut vegetables as consumers are opting for more food choices that are nutritional and convenient. In addition, an organic system is under development to control postharvest fungal diseases of fresh fruit during shipping and storage.

Quality turf beautifies and enhances the environment, conserves soil, reduces pollution and provides a site for recreation. NJAES researchers are working to develop and validate useful genetic markers for stress, heat, and drought tolerance for use in the selection of heat/drought tolerance in turf breeding programs. NJAES researchers are also studying fungi associated with grasses, including wild grasses in nature and domesticated turfgrasses.

Effective mosquito control is crucial as mosquitos pose a real public health risk and impacts the economic health of those shoreline communities where tourism is an integral part of the local community. NJAES has been charged by the State with the responsibility for developing and implementing effective mosquito population surveillance methods and ongoing surveillance of arboviral disease. NJAES researchers continue to test and improve an autodissemination station.

Urban pests cause billions of dollars of commodity loss, structural damage, and a number of diseases. NJAES researchers and RCE faculty have designed, tested, and disseminated new and improved pest management solutions based on basic and applied research on pest biology, behavior, ecology and various controls.

NJAES researchers are using ocean observations enabled by rapid advances in technology to describe the physical environment, including temperature, salinity, and water quality at varying ocean depths.

The quest for renewable energy alternatives to fossil fuels that have low carbon footprints has become a global priority. NJAES researchers are developing new aquatic agronomic methods for deploying selected duckweed strains as a waste-to-fuel platform.

Base funding from the State of New Jersey and from USDA - NIFA formula funds provides NJAES with a foundation for program development, implementation, 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 included salaries paid by counties to Rutgers Cooperative Extension (RCE) faculty and staff, 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 educational programs for New Jersey's farmers, businesses, and residents. Grant income in FY16 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	130.0	0.0	60.0	0.0
Actual	113.0	0.0	50.0	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 2016 county stakeholder meetings were held throughout the state. The Director and Associate 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 need and extension program direction. Input from these meetings was used to identify emerging issues and guide the program and 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 and social media and word 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 county stakeholder meetings individuals participate in open forums where current issues and concerns that impact the county are identified. Stakeholders are active participants in strategic planning processes conducted to identify priority needs that 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 welcomes and values the input of our stakeholders. We continually 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 essential and critical partners, and their input is

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 Extension and Research Directors to share their knowledge of their local county or special interest areas they 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 include: NJ State Board of Agriculture, NJ Farm Bureau and County Boards of Agriculture.

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
2739504	0	3341997	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	2271815	0	3224977	0
Actual Matching	11327654	0	13196245	0
Actual All Other	2830974	0	6685141	0
Total Actual Expended	16430443	0	23106363	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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	6.0	0.0
Actual Paid	1.1	0.0	3.0	0.0
Actual Volunteer	175.0	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**
137135	0	254449	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
820111	0	940611	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
83636	0	200175	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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	8440	17930	529	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	17	23	40

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
2016	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	Climate Change and Atmospheric Forcing of Water Quality in the Mullica River-Great Bay Estuary, 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.
5	Water Management and Quality for Ornamental Crop Productin and Health - 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.
6	Microbially Mediated Dehalogenation of Organohalide Contaminants in Anaerobic Environments - 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	Onsite Wastewater Treatment Systems - 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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Assessing Alternative Irrigation Water Sources for the Green Industry - The production of ornamental crops and management of landscape plants and plantings are among the most intensive activities in agriculture. Ornamental crop growers and landscape managers rely on heavy, often excessive, inputs of water, fertilizers and pesticides to produce and maintain aesthetically pleasing plants and urban landscapes. Climate change (largely drought), severe water competition, and concerns and regulations over the environmental impact of these activities demand a re-assessment of the use and management of common and alternative water resources.

What has been done
NJAES researchers have conducted several studies to evaluate and identify nutrient and irrigation management practices that improve fertilizer and water use efficiency, minimize their environmental impact, and allow for the successful use of alternative (poor quality) irrigation water sources in ornamental plants in both production and landscape settings.

Results
Ongoing results from this research project are being disseminated to green industry constituents (growers, landscapers, master gardeners, homeowners and municipal employees with responsibilities in public parks/lawns) through presentations in extension meetings/forums, and various trade media outlets and publications. It is expected that these results will be used to generate information and recommendations that will enhance the development of environmentally-friendly, best management practices that allow for adoption and extensive/intensive use of alternative irrigation water sources for both production of ornamental crops and the maintenance of urban landscapes.

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 #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.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Sustainable Residential Landscapes in Cumberland County - The landscape of Cumberland County include a mix of agricultural, urban, and suburban land uses. There are a diversity of water users and a variety of non-point source pollutants to local waters. Several lakes and streams in the area have been designated as impacted by state regulators, and one watershed in the county is considered a priority watershed for restoration by the State of New Jersey. Addressing these concerns necessitates education of clientele groups not traditionally possessing a high degree of expertise in land management including homeowners and municipalities. Conserving potable water and preventing water pollution are essential to preserving agricultural productivity, and hence food security, as well as preserving water resources for drinking water, business use, recreation, and wildlife.

What has been done

In 2016, educational workshops by Extension Agents covered water conservation with rain barrels and water pollution prevention with rain gardens. 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. In rain garden workshops, participants were educated about preventing water pollution with rain gardens. Across four workshops, there were 52 participants, with 22 rain barrels constructed.

Results

This 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. Based on the average installation rate of past rain barrel workshop attendees, approximately 15,000 gallons per year of both improved stormwater management and potable water was conserved. Workshop participants also demonstrated an increase in knowledge about stormwater management and pollution prevention. For example, evaluation of 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
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

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

2016 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Wood Recycling Facilities - Legislators, municipalities, the recycling industry and the citizens of New Jersey need assistance in addressing various special recycling issues. For example, wood waste and wood mulch are stockpiled uncovered at wood recycling facilities before being used. When rain percolates through these stockpiles, they release runoff that might affect the water quality of receiving bodies of water. It is necessary to develop recommendations on how to manage these stockpiles to reduce the pollutant load in the runoff. Assistance in handling runoff from stockpiles of other recycling materials is also needed.

What has been done

This program uses applied research to help legislators, municipalities, the recycling industry and the citizens of New Jersey to manage runoff from stockpiles. A permanent facility was constructed at the Rutgers EcoComplex that allows testing stockpiles of various materials and developing Best Management Practices (BMPs) for handling leachate from stockpiles. Previously, the primary contaminants of concern in wood mulch runoff were identified as organic matter measured in the form of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). Measured concentrations of BOD and COD in runoff were found to be closer to those found in sewage than to those typical of urban stormwater runoff. Infiltration has been the recommended method for runoff management at wood mulch operations. However, there is the concern that the high BOD and COD in the influent leads to rapid plugging of any standard infiltration system. NJAES researchers are assessing existing infiltration systems at commercial wood mulch sites to see the extent of plugging that has occurred, and the level and mechanisms of medium biofilms that might be considered. NJAES researchers are also developing treatment strategies.

Results

The outcomes are knowledge gain, the expansion of markets of recycled materials and the prevention of stormwater pollution from stockpiles of recycled materials.

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

Climate Change and Atmospheric Forcing of Water Quality in the Mullica River-Great Bay Estuary, 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Mullica River-Great Bay Estuary is the most pristine estuarine system in New Jersey. Water quality in this estuary has historically been excellent, and therefore it can serve as an ideal reference for assessing human impacts on other shallow coastal bays in New Jersey and elsewhere. Changes in the frequency and intensity of storms and droughts influence hydrologic and water quality conditions in the estuary that can significantly affect biotic communities and habitats. Local, regional, and national coastal management programs can use data collected by NJAES researchers to track short-term variability and long-term changes in the structure, function, and integrity of estuarine systems. In addition, the databases will also help coastal managers evaluate the interrelationships between meteorological events, water quality changes, and estuarine ecosystem condition; this information is vital for evaluating the response of the estuarine system to episodic weather events, such as major storms. These databases, therefore, will contribute to sound resource management of coastal waterways for the benefit of commercial and recreational fisheries, the coastal tourism industry, and residents who reside in coastal communities.

What has been done

NJAES researchers routinely collect water quality and meteorological measurements consistently in the Mullica River-Great Bay Estuary. Continuous recordings of wind speed, direction and velocity, solar radiation, barometric pressure, and humidity in the area to correlate with water quality parameters was also collected. Precipitation measurements are obtained at the U.S. Weather Bureau Station in nearby Atlantic City. The water-quality and meteorological data are submitted to the Centralized Data Management Office (CDMO) at the University of South

Carolina, which is the permanent repository of all of these environmental data. The data are likewise stored at the Rutgers University Marine Field Station (RUMFS) in Tuckerton, New Jersey, where it can be disseminated to interested users in New Jersey and elsewhere.

Results

The data is used to assess the temporal and spatial trends of physicochemical conditions in the estuarine system and to document relationships between meteorological conditions (e.g., precipitation, temperature flux, storms and extreme events) and water quality in estuarine waters. The data is also useful for the analysis and assessment of habitat conditions and habitat utilization by commercial and recreational fish species and other organisms in the estuary. A direct coupling between episodic weather events and water-quality changes was demonstrated in the study. For example, marked changes in water-quality parameters (temperature, salinity, dissolved oxygen levels, pH, turbidity, and water depth) were recorded at all four water-quality monitoring stations along the estuarine gradient during Superstorm Sandy in October 2012. These pulsed changes in water quality linked to the massive storm surge resulted in acute, albeit ephemeral shifts in physicochemical conditions of the estuary. They show unequivocally that storms can have a significant effect on water quality in New Jersey estuaries. The water-quality and meteorological data collected in this project are useful for improving the assessment of habitat conditions and habitat utilization by commercially and recreationally important fish and shellfish in the study area. Fishery biologists at Rutgers University, Stockton University, and other academic institutions use the water-quality databases collected in the Mullica River-Great Bay Estuary to investigate the life history and ecology of fish populations in the region. Fish migration patterns and larval dynamics are examined in light of meteorological drivers and water quality conditions in the Mullica River-Great Bay estuarine system. The databases are also valuable for assessing the sustainability of the Tuckerton Peninsula salt marsh system, a strategically located coastal marsh that serves as the sentinel site for long-term climate change research. One concern is that the gradual loss of this coastal marsh to sea-level rise, storm surge, and inundation will compromise its protective buffering capacity for human settlements upland of the marsh. This insidious loss of protective natural buffer therefore could pose a threat to the long-term sustainability of coastal communities in the area. In conclusion, this water-quality and meteorological data has great utility for local, regional, and national coastal management programs interested in determining the effects of short-term variability and long-term change in the structure and function of estuarine, wetland, watershed, and societal systems due to climate change. The outcome of this work will help to support the economic interests of commercial and recreational fishermen who are working in these waters, and the coastal administrators who must make informed decisions to effectively manage the resources.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Water Management and Quality for Ornamental Crop Productin and Health - 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.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The production of ornamental crops and maintenance of landscape plantings utilize large amounts of irrigation water. Drought and stiff competition for water resources drive the search for alternative, non-traditional water resources such as reclaimed water and graywater, to cope with limited availability of good-quality water (destined to other pressing human needs and uses). Alternative irrigation waters include municipal reclaimed water, recycling of drainage and runoff effluents, storm water, rainwater, graywater and brackish (naturally-saline) waters. These sources have chemical constituents and profiles that are stressful for plant growth and can potentially lead to unwanted environmental impacts - like impairment of water resources. Plant nursery managers, landscapers, and the general public all have a stake in the sustainability of ornamental crop production and functional urban landscapes and in minimizing the environmental impact of these activities (i.e. reduced pollution of surface and ground bodies of water).

What has been done
Several studies were conducted to evaluate and identify nutrient and irrigation management practices that improve fertilizer and water use efficiency, minimize their environmental impact, and allow for the successful use of alternative (poor quality) irrigation water sources in ornamental plants in both production and landscape settings.

Results

Results to date suggest that systematic tracking of water quality parameters and adjustments to irrigation management practices could allow for satisfactory use of these alternative water sources. The long-term effects of these water sources on the chemical, physical and biological properties of soils are currently being assessed. Ongoing results from this research project are disseminated to green industry constituents (growers, landscapers, master gardeners, homeowners and municipal employees with responsibilities in public parks/lawns).These results will be used to generate information and recommendations that will enhance the development of environmentally-friendly, best management practices that allow for adoption and extensive/intensive use of alternative irrigation water sources for both production of ornamental crops and the maintenance of urban landscapes.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Microbially Mediated Dehalogenation of Organohalide Contaminants in Anaerobic Environments - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Halogenated organic compounds constitute one of the largest groups of environmental pollutants. These toxic, bioaccumulating pollutants include legacy industrial chemicals, such as

polychlorinated biphenyls (PCBs), ubiquitous polychlorinated dibenzo-p- dioxins, and polychlorinated dibenzofurans (PCDD/Fs) which continually enter the environment via anthropogenic and natural inputs, as well as current commercial manufacturing chemicals including the brominated flame retardants (BFRs). Their widespread use and application has resulted in widespread dissemination and environmental contamination, with estuarine and marine sediments as significant sinks. These contaminants can enter the food chain through various routes, threaten human health and may ultimately accumulate in sediments and soils. These pollutants are problematic due to their recalcitrance and toxicity, and furthermore, are often present as complex mixtures. Consequently, the management of sediments and soils contaminated with toxic organohalide compounds, including PCDD/Fs, PCBs, pesticides and brominated flame retardants, is a major problem with far-reaching economic and ecological consequences. Remediation of soils and sediments contaminated with these toxic chemicals continues to be a major challenge. New methods are needed for in situ containment and degradation of contaminants. Anaerobic reductive dechlorination is a process whereby chlorinated organic compounds are degraded by chemical reduction catalyzed by certain species of bacteria. It offers a promising approach towards eventual detoxification and complete degradation of halogenated contaminant mixtures. However, application of in situ bioremediation of organohalide-contaminated sediments has been limited by lack of fundamental knowledge about how to effectively stimulate the microorganisms responsible for reductive dehalogenation. Detailed information on the dehalogenation process is needed to provide strategies to remediate contaminated sediments by enhancing dehalogenation of organohalogen pollutants in situ and, for example, in conjunction with sediment caps.

What has been done
An NJAES researcher is conducting laboratory and in situ studies of contaminated river sediments to identify the microbial communities and processes responsible for anaerobic reductive dehalogenation of organohalide compounds, including brominated flame retardants, polychlorinated dibenzo-p-dioxins, polychlorinated biphenyls and diverse pesticides.

Results
Results from micro- and mesocosm experiments using contaminated sediments (e.g., Anacostia River MD, Hackensack River NJ and Kymijoki River Finland) have revealed diverse communities of dehalogenating microorganisms. Although Dehalococcoides species are the most likely candidates for PCDD/F and PCB dechlorination, there are other Chloroflexi microorganisms that have been shown to be active in dechlorination. The addition of halogenated co-amendments might be one tool to enhance dechlorination of PCBs and PCDD/Fs in historically contaminated sediments. The enhanced dechlorination correlates with increased numbers of dehalorespirer populations and reductive dehalogenase genes, supporting the hypothesis that the halogenated co-substrates enhance dechlorination of historic pollutants by supporting growth and activity of indigenous dehalogenating bacteria. A combined bioaugmentation/biostimulation approach may thus be feasible for the bioremediation of sediments contaminated with PCBs and PCDD/Fs. Using sediments of River Kymijoki in Finland, researchers determined the potential for microbially mediated reductive dechlorination of weathered PCDFs in contaminated sediments and investigated the feasibility of stimulating such activities in situ. Anaerobic enrichment cultures derived from contaminated Kymijoki River sediments dechlorinated several PCDFs, including 1,2,3,4-tetra-CDF, octa-CDF and 1,2,3,4-tetra-CDD. This research also documented the speeds with which these decholorination processes occurred within these various PCDFs and the mechanisms involved. This information will aid in understanding how indigenous microbial communities impact the fate of PCDFs and in developing strategies for bioremediation of PCDD/F contaminated sediments. Further characterization of the selective and synergistic activities of PCDD/F dechlorinating microorganisms with different contaminant mixtures is essential for generating models to predict the dechlorination potentials at impacted sites and design effective

in situ treatment. Further basic applied research is needed to develop these findings into a technology that could be scaled-up for site clean-up. With the appropriate investment in the applied technology development, some of the approaches could be tested in field scale within 3 to 5 years.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Onsite Wastewater Treatment Systems - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Assessing the Impact of Climate Variability and Climate Change - Pharmaceuticals and personal care products have chemicals that are commonly used in many American households and contribute to the municipal waste stream. Some of these chemicals may be metabolized by the human body, but a large fraction is released directly into the waste stream. Pharmaceuticals and personal care products may have pharmacological activity, whereas others may interfere with hormonal systems by mimicking estrogen. These chemicals must be degraded by the microorganisms in wastewater treatment systems, otherwise they may be released into the environment. This has an ecological impact on any animals that may be living in water that receives treated effluent, and also could contaminate drinking water. NJAES researchers hypothesize that increasing temperature extremes resulting from climate change will have an

effect on the rate of biodegradation activity, ultimately impacting the amount of these chemicals that can be removed during wastewater treatment and subsequent variability in the concentrations that are released into the environment. To address this issue we must first understand the mechanism whereby microorganisms degrade pharmaceutical and personal care products under anaerobic conditions.

What has been done

Sewage sludge is used to establish anaerobic enrichment cultures that amended with individual pharmaceuticals and personal care products. This creates ideal growth conditions to promote growth of specific organisms that are likely to have pharmaceutical and personal care product degrading capabilities resulting from continued exposure to household wastes. Concentrations of substrate are monitored to detect whether and how biodegradation is occurring. Microbial communities associated with these processes are studied to identify specific metabolites and corresponding genetic markers. The result will be biochemical and genetic tools that will allow the prediction of the potential for biodegradation, as well as evaluation of the rate and extent of pharmaceutical and personal care product biodegradation during wastewater treatment.

Results

Recent findings indicate that some pharmaceuticals are transformed by microorganisms into products that are slow to degrade. For example, naproxen (found in Aleve) is known to be transformed to a metabolite, desmethylnaproxen, in wastewater treatment processes. Both the parent compound (naproxen) and the metabolite are released into receiving bodies of water. In this experiments, the metabolite remains unchanged for the length of the study (many months). Regional or federal agencies do collect some data and have monitored natural streams and waterways for the parent compound (the active ingredient). What is not known, however, is the level of the metabolites which may be entering the environment. Moreover, whether the metabolites themselves have biological or pharmaceutical activity is also unknown and remains to be determined. Research results provide evidence of metabolites that could be screened for in water samples and biosolids, which are key modes of pharmaceutical entry into the environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
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 the 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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	0.0	5.0	0.0
Actual Paid	4.8	0.0	9.2	0.0
Actual Volunteer	2002.0	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**
452913	0	513796	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1171475	0	1883361	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
230985	0	1118718	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.
• Investigate how perilipin A works in adipocytes to control fat storage and fat breakdown.
• 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; Creating Healthy Communities; Healthy Food Choices in Schools; Military Families and I-three Corps. Faculty answered ask the expert questions, developed collaborative educational products, conducted professional development sessions and provided leadership to CoPs.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	32675	16835	31548	12500

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

Patent Applications Submitted

Year: 2016

Actual: 1

Patents listed

15/026,054

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	7	54	61

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
2016	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	Hunterdon Chronic Disease Self-Management Programs -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.
5	HomeStyles LifeStyle Certificate -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.
6	From Our Farms - 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.
7	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. 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.
8	Taste Genetics, Obesity and Weight Loss - 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.
9	Structure/Function Studies of Perilipin LONG-TERM - Individuals experience: Decreased overweight and obesity conditions 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	Hub City Fresh Healthy Corner Store Initiative - LONG-TERM - Individuals experience: Decreased overweight and obesity conditions 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	Healthy Menu Options Program - LONG-TERM-Individuals experience: Decreased overweight and obesity conditions 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Mercer County Nutrition Project for the Elderly- Aging brings many changes to the body and its nutritional needs. Older adults (defined by the Older Americans Act as age 60 or older) often have at least one chronic disease, and are at risk for malnutrition and conditions that weaken their bones and muscle mass. If older adults are not physically active they burn fewer calories and may have a reduced appetite, making it critical that they make the best choices for their nutrient intake. At the other end of the spectrum are those older adults who are overweight or obese and who are at increased risk for, or already suffering from, heart disease, hypertension, or type-2 diabetes. Of the most common causes of death of adults aged 65 years and older in the United States, five or eight have a known nutritional influence. The Academy of Nutrition and Dietetics Position Paper on Food and Nutrition for Older Adults: Promoting Health and Wellness, states that nutrition is one of the major determinants of successful aging. It further states that food is not only critical to one's physiological well-being, but also contributes to social, cultural and psychological quality of life. United States population demographics are changing dramatically as baby boomers reach older adult ages.

What has been done

To address these issues, the Older Americans Act funds various nutrition programs and requires the provision of nutrition education. In Mercer County, New Jersey, congregate lunch meals are provided in eleven senior center sites within seven townships. As part of a three year contract between the County Office on Aging and RCE Extension, a Family and Community Health

Extension Educator provides group nutrition education at these sites. In 2016 the Extension Educator made 28 visits to senior sites and made 1365 client contacts and presented educational programs: Health-Wise Meals; Food Safety for Older Adults; Understanding the Current and New Nutrition Facts Label. Each evidence-based presentation was delivered prior to lunch being served and the information reinforced and related to the daily menu.

Results

Whenever feasible, barring time constraints and practicality of completing surveys, participants completed IRB-approved written surveys after consent was attained. Surveys were completed in 15 of the 28 visits. Health-Wise Meal: n=91; Administered survey 6 times - 76% of respondents female, 24% male,48% White; 40% Black; 5% Hispanic; 4% Asian; 82% reported learning: Quite a bit or a lot about the topic Food Safety: n=143; Administered survey 7 times: 78% female; 22% male 33% White; 43% Black; 2% Hispanic; 14% Asian; 86% reported learning Quite a bit or A lot about the topic Nutrition Facts Label: n=46; Administered survey 2 times (demographics not available): 76% reported learning Quite a bit or A lot about the topic. In addition to this formal arrangement with the county, nutrition education was provided to older adults at 4 additional community-based locations resulting in 201 client contacts. Health-Wise Meal Survey Results: 1) As a result of this program do you expect to make healthy food choices whenever you can: 95.5% replied Probably Yes or Definitely Yes 2) As a result of this program I understand what makes up a healthy diet for older adults: 98.8% replied Agree or Strongly Agree 3) As a result of this program do you expect to eat more fruits and vegetables: 93.3% replied Probably Yes or Definitely Yes 4) As a result of this program do you expect to eat more whole grains: 86% replied Probably Yes or Definitely Yes 5) As a result of this program do you expect to choose fiber-rich foods more often: 92.8% replied Probably Yes or Definitely Yes 6) As a result of this program do you expect to drink water and other beverages that are low in added sugars to stay hydrated: 95.2% replied Probably Yes or Definitely Yes 7) As a result of this program do you expect to choose healthy oils more often: 91.6% replied Probably Yes or Definitely Yes 8) As a result of this program do you expect to choose and prepare foods with less salt or sodium: 89.5% replied Probably Yes or Definitely Yes Food Safety Survey Results: 1) As a result of this program I understand safe food handling, preparation and storage: 99.3% replied Agree or Strongly Agree 2) As a result of this program I am confident that I could improve my safe food handling to prepare meals for myself and others: 97.8% replied Agree or Strongly Agree Nutrition Facts Label Survey Results: 1) As a result of this program do you expect to make healthy food choices whenever you can: 91.1% replied Probably Yes or Definitely Yes 2) As a result of this program which word best describes how likely you are to read the Nutrition Facts Label: 82.6% replied Quite Likely or Definitely 3) As a result of this program I will be able to shop smarter by following nutrition guidelines: 95.6% replied Agree or Strongly Agree.

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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beneficial and Adverse Effects of Natural Chemicals on Human Health and Food Safety- Obesity is a major health issue and a major risk factor 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. Root extracts of Rhodiola rosea (Golden Root) have notable anti-stress properties. Raspberry ketone is also purported to have lipolytic effects. Previous pilot studies have indicated that oral adminstration of Citrus aurantium (6% synephrine) and Rhodiola rosea (3% rosavins, 1% salidroside) together improve diet-induced obesity alterations in adult male Sprague Dawley rats. NJAES researchers are extending those findings by examining the metabolic, endocrine, and body homeostasis mechanisms involved with the treatments of C. aurantium and R. rosea in diet-induced obese mice. This investigation has been expanded to include the anti-obesity effects of raspberry ketone. Do botanical supplements really lead to reductions in obesity and associated metabolic disorders? If so, how does this happen? Answers to these questions may lead to novel mechanisms and treatment options to treat obesity and related metabolic disorders.

What has been done
NJAES researchers are using non-invasive laboratory methods to examine how botanical treatments influence the neuroendocrine markers of obesity and diabetes.

Results
Research results indicate that that raspberry ketone activates hind-brain-neural pathways involved in feeding. This activation is likely via vagal-mediated pathways. Repeated dosing of raspberry ketone reduces high-fat diet intake in diet-induced obese animals.

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 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Evaluation and Characterization of Novel Botanical Extracts for the Prevention and Treatment of Metabolic Syndrome and Diabetes - The occurrence of type 2 diabetes continues to soar to epidemic proportions, reaching almost 8% (23.6 million) of the population in the U.S. alone. Another 57 million Americans have pre-diabetes, defined by an impaired fasting glucose value as a result of insulin resistance. Insulin resistance is a key pathophysiologic feature of the "metabolic syndrome" and is strongly associated with co-existing cardiovascular risk factors and accelerated atherosclerosis. Due to the clinical consequences associated with insulin resistance in subjects

with metabolic syndrome and type 2 diabetes, clinical regimens directed at increasing insulin sensitivity in vivo remain one of the most desirable goals of treatment. Although it is well established that lifestyle modification can improve insulin resistance and effectively improve many of the risk factors associated with metabolic syndrome, the success of maintaining lifestyle changes in humans over a chronic period is poor. Therefore, strategies to improve insulin resistance by pharmacological means have represented the traditional approach for clinical medicine. However, nutritional supplementation with the use of botanicals that effectively increase insulin sensitivity represent a very attractive and novel approach for future studies designed to intervene in the development of metabolic syndrome. Plant extracts that are established as having bioactive compounds useful for the treatment and prevention of diabetes and metabolic syndrome will become a product of new use agriculture and provide local farmers with the opportunity to grow new high value crops as an alternative to traditional crops. Pharmaceutical and nutraceutical companies will use the processed plants as the source of novel ingredients for drugs, foods and or dietary supplements. These new products will promote a healthier population.

What has been done

NJAES researchers are examining extracts from Artemisia, Moringa and fenugreek to ascertain whether they improve insulin sensitivity. Researchers are also working on isolating and characterizing the active components of the extracts.

Results

Previous research findings show that an alcoholic extract of Artemisia dracunculus L., referred to as PMI-5011, increases insulin action in vivo and NJAES researchers have identified several novel intracellular pathways that may explain how it may work. A clinical study with an improved formulation was conducted in 2016 using a new formulation of PMI-5011. The new formulation was developed to enhance the bioavailability of the active components of PMI-5011, especially the most abundant one that is used as a marker compound. The analysis of the first 3 cohorts has been completed and showed consistent safety of this new formulation, even at the highest dose of 30g/day. Improved insulin trends were also observed.

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

Hunterdon Chronic Disease Self-Management Programs -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The State of New Jersey, Department of Health, Division of Aging Services, became licensed to conduct peer leader trainings to conduct the Stanford Chronic Disease Self-Management Program (known as Take Control of Your Health in NJ). This program is intended to complement, not replace, professional health care services. While there are many programs focused on increasing knowledge of chronic diseases, there are few which provide opportunities for group support and skill building, as in the Take Control program. Extension professionals, by virtue of their experience with group education, can offer this program in their community, by partnering with other organizations serving consumers with chronic disease.

What has been done
The Chronic Disease Self-Management Program is a program originally developed and tested by Stanford University to assist people with chronic illness. The workshop is a 6-week series, two and a half hours each week, held in community settings such as senior centers, churches, libraries and hospitals. People with different chronic health problems attend together in small groups. Workshops are facilitated by two trained peer leaders. Topics covered include techniques to deal with emotional issues such as frustration, fatigue, pain and isolation; appropriate exercise; healthy eating; use of medications; communicating effectively with family, friends, and health professionals; action planning and decision making. Classes are not just focused on information and content, but are highly interactive, where mutual support and success build the participants' confidence in their ability to manage their health and maintain active and fulfilling lives. In addition, many people have more than one chronic condition. The program is especially helpful for these people, as it gives them the skills to coordinate all the things needed to manage their health, as well as to help them keep active in their lives. Expected outcomes of the program include improvements in physical activity, cognitive symptom management, communication with physicians, self-reported general health, health distress, fatigue, disability, and social/role activities limitations. There is potential for fewer hospital admissions, and increased healthcare cost savings. In 2016, after taking the appropriate peer leader training program, two sessions of

the Take Control of Your Health were offered in Hunterdon County for the first time, one general chronic disease series and one diabetes-focused series. Target audiences were older adults with any chronic disease(s) and their spouses/caregivers. The diabetes focused series recruited consumers with pre-diabetes or diabetes, particularly type 2. A total of 15 participants completed the 6 week programs.

Results
A post-series evaluation survey was completed by class participants (n=15) to assess knowledge gained and intentions for lifestyle behavior change. Participants listed the following intentions to take action, as a result of taking this program: Increase the amount of exercise I do by adding another yoga class for more stress management and exercise; Exercise, meditate, get organized; Use the 200 calorie deficit plan for more exercising; Learned of the importance of water and ways to remember to drink daily; Technique of developing an action plan. Also, the 200 calorie technique to manage one's diabetes/weight; Count backwards from 100 when I can't sleep; Continue walking and eat better; I would like to get more involved in journaling. I think that is an area I haven't tried yet; Write a food and exercise and mood journal to monitor my food intake to lose some weight; Keep active- use it; Tracking food and exercise daily; Watch diet and keep active; Exercise and weight(food for my diabetes); Exercise more and drink more water. Other participant comments: It has been helpful to think of more than my problems; Learned valuable communication skills in talking with healthcare providers and pharmacy. Also, problem solving skills, more action planning in my life, so that I can accomplish goals I have set for myself; Program helped by teaching what to do and how to go about it. I was in diabetic denial. The program made me more aware of the seriousness of the disease and the importance of maintaining a proper diet; Great program. It provided a great education experience to fortify one's knowledge about diabetes and a forum to discuss problems and work out solutions with the group; It taught one many techniques to understand and combat issues which confront you as you move through your day.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

HomeStyles LifeStyle Certificate -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
HomeStyles LifeStyle Certificate - In the U.S., approximately 12% of preschool children (i.e., 2- to 5-years-old) are obese, with an additional 16% at risk to be overweight. Being overweight is more prevalent among some minority and economically disadvantaged groups. For instance, in New Brunswick, NJ 50% of Black and Hispanic children attending Head Start were obese or at risk for overweight. Being overweight during infancy and childhood sets the stage for premature development of chronic diseases. Obese children also experience psychological stress in the form of social stigmatization and depression. Home environment lifestyle practices develop eating and physical activity patterns in childhood that tend to serve as the basis for adult behaviors. As role models and gatekeepers, parents strongly influence food and exercise behaviors of children and are key players in obesity prevention. Practices that parents of preschoolers can shape within the home environment are related to diet (e.g., food availability, energy density of available foods, feeding/mealtime patterns, response to children's requests for advertised foods), physical activity (e.g., screen-time, age appropriate exercise options, family activity patterns), and children?s sleep habits. Closely related is childcare. Young children in non-parental childcare settings have a greater risk of obesity, indicating parents may need opportunities to develop skills to advocate for provision of healthy foods and sufficient physical activity and naptime while children in childcare.

What has been done
The HomeStyles Healthy LifeStyles for Preschool Families Certificate, an online training program was developed with the aim to increase childhood obesity prevention cognitions and behaviors of NNPs working with families with preschool children, includes 13 brief videos focusing on child growth, pediatric weight management, food/nutrition (e.g.,child feeding, family meals, portion sizes, physical activity/screen time, and sleep).

Results
Participants (n=68; 68% white; 94% female) took an online pre-test assessing cognitions and behaviors related to video content, watched each video and completed its brief quiz, and took a post-test. Paired t-tests revealed that at post-test, NNPs had significantly ($p<.05$) improved knowledge of the benefits of breakfast, fruit/vegetable intake, age-appropriate portion sizes, limiting screen time, and involving kids in food preparation. Knowledge of recommended child feeding practices and healthy child growth patterns also increased. At post-test, NNP attitudes

toward key weight-related parenting practices significantly improved and were aligned with best practices (e.g., family meal planning, parent: child co-play, parent modeling of physical activity, covertly controlling children?s food choices, talking with kids about TV content). NNPs also significantly increased intentions to teach families about benefits of eating breakfast, fruits/vegetables, role modeling health behaviors, age-appropriate portions sizes, limiting screen time, and advocating for healthy weight-related behaviors in childcare settings. NNPs perceptions of parameters defining healthy child weights significantly improved. NNPs also reported significant changes in their own behaviors (e.g., decreased screen time use while eating)and values (greater importance placed on physical activity). This certificate program is an effective, efficient, and cost-efficient way to increase NNPs evidence-based cognitions and behaviors related to childhood obesity prevention.

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 #6

1. Outcome Measures

From Our Farms - 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

2016 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity prevention and improving the health of youth is a national priority. Youth need to understand the food system and how food is grown and produced, as well as how food promotes health. Early exposure to a variety of foods will help young children eat more variety in their diets. From Our Farms is a fun-filled, educational project that teaches children and their families about the importance of good nutrition, the value of local agriculture, and the role farms play in enriching our communities and the environment. Through fresh food focused stories and activities, children are given the opportunity to explore where the food they eat comes from.

What has been done

The program focuses on a specific fruit or vegetable, mostly those grown locally. Participants learn where the fruit or vegetable comes from, the growing process, nutritional value and the role fruits and vegetables play in a healthful diet. They prepare and taste a healthy snack made with the fruit or vegetable and receive further enrichment through a children's story about the fruit or vegetable, as well as other fun food activities. The programs focused on seasonably appropriate fruits and vegetables. The first half of the program included an introduction to the produce through a series of pictures documenting its growing process, a children's story about that particular fruit/vegetable, and songs or other activities about the fruit/vegetable. The second half of the program involved making a healthy snack with the fruit/vegetable and tasting it. From Our Farms workshops were conducted at childcare centers, preschools, elementary schools, community centers and libraries for children ages three through ten. Groups ranged in size from 10 to 80 participants, and the program duration was one hour. 2016 From Our Farms Programs Focus Area Number of Sites Number of Children Bananas 7, 215 Beans 6, 289 Corn 1, 20 Superfoods 1, 28 Apples 12, 361 Tomato 2, 38 Fruits & Vegetable (General) 2, 40 Totals 31, 991.

Results

Children thoroughly enjoy these programs, retain content from program to program, and have the opportunity to experience new foods. They have fun tasting the featured fruit or vegetable, and often ask for seconds. The program sites ask for the speaker to return with additional "From Our Farms" programs which attests to both program content and teaching skills. Students loved the snack so much that program sites have implemented them into their yearly snack schedule. Comments about From Our Farms Programs: "We truly enjoy the program!!" "The children were excited and engaged the entire time!!" "Looking forward to having the Extension Educator back in the future!"

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

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. 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many New Jerseyans have health and personal finance issues including diabetes, overweight and obesity, low household savings rates, and high household debt. There are also many ways that health affects personal finances (e.g., the high cost of unhealthy habits (e.g., smoking) and medical expenses) 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. In addition, implementation of the Affordable Care Act (ACA) has prompted increased public interest in the issue of health insurance and understanding nuances of the ACA.

What has been done

In 2016, RCE Extension Specialist continues to deliver health finance education programs to New Jersey residents. The education included: monthly Small Steps to Health and Wealth (SSHW) financial messages that are archived online and available to media outlets and Extension agents nationwide. In addition, the RCE Extension Specialists serves on the advisory committee of the

State Senior Medicare Patrol (SMP) program. SMP addresses issues related to Medicare fraud and committee membership provides opportunities for networking with health-related government and human services agencies. Along with an RCE Family and Community Health Sciences Educator, an online Personal Health and Finance Quiz was publized 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 and again in July 2016.

Results

Almost 5,000 people took the Personal Health and Finance Quiz during its first two years online 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. Data analyses to date have indicated positive statistically significant relationships between health and personal finances. The SSHW program, developed by RCE, is being replicated by Extension colleagues in over a dozen states. Individual chapters of the SSHW workbook are available online and 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 #8

1. Outcome Measures

Taste Genetics, Obesity and Weight Loss - 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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the last 30 years there has been a growing epidemic of obesity in the population, and current interventions have not been successful in stemming this tide. Taste sensitivity to the bitter compound 6-n-propylthiouracil (PROP) is a common genetic trait that is a marker for food preferences and eating habits. Studies have shown that women who are genetically taste blind to PROP (i.e., non-tasters) habitually consume diets that are higher in added fats and sweets and higher in energy content than PROP tasters or supertasters. These dietary differences could explain why non-taster women are heavier than super-taster women. These data suggest that, in the context of obesity, non-taster women would be more successful following a low-carbohydrate diet that does not restrict calories and fat content. Super-taster women would be more successful following a low-fat diet because they are less sensitive to reductions in dietary fat content and they typically consume fruits and vegetables that are emphasized in this diet. At present, there are no specific strategies for personalizing diet interventions in order to maximize weight loss. Knowledge of individual differences in genetic sensitivity to bitter taste (PROP tasting) as a biological marker for dietary intake and obesity will help us understand the specific dietary patterns associated with obesity in young women and identify bio-behavioral factors (e.g. eating attitudes, dieting behaviors) that increase this risk. This knowledge can lead to the development of improved nutrition interventions that can be targeted to an individual's genetic taste background and therefore optimally promote behavior change in that individual. These innovations are expected to improve the health, nutrition and quality of life for citizens of New Jersey and the nation. Although all segments of the population are susceptible to obesity, young adulthood is a time of particular high risk, and few interventions have targeted this group.

What has been done
NJAES researchers randomized study subjects (obese women) by their PROP taster status into to either a standard low-fat diet or a high-protein/low-carbohydrate diet. Weight loss, energy intake and other outcomes were measured and compared.

Results
As expected, non-taster women lost more weight following a low-carbohydrate diet, compared to a low-fat diet. Weight loss did not differ by diet type for super-taster women at 6 months. These data suggest that non-taster women may be more successful in a short-term (6-month) weight loss intervention following a low-carbohydrate diet, but super-taster women appear to be successful following either diet. Researchers hypothesized that dislike of the low-fat diet and greater difficulty adhering to this diet would explain the lower weight loss of non-taster women in the low-fat diet group. However, none of these variables were strong predictors of weight loss in

these women. In conclusion, low-fat diets are the most common type of diet used in behavioral weight loss therapy, although low-carbohydrate diets have been growing in popularity. The results suggest that understanding genetically-mediated food preferences may permit dietitians and nutritionists to match weight loss participants with a diet that maximizes their weight loss. Screening for PROP phenotype may be a successful strategy for personalizing weight loss therapy in women to optimize short-term weight loss.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #9

1. Outcome Measures

Structure/Function Studies of Perilipin LONG-TERM - Individuals experience: Decreased overweight and obesity conditions 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 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity is a growing problem in the U.S. and most other countries of the world. To develop effective treatments for obesity, it is critical to understand the biology of fat storage in adipose tissue. Perilipin is found in fat storing cells in adipose tissue and is the major protein surrounding the fat storing structures called lipid droplets. Perilipin functions to control the amount of fat stored during feeding or released when energy is needed by the body. When fat is released from adipose tissue in the form of fatty acids, it is used by other tissues such as heart, muscle and liver to make energy for those tissues. In obesity, the release of fatty acids from adipose tissue is

inappropriately high; these fatty acids can then be deposited in muscle, heart and liver, leading to dysfunction in these tissues, and reducing the ability of these tissues to detect insulin.

What has been done

Prior NJAES-supported research has identified perilipins as gatekeeper proteins controlling the flux of lipids into and out of lipid droplets; this work has changed the paradigm of how adipocytes and other tissues regulate whole body energy metabolism. Extending this research groundbreaking work to continue further elucidation of the mechanisms by which perilipins regulate lipid flux in cells will expand the growing knowledge of how adipocytes control energy metabolism, and will ultimately provide information needed to design new pharmacological interventions to prevent or treat obesity. Understanding how intracellular metabolism affects insulin function in tissues, with its implications to understanding mechanisms of type II diabetes, is paramount to combating this major epidemic and improving the health of the citizens of New Jersey, the United States, and the world. NJAES researchers tested the hypothesis that the phosphorylation of perilipin 1 alters protein structure to promote lipid droplet remodeling and lipase access to stored triacylglycerol, thus increasing lipolysis.

Results

Research findings from this project have added to a growing mechanistic model for how adipose (fat) tissue controls the storage of fat (triacylglycerols) and release of fatty acids when the body requires energy. Fat is stored within the cells of adipose tissue in structures called lipid droplets. The most abundant protein associated with these lipid droplets is perilipin 1. Perilipin 1 serves as a gatekeeper protein, controlling how much triacylglycerol is stored in the lipid droplets of adipocytes (fat cells) and how much is released in the form of fatty acids during exercise and fasting to supply a source of energy to muscle and other tissues. Perilipin 1 controls triacylglycerol storage and breakdown (lipolysis) by regulating the activity and access of various proteins, including enzymes that break down fat called lipases, to triacylglycerols stored in lipid droplets. These control mechanisms include the binding of lipases and accessory proteins directly to perilipin under specific conditions. Various hormones exert control over these conditions by altering the structure of perilipin through chemical modification (phosphorylation). Over the years, this research has defined how phosphorylation of perilipin 1 is needed to recruit some proteins to the lipid droplet, while dispersing other proteins away from lipid droplets. Thus, these studies have helped to unravel the complex mechanisms by which perilipin 1 accomplishes control of fat metabolism in adipose tissue, an important component of the maintenance of whole body energy balance. The maintenance of energy balance is critical to avoid pathological complications of obesity and insulin resistance that leads to type II diabetes. Although perilipin 1 itself is not a likely target for the development of new drug therapies, some of the enzymes that bind to perilipin may be viable future targets for drugs to treat obesity or type II 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

Outcome #10

1. Outcome Measures

Hub City Fresh Healthy Corner Store Initiative - LONG-TERM - Individuals experience: Decreased overweight and obesity conditions 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Limited availability of and access to healthier food options in the environment has been linked to higher obesity rates, and this limitation negatively affects food choices of consumers and their families. In urban locations such as New Brunswick, access to full size grocery stores is limited, and the smaller food stores (i.e., corner stores) do not carry or promote a variety of healthier foods and beverages.

What has been done
Hub City Fresh Healthy Corner Store Initiative (Hub City Fresh) aimed to increase availability of and access to healthier food options in the corner stores of New Brunswick, NJ. The project used a mixed-methods design and a community-based participatory research (CBPR) approach. Following the objective evaluation of the city's food stores, and interviews with 35 store owners or managers in the previous years, nine corner stores agreed to participated in Hub City Fresh. Intervention included improvements to the number and placement of healthier foods in the stores, new containers to display fresh produce; provision of training materials for the owners about pricing and maintaining fresh produce; and in-store promotion of healthier food and beverage choices (e.g., free healthy recipes, signage for healthier foods). In addition to close communication with the store owners, 40-member Healthy Food Access workgroup of the New Brunswick Community Food Alliance contributed to the development and design of the promotional materials.

Results
Eight of the nine participating corner stores improved their inventory of healthier food options by providing four additional variety of healthy foods or beverages. Eight corner stores improved their promotion of healthier foods by placing baskets of fresh produce near the cash registers. All participating corner stores improved their promotion of healthier foods by displaying "Healthy Selection" signs next to the healthier food and beverage options. All participating stores provided free healthy recipes for their customers to promote healthy cooking behaviors.

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 #11

1. Outcome Measures

Healthy Menu Options Program - LONG-TERM-Individuals experience: Decreased overweight and obesity conditions 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Healthy Menu Options Program - The 2020 Healthy New Jersey objective is to prevent an increase in the proportion of population that is obese, based on the 2011 baseline rate of 23.8% of adults. Since residents in Warren County, NJ are far above this target, (32.4% obese, 31.8% overweight), a focus on healthy eating is needed. Small, privately owned restaurants are abundant and thriving in Hackettstown, NJ. Studies have indicated that use of symbols to indicate healthy menu options were effective in promoting healthy eating and sales of labeled healthy menu options increased significantly as a result of an intervention. Awareness of the healthy menu options by restaurant patrons has also been shown to increase significantly by study completion. With a state grant, Extension educators were interested in implementing a Healthy Menu Options Program (HMOP) to provide healthy choices on the menus of several privately owned restaurants in a small town.

What has been done

Restaurants were invited to participate in the program by providing recipes for menu items that were identified as potential healthy choices. Recipes were analyzed with the Nutritionist ProTM nutrition analysis software and restaurants made the suggested changes, if necessary, for items to meet the HMOP criteria: An entrée serving will have: No more than 750 calories; At least 2 servings of fruits and/or vegetables; If there are grains in the item, at least half will be whole grain; Or the dish may be served with a whole grain. If there is dairy in the item, it will use low fat or fat-free milk or yogurt and cheese will fall within the saturated fat limit; No more than 0.5 grams of artificial trans-fat; No more than 30% of calories from fat; No more than 7% of calories from saturated fat; No more than 750 mg of sodium.

Results

Eight restaurants have participated in the HMOP and as a result have had 24 healthy menu options approved.

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

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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	0.0	0.0	0.0
Actual Paid	4.0	0.0	0.0	0.0
Actual Volunteer	3500.0	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**
396539	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1572177	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
408321	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 used the following CoPs: Program Evaluation and Volunteer Administration. Faculty participated in the development of collaborative educational products.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	42555	0	65532	194500

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	3	0	3

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
2016	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	NJ 4-H CYFAR Science Pathways Program Paterson Site -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.
5	Video Teleconferencing to Antarctia - 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 Citizenship Programs -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	Annual 4-H Summer Science - 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.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Programming for Clientele with Developmental Disabilities - According to the Centers for Disease Control and Prevention there are over 6 million individuals in the United States with developmental disabilities. One in six children, between the ages of 3 and 17, has one or more developmental disabilities or delays. The population of individuals with developmental disabilities living in the community is much larger than in the past due to legal and normative changes. This currently underserved population has much to gain by participating in inclusive educational and recreational programming. Without trained educators, programming may miss the mark in providing the optimal modifications and content to have a positive impact on participants.

What has been done
A Professional Development Series, conceived by a Family and Community Health Sciences Educator and a 4-H Agent was developed to help Extension fulfill its mission of being an equal opportunity program provider. Research found that Extension educators view inclusive programming (programming that is offered in accessible settings and that gives all learners the services and accommodations they need) as favorable. However, research also found that there are limited training opportunities for outreach educators and volunteers who design and implement programs for youth and adults with developmental disabilities in schools and community settings. This professional development series will address the issue of limited training opportunities. The project goals are to promote a better understanding of developmental

disabilities and how they impact learning and behavior; and to prepare Extension educators with the communication and teaching skills needed to address diversity and inclusion in order to deliver more meaningful programming. Programming for Clientele with Developmental Disabilities: Professional Development Series will introduce Extension faculty, staff and volunteers to effective educational methods and will provide information on current disability laws, regulations, resources and support. The series includes five modules (PowerPoint presentations; small group activities; handouts): Module 1: Overview of Disabilities; Module 2: Disabilities and Learning; Module 3: Understanding and Managing Behavior; Module 4: Visual Supports; Module 5: Understanding Disabilities Laws and Making Program Accommodations Content is evidence-based and has been developed by faculty with years of experience working with this population.

Results

To date 36 individuals have participated in either short or long versions of the series. Upon surveying the participants their rating of the overall instruction and teaching was 4.79 (longversion) and 4.33 (short version); and their rating of the overall program content and presentation was 4.79 (long version) and 4.34 (short version). Participants represented all three departments of Rutgers Cooperative Extension as well as Master Gardeners and a multi-state audience who attended the Epsilon Sigma Phi annual national conference. After piloting an evaluation tool, final IRB-approved evaluation surveys were designed and administered following each workshop. Summary results follow: 94.5% Agree or Strongly Agree that they have a better understanding of developmental disabilities. 100% Agree or Strongly Agree that they learned instructional strategies to enhance learning in an inclusive environment. 100% Agree or Strongly Agree that they have a better understanding of how to make accommodations and modifications for youth and adult audiences. 94.5% Agree or Strongly Agree that they can recognize the characteristics of the three main learning styles, visual, auditory and kinesthetic. 94.5% Agree or Strongly Agree that they have a better understanding of the different types of visual supports and how to use them. 94% Agree or Strongly Agree that they have a better understanding of how disability is defined by law. 100% Agree or Strongly Agree that they have a better understanding of procedures to follow when programming for clientele with developmental disabilities. 83% Agree or Strongly Agree that they learned techniques for managing and preventing problematic behavior.

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
2016	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.

What has been done
The Youth Urban Farm Club (YUFC) recruited youth and volunteers throughout Essex and Hudson counties. Volunteers were recruited through the 4-H Leaders Association, Master Gardeners, the Rutgers Veterans Environmental Technology Solutions program and local community garden sites. 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, and word of mouth. As part of registration, 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. In 2016, 6 community garden sites were selected as classrooms for the program, 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. Some site descriptions and projects include: East Orange Library-4-H staff offer educational programs on topics of food and gardening. Youth help to maintain the vegetable garden beds while participating in hands-on food preparation activities. Montclair Community Farm - Youth assist with maintaining 26 vegetable beds and care for the chickens to support the Senior Access Mobile Stand. The Children's Garden-Branch Brook Park) - Youth work alongside the Rutgers Master Gardeners to learn and help grow the Children's Garden. This is the first year of gardening here so youth involvement is crucial in building the site. The Historic Jersey City & Harsimus Cemetery - Youth work with a team of adult volunteers to maintain and restore the historic gardens at the Harsimus Cemetery. Participants learn about gardening for food, and special topics such as maintaining historical sites. Volunteers also help care for the resident goats! This program integrates 4-H Positive Youth Development best practices, Master Gardener and the Department of Agriculture and Natural Resources technical skills, and Rutgers University resources to provide a high quality community program for our underserved communities. This project brings healthy and affordable produce to families across Essex and Hudson counties, and it reconnects our community to our food and our land.

Results

Fourteen adult volunteers dedicated over 250 hours to lead YUFC. Thirty five youth from ten cities dedicated over 780 hours to help build and maintain local community garden sites. Six community garden sites were supported during the growing season helping to increase food availability in the neighborhoods and brining a greater community engagement into the local gardens. All sites invited the urban youth farm club members and leaders to come back in 2017. 95% of youth indicated they learned a lot about where their food comes from as a result of participating in the program - 100% of youth indicated they learned something new or different as a result of participating in the program - 200 short term volunteers dedicated over 400 hours to help build and maintain local community garden sites - Montclair garden sites reported selling over 900 lbs of food to senior residents at the mobile farm stand.

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
2016	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

NJ 4-H CYFAR Science Pathways Program Paterson Site -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of the NJ 4-H Science Pathways Program is to develop leadership, service and life skills in urban teens, while exposing them to the various science, engineering and technology fields that exist through use of hands-on fun science activities in a Makerspace setting, within their community.

What has been done
The program is designed for urban youth to enter at the beginning of their freshman year of high school and continue until their senior year. Each year a new group of program participants enters the program. For example cohort 1 starts their first year, continues into their second year and a new cohort (two) enters the program at that time. Recruitment is a big part of this program, finding the right youth who are interested and can benefit from the program is very important. Recruitment begins for the Science Pathways program the middle of participants 8th grade year.

The site coordinator meets with Paterson schools to present the program to administration, science teachers, and guidance counselors. After learning more details about the program teachers and counselors often identify youth who they believe would be a good fit and benefit most from the program. Those youth are invited to attend a presentation about the program. Parents are often invited to attend those presentations at the school as well. Interested youth submit an application, transcripts and a five hundred word essay describing their interest in science and why they should be selected for the program. After review of all the applications, youth are invited to participate in an interview process. Once selected, participants attend program orientation along with their parents where program details are discussed and further information is given. First year participants meet twice a week for four hours in a Makerspace environment located at the Boys & Girls Club of Paterson & Passaic. Participants are exposed to various materials and the necessary equipment to aide with the various science projects. Science Pathways projects during year one include screen printing, movie maker, learning scratch (coding), sewing, soldering, and others. Program participants spend weeks on each project building their skills. Participants have time to learn, play, and really experience the project. Each session is run by the site coordinator who plans sessions, coordinates volunteer instructors and/or speakers, and coordinates outside events/activities. The program is assisted by many community partners. Near the middle and through to the end of their first year, youth also assist in teaching hands-on science programming to younger youth throughout their community. Hands-on teaching take place at their local libraries, in after-school/summer camp programming, and other locations. Working together they put together program plans, using the skills and activities they learned during the Science Pathways program. At the end of each program year, participants attend an overnight Science Pathways Summit at Rutgers University, where they meet up with program participants from their sister site in Trenton (Mercer County). At the Summit participants showcase their final projects, receive feedback on their projects, meet with University professionals, participate in various science activities, and interact with individuals working in various fields. Participants entering their second through fourth year of programming, work on more advanced science projects, increase their teaching time in the community, and spend more time outside of programming learning about and speaking to professionals in the field. As the participants continue on through the several years of programming, they learn more about themselves, improve many life skills, become more involved in leadership roles throughout their community, and are exposed to many people, jobs, and opportunities they may have never even knew existed.

Results

Feedback from program participants during their end of the year summit included what they liked most about the Science Pathways program. Participants liked volunteering and teaching back, better college opportunities, fun activities, meeting new people, real life opportunities, leadership and teamwork, and making science connections. They also reported that program activities have helped them think about life skills, career, making connections, and ideas about what to do in the future. Program participants have taken on leadership roles as science instructors to younger youth in the community, teaching at a Barnes & Noble mini maker fair in Totowa, NJ. Three program participants meet with and instructed over 20 youth throughout the day teaching Makey Makey, one of the projects learned during programming. Science Pathways participants also taught over 60, 4th-8th graders, during the 2nd Annual Passaic County 4-H Science-Sational Day held at Passaic County Community College. They also taught six hours of science programming to 15 youth using Movie Maker, another project learned during programming, at the Clifton Public Library. Participants planned and implemented a 12 hour, hands-on science program, during William Paterson University's summer youth programs. A total of 13 youth in grades 4-6 attended this week long program. These Science Pathways participants are providing valuable and low-cost programming to youth in their own communities. The Science Pathways program offers leadership opportunities for program participants, and also provides role models to younger youth

from within their own urban community. Youth who attended the program at the Clifton Public Library had this to say about what they learned during their Movie Maker Program: "I learned how to improvise when things don't go my way and how to edit a video"; "I learned how to make a movie and what 4-H is"; "I learned how to make a good movie with some good help." Youth also said that they were interested in making their own movies in the future. Here is what some of the Science Pathways participants said about participating in the Science Pathways program: "The best part about giving to my community is that there are many jobs for everyone as long as there is interest in the subject and we are aware of everything within the subject. We are giving our community a good shot on science and now we can apply it to our community by teaching back. Being in the program for two years, I have gained knowledge on public speaking & experience working with youth"; "Teaching at William Paterson University and Passaic County Community College was a new and exciting experience for me"; "Seeing the expressions on the youth faces after completing a task is a great feeling and when they want to be your best friend is even better."

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Video Teleconferencing to Antarctia - 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
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Connect young people with practicing scientists to improve their science knowledge of climate

change and to support the development of their identity as future scientists.

What has been done

Palmer Station LTER (Long Term Ecological Research Project) scientists offer seven video teleconference calls (VTCs) to virtually connect students and their teachers to Palmer Station. Teachers completed an application process and agreed to teach 2-3 lessons prior to their call, with hands-on activities that would help prepare the students for the experiences. Students submitted science questions 24 hours in advance. These questions were shared with the Palmer scientists prior to the call to help them prepare their responses. There were seven calls in total. Through this effort, we reached 21 educators and 630 students directly. They participated by asking questions and watching participating in the live calls. Based on reports from the educators, we estimate that 3,990 kids watched the recorded phone call with their teacher. These students also participated in hands-on activities and talked about the LTER in their class. . The Science-Investigator (Sci-I) Project is designed to increase educator and student skills in designing and conducting science investigations as well as analyzing and interpreting data in alignment with Next Generation Science Standards (NGSS) requirements through the lens of polar science. The Sci-I Project was made available to science teachers from grades 6-9. Preference was given to educators that work in school districts that serve predominately underserved and underrepresented communities. The Sci-I Project is a year-long project that consists of a Summer Educator Workshop ? June 27-30, 2016. Twenty-four educators from California, and New Jersey explored polar science and data through interactions with six Palmer LTER scientists and participate in polar data-focused activities. A large portion of the workshops are devoted to using exemplar student science investigations as case studies to highlight how to effectively lead students in designing, developing, and conducting polar science investigations. Educators, who were paired (2 from 12 schools), will be asked during the school year to teach 2 polar-related science classroom lessons that use real polar data from the Palmer LTER data zoo. Educators assist their student in designing and conducting science investigations using real data. Students participating in the Sci-I Project have the unique opportunity to conduct their own investigations related to the topics and data of polar LTER research explored through this project. The students work on these investigations throughout the winter and spring and then present their results and findings to polar scientists and to one another at the Student Polar Research Symposium. Educators will create lessons that focus on Palmer LTER data. The lessons will be shared broadly through the Polar-ICE, LTER, and EARTH/MBARI websites. An evening workshop was conducted focusing on the LTER childrens book focused on Palmer Station. Rutgers has maintained a network of approximately fifty K-8 schools in NY-NJ that are integrating marine science themes and concepts in their school curriculum. MARE is a whole school program that trained 2,940 educators, in 30 New Jersey K-8 schools, and impacting more than 20,000 children. The MARE program which was developed by the Lawrence Hall of Science at the University of California- Berkeley and has been running more then sixteen years in NJ, engages elementary age students in non-fiction science reading, and hands-on lessons, and demonstrations that promote Ocean Literacy. The Education and Outreach group used professional development workshops, webinars, and general marketing efforts to promote the Palmer focused books through this network.

Results

The intended impact for this work is to: 1) contribute to the engagement of middle school youth in science and 2) increase student identity as a scientist through increased enthusiasm and personal engagement with scientists. The objective is to make science personally relevant to students and influence their long-term interest in science through authentic science data experiences. It is still too early in the program to determine if these goals have been met but the early indications are that we have been successful in achieving these objectives.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

NJ 4-H Citizenship Programs -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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth that report they participate in service-learning are more likely to engage in activities that promote civic engagement (Corporation for National and Community Service, 2006). 4-H strives to develop young people who are engaged and informed citizens. 4-H Citizenship is the knowledge, skills, attitudes, and motivation that give youth the capacity to move beyond ones individual self-interest and to be committed to the well-being of some larger group.

What has been done
The Citizenship Working Group of the 4-H Youth Development Program is developing training materials and activities to assist volunteer and teen leaders in taking members from community service to service learning. In addition, the NJ 4-H Study of Citizenship Programs survey was created on Qualtrics with IRB approval for club, county, regional, and statewide reporting on community service/service learning efforts, what areas of actual service learning was part of the project, and other impact on life skills development and benefits.

Results

All 4-H individuals that participate in service of some type as part of their 4-H program (individual, club, county, regional, state) are targeted to complete the survey after each project. Staff members also enter county programs. The 4-H volunteers, members, and staff that have completed surveys are satisfied with data entry and the overall purpose. In 2016, 52 community service/service learning efforts were recorded that benefited 20,760 New Jersey residents; an average of 423 people/project Overall, 87% were at the club level with 92% youth participation, 8% adult involvement, and 59% collaborated with local organizations or efforts. The projects addressed: 17% homelessness & poverty 15% environment 15% hunger 15% other/fundraising 10% senior citizens 10% youth serving youth The types of service included direct/community service focused (58%), fund raising for a cause (31%, 4% service learning, 4% advocacy, and the rest unclear. As a result of training, planning, and/or reflection, youth involved in the projects learned more about service in following areas: 100% Accept responsibilities for tasks, 100% Communication with others, 84% Identify a problem or need, 84% Get others to care about problem, 83% Work & contribute to the group, 77% Create a plan to address problem, 73% Decision making and building consensus, 66% Use of resources, 63% Organize an event or meeting to deal with problem, 65% Evaluate the project, 48% Find solutions to group's conflicts. In addition, youth reported: 97% learned more about the people or community they served, 95% learned more about an issue or need in community, 95% learned they can make a difference in our communities, 94% feel they helped the people or community issue/need, 82% feel more projects like this are needed to help with this issue, 56% discovered new resources and people to help. 43% had obstacles but revised our plan to overcome them Personal statements included: "I think that my group learned about what it means to be homeless and gained empathy for those less fortunate than themselves. They learned that homelessness can happen to anyone. The life skills that our members exhibited throughout our ongoing project is empathy for those less fortunate than themselves, learning of a need and giving of time and real help to their community." "I think my group learned that helping others can be a lot of fun and that giving time to help is as important as giving money. The life skills learned were anticipation of needs, adaptability to situations and generosity and empathy.? ?Life skills exhibited throughout the project include responsibility, time management, cooperation, teamwork, generosity, flexibility, leadership, and creativity."

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

Annual 4-H Summer Science - 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
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Rutgers 4-H Summer Science Program was established in 2009 as an opportunity for traditionally underserved youth to: learn more about science, explore research occurring on campus, and gain a better understanding of opportunities available in science, engineering, and technology; explore opportunities available at Rutgers University, experience campus-life, and learn about post-secondary education; prepare to serve as a 4-H Science Ambassador in their home community.

What has been done
In its eighth year, sixty-three (63) high school youth from seven urban counties throughout New Jersey participated in the campus-based portion
of the program, July 11-15, at the Rutgers School of Environmental and Biological Sciences. During their weeklong residential experience, they explored science through hands-on activities in animal science, biotechnology, engineering, environmental science, exercise physiology, food science, geospatial technology, horticulture, marine science, microbiology, and nutritional science. Youth participated in discussions, workshops, and lab tours by faculty, staff, and graduate students. During the week, they also learned about campus life and the opportunities available at Rutgers from an undergraduate student panel and a representative from SEBS. They were also motivated by keynote speakers. In addition to exploring science, the youth participated in personal development and teambuilding activities ? including a Cook Campus scavenger hunt. They also enjoyed evening social events - including a cookout and a trip to one of the recreation centers. The experience also helped prepared them to become 4-H Science Ambassadors. They also prepared and presented posters of their experience to partners, administrators, parents, and other guests. As 4-H Science Ambassadors, they returned home and worked with their local 4- H program to promote 4-H and science to other youth. Program Schedule Overview Monday Exploring Your STEM Pathway; Orientation to Rutgers by University Admissions; Cook/Douglass Campus Scavenger Hunt; Kickoff Speaker; Chemistry Demonstrations Tuesday Discover STEM Roundtable Discussions and Tours, Explore STEM Sessions, Physics Demonstrations, Cookout, Rutgers Student Panel and Assistant Dean Q&A, Indoor Recreation Wednesday Pursue STEM Projects, STEM Poster Session Preparations Thursday 4-H Science Ambassador Presentation; 4-H Science Ambassador Training and Planning ? Computer Science Unplugged, Scratch Programming, MaKey MaKey, and Finch Robots; Tours of Campus Farm Friday Marine Science Teachbacks, STEM Poster Session, Closing Luncheon with Parents and Invited Guests (speaker and recognition of youth and partners).

Results

A total of 243 youth participated in the Rutgers 4-H Summer Science program between 2009-2014. In 2015 past program participants were surveyed about their experience in 4-H Summer Science (105 survey responses with a 43% response rate). 82% believe interactions with scientists motivated and supported learning, 70% believe participation better prepared them for college, 55% can see themselves as STEM professionals, 50% reported positive change in motivation to learn about science. Of past participants who were in college at the time of the survey: 59% enrolled in STEM major or interested in a STEM career, 31% attended Rutgers. Of past participants who were still in high school at the time of the survey: 72% interested in pursuing a STEM major/career, 39% interested in attending Rutgers. Results of Pre/Post Survey of 2016 Youth Participants (n=50). Average Response Survey Question Pre Survey Post Survey Change Science Skills (1=never, 2-sometimes, 3-usually, 4-always) I can design a scientific procedure to answer a question. 3.0 3.3 0.3 I can communicate a scientific procedure to others. 2.9 3.2 0.3 I can create a display to communicate my data and observations. 3.2 3.5 0.3 I can use models to explain my results. 3.2 3.4 0.3 I can ask a question that can be answered by collecting data. 3.1 3.3 0.2 I can use the results of my investigation to answer the questions I asked. 3.2 3.4 0.2 I can use scientific knowledge to form a question. 3.0 3.2 0.2 I can analyze the results of a scientific investigation. 3.2 3.4 0.2 I can record data accurately. 3.1 3.3 0.2 I can use science terms to share my results. 3.2 3.3 0.1 I can use data to create a graph for presentation to others. 3.3 3.5 0.1 Science Ambassador Skills (1=not ready, 3-somewhat ready, 5-very ready) Teach and lead youth in science programs and activities. 3.7 4.3 0.7 Communicate about 4-H science to community leaders. 3.6 4.3 0.7 Present activities on science topics. 3.6 4.2 0.6 Organize community awareness events about 4-H science. 3.7 4.2 0.5 Motivate other students to participate in 4-H science. 3.8 4.2 0.4 While there were 63 participants who completed the program, the results are from 50 participants who completed both a pre and post-survey. How would you rate the quality of your interaction with scientists during the Summer Science program overall? (1-poor, 2-fair, 3-good, 4-very good, 5-excellent) - 4.4 Selected comments from participants: My experiences with the scientists were fun, exciting, educational, and overall very enjoyable. I have learned that there are many different careers that I am interested in because of my attendance in the 4-H Rutgers Summer Science Program. The scientists here really inspire me and my thoughts of science. I liked how the scientists were approachable because it made it easy to ask them questions and get comfortable with them. The scientist that kept talking about time being nonrefundable really opened my eyes to the diversity available in the sciences. He motivated me to be more aware of my decisions and actions. I loved going to their labs and seeing where they work because it gave me an idea of what my future could be like. All the scientists were very helpful in providing me with information about each science field. Because of them, I have figured out what science field I want to get into. I like how the scientists were relatable and open for questions. They helped me understand what we were learning and why it was important to the environment. I loved interacting with scientists. It really helped widen my interest and passion for science.

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 the 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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	65.0	0.0	36.0	0.0
Actual Paid	5.2	0.0	13.1	0.0
Actual Volunteer	4862.0	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**
667647	0	945938	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
3308890	0	4437200	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
136882	0	1931204	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, Wildlife Damage Management, Agricultural Waste Management, Specialty Vegetables, Blueberries, Organic Agriculture, Grapes, Agritourism CoPs, learn professional sessions and the development of collaborative educational products.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	86000	62895	38950	0

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

Patent Applications Submitted

Year:	2016
Actual:	4

Patents listed
13/260,475
2016-146
13/999,233
62/053,580

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	58	86	144

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
2016	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	Quality and Safety of Fresh-Cut Vegetables and Fruits -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.
5	Junior Breeder Livestock - 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.
6	Resource Management in Commercial Greenhouse Production - 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	Integration of Classical and Molecular Perennial Grass Breeding for Improvement and Biofule Production and Turfgrass Breeding and Evaluation - 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.

8	Value Added Lamb Production Model - LONG-TERM - Existing and 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.
9	Regulation of Cellular Apoptosis and Survival in the Bovine Mammary Gland - 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.
10	Extend and Maximize the Post Harvest Quality of High Value and Perishable Crops-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.
11	Strawberry Breeding and Management Team -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.
12	Enhancing Food Security in Union County, New Jersey -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.
13	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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Promoting Agricultural Retention and Development in Urbanizing Regions - New Jersey is the most densely populated and highly urbanized state in the nation, but simultaneously possesses a rich farming history and a long track record of progressive policy to sustain a vibrant agricultural industry. New Jersey is at the vanguard for issues related to the interplay between agriculture and suburban growth. New Jersey has among the older, and most accomplished, state farmland preservation programs in the country. Nearly one-third of the state's farmland base (225,000 acres) is permanently preserved. New Jersey voters have long supported farmland preservation as a method to protect farms and farmland resources threatened by urbanization pressures. However, public support for state and local farmland preservation financing has become less assured in recent years amidst budget challenges and competing funding priorities. Whether this reflects concern over public spending in an austere fiscal environment or fundamental changes in perceptions of the value of farmland preservation is unclear. Fortunately for land preservationists, the State of New Jersey adopted, after a voter-approved funding referendum, a long-term constitutional dedication of corporate business tax revenue to support continued farmland and open space preservation. At the same time, New Jersey's farmland preservation program is among the more mature farmland easement acquisition programs in the country. Despite a 34-year history of protecting farmland through acquisition of agricultural conservation easements, little post-preservation research has been conducted to inform managers of the New Jersey program (as well as agricultural leaders and farmers) about program outcomes and impacts. These realities provide impetus for examining the efficacy of existing farmland preservation efforts, their consistency with public policy goals and landowners' interests, and potential areas of program reform. Lessons learned in New Jersey have applicability in regions across the nation experiencing urban pressures in agricultural production areas.

What has been done

Using primary and secondary (Census of Agriculture) survey data, an NJAES researcher has analyzed the impact of New Jersey's purchase of development rights (PD) program (established in 1983 under the Agriculture Retention and Development Act).

Results

Survey research documented the perceptions and experiences of owners of preserved farmland in New Jersey, Maryland, and Delaware. Notable findings include: 92% of 505 surveyed owners of preserved farmland owners in NJ, DE, and MD were "very" or "somewhat" satisfied with their participation in a farmland preservation program. "Second generation" owners (i.e., those that purchased or inherited land already preserved) were found to be less likely to be satisfied, reflecting concerns over unanticipated restrictions on uses of their land or perceived inflexibilities in deeds of easement. Preserved farmland largely remains in active agriculture, as opposed to being idled or diverted into residential estate. Farmland preservation programs in these states appear to facilitate access to farmland by young farmers. This often relates to perceptions that deed-restricted farmland is more affordable than unpreserved farmland. Agricultural and land stewardship investments appear to be widespread on preserved farms, suggesting an alignment between "on-the-ground" realities and the goals of state program administrators and enabling legislation. An analysis of respondent-level Census of Agriculture records accessed via a data access agreement with USDA-NASS evaluated profitability impacts attributable to farms participation in preservation. Using propensity score matching techniques to control selection bias (e.g., participation in farmland preservation is voluntary), statistically significant and positive profit differences were found when comparing small farms (i.e., those with <$100,000 in sales) operated by persons for whom farming is a principal occupations in agriculture to their

observationally equivalent unpreserved farms. Collectively, these research findings expand the base of knowledge needed to effectively administer farmland preservation programs in the region, and highlight areas of possible reform needed to maintain landowner interest in farmland preservation and support industry viability.

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 #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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Multistate Evaluation of Winegrape Cultivars and Clones-Grape growing and wine production in New Jersey predate the founding of America. Today, the industry has reached a size and stature that makes it a major force in the state's growing agricultural and tourism sectors. Over the last

decade, the number of wineries in New Jersey has more than doubled, with corresponding increases in the acreage devoted to wine grape production. New Jersey has all the right ingredients to be a great wine state: affluence, proximity to major markets, a large wine-consuming population (the state ranked sixth in the nation in 2012), an amenable climate and proximity to the ocean that cultivates a rich soil for a growing wine industry. New Jersey's wine industry needs information about the performance of traditional global cultivars that have not been widely grown in this region, some of which may be minor cultivars from breeding programs. The economic viability of vineyards is 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.

What has been done

In 2014, NJAES established the New Jersey Center for Wine Research and Education to address New Jersey's wine industry needs pertaining to research, education, and outreach. Researchers and educators associated with the Center communicate current, science-based information to wine industry members and connect grape growers and winemakers to industry goods and services. An NJAES researcher is testing how well clones of the major global cultivars perform in New Jersey, as well as the performance of new or previously neglected wine grape cultivars.

Results

A NJAES research vineyard has yielded important data regarding performance of some very promising cultivars for New Jersey. The results have helped identify "Lemberger" and "Petit Verdot" as cultivars that perform well and can be recommended for New Jersey. Planting and acceptance of these cultivars has increase around the state. New hybrid cultivars evaluated by this project have been planted by commercial wineries in New Jersey. Plans are now underway for the next cycle of evaluations. Cold hardy and disease resistant cultivars have been planted; these will be evaluated for quality and vineyard performance in New Jersey and similar regions. The New Jersey grape growers and county agents serving them are the primary audience for this research. The grape growers have participated in tours of the research vineyard and attended education meetings where research results were presented. Recently, experimental wines made from grapes from this research have been produced by a commercial winery and presented at a scientific symposium.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New Crops and Plant Products for Income, Health, Nutrition, and Medicine-Profitability and, subsequently, farm viability has been a challenge to produce growers in the eastern United States since the 1980's because of highly volatile market prices. Growers in the East also operate on a relatively small land base with production costs that are generally higher per unit of crop output. This puts them at a competitive disadvantage against larger commodity growers from other states, where production costs are comparatively lower. Encroachment of farmland by development, coupled with the difficulty to maintain profitability, create a challenge for some farming enterprises, leading to the need to produce higher value crops in New Jersey and the East coast. Future success in commercial farming will depend largely on the commercialization and expansion of high value, specialty crops such as ethnic produce, and plants of interest because of their health and nutritional benefit. Targeting specific niche markets can provide favorable competitive advantages, as does the rise in interest of locally grown produce and leaving a greener footprint with lowered transportation costs.

What has been done
NJAES researchers are building upon ongoing work on new crops and plant products and the development of ethnic greens and herbs, using a market-first approach. This project also builds upon international models of horticultural commercialization which uses a market-first science-driven approach with fresh and processed vegetables, herbs, spices and medicinal plants that serve as the economic driver for targeted rural African communities in sub-Sahara Africa. In the course of this work, researchers are exploring scale-up and replicability and continue to develop new crops and new products. The program focuses on good agricultural practices, introduction of high quality germplasm, the nutritional and health promoting properties of the plant that are coupled to quality assurance and quality control systems for collection or cultivation.

Results

NJAES researchers continue to breed new sweet basils, Thai basils and ornamental basils for downy mildew resistance. There are currently several advanced lines with stable resistance to downy mildew under high disease pressure and which have the sweet basil phenotype (look) and aroma and taste. Breeding efforts are increasing towards the development of new fusarium resistant basils. Results continue to be very encouraging and high degree of resistance to Fusarium has been achieved in new sweet basils. Earlier, project investigators completed the development of a new catnip variety, which is rich in essential oil and the bioactive isomer of nepetalcatone, a potential insect repellant. In 2016, another cultivar of catnip was developed, this with unique chemistry and attributes. Two new oregano varieties developed were again field tested in 2016. These varieties are tolerant to high heat, wind and abiotic stress, exhibit improved winter survival, and are characterized by upright growth habit, high essential oil and rich in carvacrol and other nonvolatile compounds which have shown to exhibit anti-inflammatory activity. New exotic peppers, including habaneros, poblanos, and African Bird Eye Chili are being developed for unique taste, flavor and visual appeal to meet the ethnic markets. Protocols were developed for extraction and analysis of natural products from a wide range of African herbs, botanicals and indigenous plants. In this context, a patent was issued for the use of kombo butter acid enriched extracts derived from the seed of African nutmeg as a neuroprotective agent. This is a novel method for treating neurological or neurodegenerative diseases or disorders. The aroma composition of several culinary herbs, hops, spices, fruits and vegetables were characterized and is being used in selection and breeding studies.

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

Quality and Safety of Fresh-Cut Vegetables and Fruits -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. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	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. The Rutgers component of the S-294 Multi-state project will focus on packaging technologies that prolong shelf life of pre-cut vegetables and minimize the possibility of contamination by food pathogens. Better packaging that make cut fresh produce more available and attractive to consumers will benefit both the food preparation industry and vegetable farmers.

What has been done
Asparagus grown in the Mid-Atlantic regions of the U.S. were pre-cut and tested for shelf life and freedom from contamination following packaging and storage in extruded polymer films that exhibited favorable gas exchange properties.

Results
A strong correlation was established between measured CO2 (carbon dioxide) levels in the sealed headspace gas admixture and traditional manifestations of asparagus shelf life such as postharvest pathogen epidermis lesions and microbial rots. CO2 level is much more quantitative and reliable than were traditional subjective measures of shelf life. Genetic background has a significant effect on the shelf life of packaged asparagus spears. A purple tetraploid variety exhibited consistently more prolonged shelf life than did diploid varieties that lacked anthocyanin.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #5

1. Outcome Measures

Junior Breeder Livestock - 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. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New Jersey is becoming an ever more urbanized state. Youth interested in learning agricultural practices, especially related to the large animals, have increasing difficulty finding that information. The Livestock Symposium is designed to give youth information about best management practices and discover careers in animal sciences.

What has been done
The 2016 Junior Breeder Livestock Symposium was designed as a mix of experiential activities using live animals, hands on workshops, and illustrated talks. The event was held on the Cook Campus Farm. Participants learned how to improve how they care for their animals; understand when something is wrong with an animal's health; increase their awareness of current issues affecting the agricultural community. The day comprised of workshops and hands on activities in the barns and classrooms around the Cook Campus Farm encompassing the following tracks; Small Ruminants (Goats and Sheep), Large Ruminants (Dairy and Beef), Swine, Equine and Poultry. Topics for 2016 included: Natural Horse Behavior, Equine Skeletal Anatomy, Equine Limb Anatomy and Laminitis, Horse Anatomy Jeopardy, Parasites and Infections in Dairy Cattle, Dairy Heifer Judging, Dairy/Beef Hoof Care, Dairy Clip- off, Poultry Biosecurity, Poultry Housing and Management, 4-H Avian Bowl, Zoonotic Diseases of Sheep and Goats, Lamb Carcass Evaluation, Market Lamb and Meat goat Judging, Beef Cuts of Meat, State 4-H Goat and Sheep Film Festival.

Results

In 2016 there was a record number of attendees with 250 youth and adults in attendance. Evaluations from the participants some of the following questions (with a scale from 1- 5 with 5 being the highest ranking) Q1- Overall this meeting met my expectations- 4.75 Q2- Overall the presenters were well versed and knowledgeable- 4.85 Q3- The meeting went according to schedule- 4.8 Q4- Overall the meeting was well planned and executed-4.35 Q5- The meeting rooms, location were comfortable and accommodating-4.35 Q7- I had the opportunity to share problems and seek solution with my peers- 4.3 Q8- In general, the symposium was well worth my time, energy and expense- 4.35 When asked if they would attend this type of event in the future 85% responded YES!

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #6

1. Outcome Measures

Resource Management in Commercial Greenhouse Production - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Greenhouse and nursery facilities are high input systems using vast amounts of water, fertilizers, chemicals, plastics, and labor to produce crops. Over recent decades, greenhouse growers have been faced with resource management issues that have significantly impacted their livelihoods. Energy prices (oil in particular) have risen dramatically, increasing the costs of greenhouse operations. As a result of shortages in some parts of the country, water (used mainly for crop irrigation) has not always been available in sufficient quantities to grow horticultural crops using traditional production practices. While year-round crop production in greenhouse facilities often requires significant amounts of water and energy, the fact that all aspects of the growing environment can be accurately controlled enables much higher resource use efficiencies per unit produced in greenhouses, compared to outdoor field production. Hence, optimized resource management is vital for the successful future of greenhouse operations. Greenhouse operators face other economic challenges. Consumers are now exhibiting a much greater degree of environmental awareness. Mass marketers are adopting strict purchasing guidelines that encourage environmental sustainability. Government policies to reduce carbon emissions have resulted in a demand for crops that not only meet aesthetic expectations, but that are also produced, distributed, and marketed using sustainable methods. The use of renewable and biodegradable inputs while growing an aesthetically pleasing and healthy plant will meet these demands. Green industry stakeholders have identified production practices which reduce plastic and water use as a major focus to increase sustainability, even though the environmental and economic costs associated with these specific practices are undetermined. The goal is to develop and implement environmental control strategies that optimize resource management and maximize crop quality and yield, while also maximizing the economic return to the grower.

What has been done

An NJAES extension specialist, in collaboration with colleagues at other institutions and with industry stakeholders, is using sensors to collect improved information about the plant status, the growing environment and outdoor conditions. The whole continuum in the greenhouse and crop system is considered and evaluated, and decisions are made for optimized resource use.

Results

Work has continued on evaluating a variety of lamps (luminaires) used for horticultural applications. These lamps were tested in an integrating sphere in order to test their overall efficacy (total light output in the photosynthetically active radiation waveband per unit of electricity consumed; micromol/J). A darkroom was used to measure light distribution patterns at various lamp mounting heights. Results of these tests were shared with the lamp manufacturers of the specific models tested. Several LED lamps designed specifically for horticultural applications have surpassed the efficacy (expressed in micromol/J) of the best high-pressure sodium lamps, which have been the lamp of choice in greenhouses for the last several decades. The use of an information label (modeled after the Lighting Facts label that is now available on packing used for lamps and lighting products for the residential and commercial market) is proposed for greenhouse operations. The proposed lighting label describes several key characteristics for horticultural applications and has been well received by several manufacturers. Elements of the label will be incorporated into a measurement standard that is currently under development by a subcommittee of the American Society of Agricultural and Biological Engineers. If adopted, the proposed information label will provide useful information for commercial growers who are planning to use supplemental lighting in their operations.

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

Integration of Classical and Molecular Perennial Grass Breeding for Improvement and Biofule Production and Turfgrass Breeding and Evaluation - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Integration of Classical and Molecular Perennial Grass Breeding for Improvement and Biofuel Production and Turfgrass Breeding and Evaluation-Turfgrass touches millions of Americans' lives daily in physical and social ways that make it an important and positive element in a myriad of environments. Quality turf beautifies and enhances an environment, conserves soil, reduces pollution and provides a site for recreation. Although turfgrass is an important component of our economy and a benefit to the environment, it also accounts for a large percentage of pesticides, water and fertilizer applied annually. The development and use of new improved cultivars that are resistant to drought, heat, pests and pathogens, and salinity continues to be the greatest need in the turfgrass industry. Disease and pest-resistant grasses will reduce the use of fungicides and insecticides needed to maintain fine turf areas. Improved cultivars with better wear tolerance can provide better, safer sports turf. There is a great need for cultivars with better shade and drought tolerance and a reduced growth rate to also reduce maintenance costs. The development of improved breeding and evaluation techniques will benefit also other breeding programs designed to improve turf, forage, and biomass grasses.

What has been done

Researchers from the NJAES Center for Turfgrass Studies take an integrated approach to turf breeding, using both traditional plant breeding methods and genetic engineering technologies to improve turfgrasses and perennial grasses for disease resistance, salinity, heat and drought tolerance, and other desirable traits. Researchers gather and analyze turfgrass samples from around the United States, as well as from Europe, Africa, and Asia, to identify and evaluate grass germplasm with desirable traits that can be incorporated into the turfgrass breeding program. At the same time, NJAES researchers work to develop and validate useful genetic markers for stress, heat, and drought tolerance for use in the selection of heat/drought tolerance in turf breeding programs. Center for Turfgrass Studies staff also maintain and monitor cultivars developed at the New Jersey Agriculture Experiment Station to continue the assurance of quality seed.

Results

Since 1967, the NJAES Center for Turfgrass Studies has developed and released hundreds of turfgrass varieties. Virtually all major producers, distributors, and marketers of turfgrass seed in the United States rely on the NJAES Center for Turfgrass Studies for a significant portion of new turfgrass varieties. During 2016, there were over 15 U.S. Plant Variety Protection (PVP) Applications. Twenty-eight U.S. PVP certificates were issued to turf grass developed by NJAES turf breeders. Among the new turf cultivars released in 2016, there are several varieties with high levels of disease resistance. These will require less maintenance and use of expensive pesticides and fertilizers. This will directly improve the bottom line for golf course superintendents, sod farmers, and turfgrass seed companies. The environment and public at large will also benefit from a reduction in chemicals used to maintain quality turf. NJAES researchers have recently developed genetic markers for heat tolerance and dollar spot resistance in creeping bentgrass (typically used on golf course putting greens); these markers are now published and can be used in breeding programs. This will improve the efficiency of selection for improved characteristics, improve our understanding of how these desirable traits are inherited, and hasten the development of new pest and stress-tolerant creeping bentgrass cultivars.

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

Value Added Lamb Production Model - LONG-TERM - Existing and 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Value Added Lamb Production Model-Existing and new small farm producers looking for complimentary or start-up small ruminant livestock production are implementing and using at various scales a Value Added Lamb Model developed by an RCE Extension Agent. The model in its 29th year is a self-directed extension supported production model using lambs for terminal meat production. The model originally developed for farm assessment purposes has grown into a viable meat production model for small acreage land owners to meet the demand for locally grown high quality lamb.

What has been done
The lamb model is an applied project that walks new and existing growers through a step by step application covering production and marketing concepts including a flex budget and guaranteed income potentials. Twilight meetings over the years and 4-H lamb carcass evaluations have been used as tools for teaching participants. Participants represent both existing and new adult and youth members desiring to learn about and produce high quality value added lamb. Growers purchase lambs every spring and then direct market them as finished and processed sides in the fall. A high majority of the producers have found the lamb model easy to implement and very gratifying as a livestock production system. Growers have been able to take the model and implement with success. Not only do they learn to raise the lambs, the growers learn how to market the lambs for top dollar via direct marketing to consumers. Most of the growers net $150 to $200 per lamb. Growers also have been able to tap into the locally grown-natural-source identified markets and make positive returns compared to the industry average. On average approximately 40 growers implement the model in some form annually.

Results
Participants represent both existing and new adult and youth members desiring to learn about and produce high quality value added lamb. Growers purchase lambs every spring and then direct market them as finished and processed sides in the fall. A high majority of the producers have found the lamb model easy to implement and very gratifying as a livestock production system. Growers have been able to take the model and implement with success. Not only do they learn to raise the lambs, the growers learn how to market the lambs for top dollar via direct marketing to consumers. Most of the growers net $150 to $200 per lamb. Growers also have been able to tap into the locally grown-natural-source identified markets and make positive returns compared to the industry average. On average approximately 40 growers implement the model in some form annually.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #9

1. Outcome Measures

Regulation of Cellular Apoptosis and Survival in the Bovine Mammary Gland - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Sustainability of our dairy production systems requires that dairy farmers continue to improve productive efficiency of their operations, resulting in an economically viable system where a high quality food product is affordable for the consumer and profitable for the farmer. The mammary gland is the working unit of the dairy cow. Peak milk production in dairy cows occurs six to eight weeks after calving. After this, milk yield gradually decreases. In dairy cows, the decline in milk yield following peak lactation is associated with loss of the milk-secreting cells of the gland through a programmed cell death pathway termed apoptosis. The cellular and molecular mechanisms that induce apoptosis following peak lactation are unknown, but may involve decreased production of insulin-like growth factor (IGF)-I or increased production of IGF binding protein-3. The insulin-like growth factor (IGF) system and its binding proteins represent a family of proteins that control cell survival and cell death. NJAES researchers have previously determined that IGFBP-3 plays a role in the apoptotic pathway in bovine mammary epithelial cells, the cells in the gland that make milk. The elucidation of these mechanisms in the bovine mammary gland has been impeded by the lack of a commercially available antibody that recognizes bovine IGFBP-3. By understanding basic mechanisms that regulate the number of milk-secreting cells in the mammary gland we will be able to develop technologies to increase milk production more efficiently. If dairy farmers can produce more milk per cow, they can dilute out maintenance costs

and ultimately produce more milk from fewer animals, contributing to our ability to feed the world in the face of an ever-increasing population. This will also reduce animal waste products such as soil erosion and the use of fertilizer, water and fossil fuels associated with dairy farming. This will benefit farmers by allowing them to compete in a global economy.

What has been done

An NJAES researcher is conducting research that is enhancing our knowledge about the complex processes inside the milk-secreting cell that lead to cell death, and how survival factors that oppose cell death counteract these mechanisms. Cellular and molecular biology approaches are used to identify the key proteins in these pathways and the regulatory mechanisms that control their action.

Results

To identify the antibody that recognizes bovine IGFBP-3, researchers genetically engineered bovine milk-secreting cells to secrete IGFBP-3 into the culture media that contained a tag allowing for purification of the protein from the media. Once purified, this protein was used as an immunogen to generate an antibody in rabbits that can be used to detect bovine IGFBP-3 in cell biology experiments. Using this antibody, researchers were able to conduct experiments to determine how much of this protein is made by the milk-secreting cells under different conditions and to determine where the protein is localized in the cell. Research results indicate that IGFBP-3 localizes to the nucleus when the apoptotic cell death pathway is activated, which could play a role in the decline in mammary epithelial cell number following peak lactation. This reagent will enable the use of bovine cell culture systems to further advance our understanding of how the milk-secreting cells in the gland divide, become functional cells, and escape cell death. This basic knowledge will allow the development of technologies to improve productive efficiency of dairy cows.

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

Extend and Maximize the Post Harvest Quality of High Value and Perishable Crops-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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Small fruit is an important horticultural commodity in the US. For example, strawberries are a $2.3 billion industry. Most fruit are consumed domestically, but are shipped throughout the country largely from a handful of states (most notably CA and FL), with a significant export market in Canada. The markets for these horticultural items are global; winter demand for these items among U.S. consumers is met by imports from South America. If global export and import markets are to be expanded, shipping and storage of these high value but perishable commodities will require new methods to control disease and senescence of fruit. The development and introduction of organic methods preserve post-harvest quality of agricultural products will expand the trade in fresh fruit and increase incomes to farmers and workers worldwide.

What has been done
An NJAES researcher is developing an organic system to control postharvest fungal diseases of fresh fruit during shipping and storage, using the controlled release of natural antifungal volatile compounds in a modified atmosphere package.

Results
In 2015, this research resulted in a patent application for a cost effective solution to the problem of microbe-mediated degradation of packaged agricultural products. This solution harnesses the anti-microbial properties of volatile essential oils of herbs (such as thyme) and controls the release of anti-microbial oils in a manner that inhibits, prevents, or delays microbe-mediated degradation or decomposition of produce (such as cuts fruits and vegetables). In 2016, research focused on developing innovative packaging systems for fresh blueberries that utilize this new technology. NJAES researchers are making progress towards the development of innovative packaging systems for fresh blueberries and other fruits to enhance quality and safety, and to extend shelf-life. Results to date indicate that anti-microbial essential oils (thyme oil formulations) as capsules can successfully be applied as a coating to the clamshell pack, delivered as thyme oil encapsulated in cyclodextrin (TO:CD) and applied to the inner lid. This proved very effective in disease control and avoidance of fruit shrinkage for blueberry stored for long periods (30 days). The results of this research will make it possible to reduce production losses of high value, perishable, organic and conventionally grown horticultural commodities. These losses are estimated to be as high as 25% in the US and even greater worldwide. Export markets for US blueberries and strawberries could expand as post-harvest life is extended and microbial contamination reduced. By reducing losses due to disease and extending the shelf life of fresh

fruit shipments, this technology will benefit growers, processors and shippers of fresh produce, as well as consumers.

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

Strawberry Breeding and Management Team -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A survey of New Jersey farmers was conducted in 2015 and 2016 to identify the current status and needs of the small fruit industry in New Jersey. Over half of the estimated growers in New Jersey (75 respondents) indicated that small fruit growers were interested in the development of new varieties with exceptional flavor and adequate yields for their direct markets. Growers wanted a more flavorful berry that could be used in their farm markets, CSA's and tailgate markets. Growers indicated that although strawberries comprised a minority of total sales, the crop had a greater impact on overall direct market sales and attraction of customers to their markets.

What has been done

As a result of the needs identified by the industry in our statewide survey and in direct consultation with industry council representatives in the small fruit industry. The strawberry breeding team has been working on the testing, patenting and release of new strawberry varieties developed by a Professor Emeritus at Rutgers University. New Rutgers strawberry selections were tested on over 13 farms throughout the state including organic and conventional farms. A new strawberry, Rutgers Scarlet was patented and released and is now being grown in 22 states. The new Rutgers Scarlet strawberry is now available through Nourse farms in MA and through Kube Pak in Allentown, NJ. Over 300,000 Rutgers Scarlet plants have been sold to growers in 22 states throughout the United States. The team is now working to develop agreements to test the new Rutgers breeding lines in European countries. Two additional Rutgers Strawberry NJAES lines are targeted for Patent and release.

Results

The research team has received feedback from participating NJ growers. Nourse farms has also collected data from customers throughout the 22 states that Rutgers Scarlet strawberry has been sold. Growers have expressed great satisfaction with the taste of the Rutgers Scarlet strawberry. The release of the new variety attracted media coverage on television, radio, newspapers and in statewide magazines that enhanced customer awareness and interest in New Jersey grown NJAES strawberries. New Jersey farmers indicated that the media coverage enhanced early season strawberry sales. Over 100 growers in 22 states are now growing over 300,000 Rutgers Scarlet Strawberries developed by the Rutgers NJAES strawberry breeding team. Nourse farms in MA and Kube Pak produced dormant plants and plugs respectively and generated revenue for their businesses. Participating growers report that statewide positive media coverage has enhanced their direct market sales of strawberries from 10 to 30% from previous years. Growers, consumers and the media have expressed great satisfaction with the taste of the Rutgers Scarlet strawberry. It is estimated that media coverage on television, radio, newspapers and in statewide magazines reached over 1 million potential customers in the state and region.

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 #12

1. Outcome Measures

Enhancing Food Security in Union County, New Jersey -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

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Through Action and Education - Current (Feb. 2017) US Census data for Union County NJ, indicates that 10.6 % of the population is living in poverty. According to the NJ Anti-Hunger coalition from 2010 to 2015, the number of children eligible for free- or low-cost school meals rose an alarming 19 percent. In 2015, nearly 450,000 children lived in low-income households that qualify for school meals. (NJ Kids Count 2016). In 2014, 11 percent of New Jersey?s nearly 9 million residents lived below the meager federal poverty line of $23,830 for a family of four. (U.S. Census Bureau). When factoring in the real cost of living in New Jersey, an estimated 1 in 4 residents earn too little to meet their basic needs. (New Jersey Anti-Poverty Network). Almost 900,000 people in the state rely on food banks. (Hunger in America 2014). Food pantries in Union County are resources for families and individuals in need of food. Donations of fresh vegetables to food pantries give families access to healthy food and allows pantries to use financial resources to purchase other perishable items such as milk and meat.

What has been done

RCE of Union County has been addressing the food security issue on two fronts: starting community gardens and providing local food pantries with produce for distribution. Schools and community organizations look to NJAES Cooperative Extension for guidance on starting and managing school and community gardens. The Master Gardeners of Union County have been providing local food pantries with fresh produce since 2002. They grow fruits and vegetables in their "Sharing" demonstration garden located at Trailside in the Watchung Reservation. One of the volunteers coordinates with local food pantries for delivery of the produce. Master Gardeners also volunteer at the Mitzvah Garden at Temple Emmanuel in Westfield and the Union Community Garden. The RCE County Agent has been working with the a local community organization and county government to establish community vegetable gardens. The goal of the project is to provide organizations with raised beds and vegetable transplants to get community gardens started, give guidance on growing and harvesting vegetables, and teach plant and nutrition workshops. Since the project started in the spring of 2009, the organization has expanded to having 13 community garden sites. In 2016, the Union County Board of Chosen Freeholders offered a grant program to help communities start / maintain vegetable gardens. RCE provided soil nutrient and lead tests, garden designs and material lists for many of the sites. RCE County Agent provides training programs for community garden leaders and several Groundwork employees/volunteers have completed the Rutgers Master Gardener program in the County. RCE County Agent visits garden sites to provide guidance on integrated pest management. To help schools and community groups establish and maintain gardens RCE of Union County offers an

annual day long workshop "Get Your Vegetable Garden Growing: Home-School- Community." The workshop is attended by teachers, community leaders and volunteer Master Gardeners. A team of Rutgers Cooperative Extension faculty and program coordinators has developed a new Community Gardening Curriculum for volunteer Master Gardeners to deliver to local groups. One-hundred twenty five (125) Master Gardeners have been trained state-wide to deliver the program starting in spring 2017.

Results
The Master Gardeners "Sharing Garden" project yielded 2,391 pounds of produce in 2016. The retail value of the small fruits, herbs and vegetables donated to fifteen local agencies that provide food to their clientele is $4,337. Since 2002, volunteer Master Gardeners have cultivated and donated 28,091 lbs. of hardy vegetables, fruit and herbs to help feed the hungry in Union County. Program evaluations of the RCE Union County workshop indicated that participants (N=47) improved their knowledge about selecting a community garden site, how to grow vegetables and flowers from seed in a classroom, and composting. From a panel discussion, they learned: good ideas about grants and where to find funding; the basics of gardening from small to large scale; and challenges and logistics including funding and help with the physical work involved. Twenty-eight (28) of the participants used the workshop for professional continuing education credits.

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

Outcome #13

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Milk Quality - The rapidly declining number of New Jersey dairies is concerning and could be detrimental to the milk industry. The total number of NJ dairies is hovering around 60 by a thread. The high demand for milk and low market prices can make it difficult for dairies to stay afloat since the operating cost has risen above the small price producers are paid per hundredweight of milk. NJ dairies receive minimal to no support and do not have much of a market in which they can compete, especially if milk cooperatives do not wish to take only a portion of a farm's milk. Rutgers Cooperative Extension of Salem County works daily with dairy producers throughout the state in order to provide as much support as possible as well as useful resources that can improve a dairy farm's function and productivity.

What has been done

To best help the dairy industry remain viable in New Jersey, it is necessary that the remaining dairy producers operate efficiently, taking advantage of all available premiums offered to them for producing a quality product; producers can receive a premium if their somatic cell counts are low and quality is therefore great. With the support of Rutgers Cooperative Extension of Salem County, New Jersey dairy producers have been able to do just that. By using cow side tests for parameters such as somatic cell count and bacterial levels, producers were able to identify and address issues before they became major problems. All New Jersey dairy producers had access to two in-state analytical labs (New Jersey Department of Agriculture Lab in Trenton-official and Rutgers Cooperative Extension of Salem County lab-unofficial) to identify microorganisms responsible for issues found on farm. RCE employees collect sterile milk samples from farms and then use products in the incubators to encourage bacterial growth to determine what organisms make cows sick so that treatment can be discussed with farm veterinarians. Components within the milk produced were also monitored by sampling milk in-line using specialized equipment as well as in the bulk tank, and those samples were then sent to another university milk quality lab. Milk temperature and time for milk cool down to take place were also monitored to ensure that milk was managed in a responsible manner so that it would be of the highest quality and have to longest possible shelf life for consumers. Cowside tests have also been used to determine beta-hydroxybutyrate levels in cows and calves to determine chances of developing serious conditions such as ketosis after parturition. Cow comfort and housing conditions were also monitored and recommendations were made to improve cow comfort (which then can improve milk quality). Experimental and market teat dip and hoof bath products have been given to producers to use to keep cows healthy and make improvements in milk quality. By keeping an eye on all of these parameters, the dairy producer was able to use best management practices to run a more efficient and profitable operation. Attention to minor details helps to make up the dollars and cents needed to remain a viable industry in New Jersey.

Results

In 2016, dairymen have benefitted weekly from efforts made by RCE of Salem County staff. These farms received somatic cell and organism information on tested cows, milk quality information from lab staff, recommendations for improved cow productivity, learned from both cowside and laboratory-analyzed testing done throughout the year, and received experimental teat dip and hoof bath products for milk quality enhancement during both lactation and the dry period. An estimated 40% of dairies participated in various research efforts made by RCE in 2016 in regards to milk quality. Due to milk quality improvements made, producers have noted lowered somatic cell levels and experienced the rewarding premiums offered for high quality milk. Bulk tanks have also been monitored to determine if there were any spikes in somatic cell or organism presence so the herd could be looked into more closely. Best management practices were made

on a number of dairy farms which led to an increase in cow comfort and therefore an increase in milk quality since comfortable cows produce more high quality milk. Such implementations include cow misters for hot weather, sources of shade away from excessive light intensity in summer, large fans to circulate and cool air, and clean bedding. Such improvements in comfort and quality result in a bigger paycheck and a larger amount of milk within the bulk tank!

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

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 the 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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	10.0	0.0
Actual Paid	2.5	0.0	8.2	0.0
Actual Volunteer	1052.0	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**
312715	0	396998	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1448639	0	2983975	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
169461	0	802205	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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	25060	26200	0	0

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

Year:	2016
Actual:	56

Patents listed

RU2015-123
RU2016-047
RU2016-076
RU2016 -082
RU2016-137
2016-103
201400298
201600015
201600041
201600066
201600067
201600068
201600091
201600098
201600099
201600100
201600101
201600142
201600143
201600144
201600234
201600245
201600263
201600301
201600316
201100367
201100368
201100369
201200444
201200445
201200446
201200447
201300014
201300032
201300033
201300365
201300435
201300478
201400002
201400071
201400133
201400137
201400191
201400224
201400236
201400404
201400405
201400510
201400511
201500013

201500071
201500312
200800167
201300137
201400346
201400138

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	4	40	44

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
2016	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	Organic Land Care -MEDIUM-TERM- Organic Land Care - 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.
5	Mosquito Control Activity - 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	Protecting Human Health and Urban Environment Through Integrated Pest Management Progrmas -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	Understanding Epichloe Festucase Endophyte-Mediated Dollar Spot Resistence in Strong Creeping Red Fescue - 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.

8	Lead Poisoning Prevention and Nutrition -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.
9	North Jersey Ornamental Horticulture Conference Turf Day - 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.
10	Management of Annual Bluegrass on Golf Courses: Improved Practices for Maintenance, Pest Control, and Viable Techniques - 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.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

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

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rutgers Veteran Environmental Technology and Solutions (VETS)- 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% (US Bureau of Labor Statistics, 2014.) 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.

What has been done

Thirteen veterans entered this green job skills training program in June and received nearly 1,000 hours of training through the end of 2016. There were more than 30 unique guest lecturers, 22 educational field trips, and 12 projects benefitting Essex County and the local community. The program is 40 hours a week from June through December. The trainees have also learned about starting their own businesses and how to become successful small business owners. Tilapia and vegetables were raised aquaponically and were donated to the food bank located onsite at the VETS facility. There was also an entrepreneurship component to the training through a partnership with the Rutgers-Newark Business School.

Results

This is an educational and vocational program for unemployed veterans in Newark and Essex County. The program is reaching a new extension audience, as 100% of the participants had never attended an extension program prior to being involved in this training. 100% of the participants (n=13) were happy that they had attended this program. The community garden and greenhouse maintained by the veterans provided nearly 500 pounds of vegetables to the food pantry adjacent to the facility (greens, herbs, tomatoes). 80 pounds of tilapia were donated to the food pantry. Seedlings grown by the vets were distributed to local residents during community outreach events. The veterans planted 100+ trees and pruned others in Newark parks. 2 community gardens were established in the area. Of the graduates from the 2015 class: 5 veterans found full-time jobs landscaping, AeroFarms; 3 started their own landscaping company; 2 went back to school full-time; 3 stayed on as second-year program interns for advanced training. The veterans earned educational stipends ($13,440) that had personal economic impacts, as they were all unemployed prior to the start of the program. The veterans used what they learned to find jobs, improve the local community in Newark and surrounding towns in Essex County, and to start their own businesses. Some of them also took the initiative to become certified pesticide applicators and certified fertilizer applicators.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fungi associated with grasses: Biodiversity, Systematics, Genomics, Functions and Molecular Detection - Turfgrass touches millions of Americans' lives daily in physical and social ways that make it an important and positive element in a myriad of environments. Quality turf beautifies and enhances an environment, conserves soil, reduces pollution and provides a site for recreation. Fungi constitute the majority of pathogens that infect and damage turfgrasses. Early detection and accurate identification are essential for developing efficacious control strategies and for turfgrass breeding. Traditionally, diagnosticians use direct observation or culturing of specimens to identify turfgrass pathogens. DNA macroarray and real-time PCR are molecular tools that offer fast, culture-independent alternatives for the detection of microbes. The development of molecular techniques for rapid detection of turfgrass pathogens will assist turf managers and landscapers in detecting and treating emerging fungal infestations as well as assist turf breeders in identifying fungi-resistant germplasm for use in their breeding programs stress.

What has been done
NJAES researchers are conducting a multidisciplinary study on fungi associated with grasses, including wild grasses in nature and domesticated turfgrasses. This methodology integrates basic fungal biology study, molecular diagnostic technology development and application. A prime focus of this research is the development of molecular techniques for the rapid detection of turfgrass pathogens.

Results
A patent was issued in 2016 for a macroarray diagnostic technique with enhanced detection sensitivity for pathogens. This technique should be useful for early human, animal or plant disease diagnosis when only trace amounts of target microbes are present in a sample. This finding should aid in the development of a multiplex diagnostic macroarray system to facilitate early disease diagnosis and management. The technique also can be adapted and applied to microbial ecological studies and other research areas. In addition, research findings indicate that ACC-deaminase bacteria inoculation of roots is effective in improving salinity tolerance of perennial ryegrass and could be incorporated into turfgrass maintenance programs in salt-affected soils. ACC-deaminase is an enzyme that facilitates plant growth and development, especially after environmental stress.

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

Organic Land Care -MEDIUM-TERM- Organic Land Care - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Organic Land Care - An assessment was conducted to determine the needs of professional landscapers and homeowners with regards to organic landscaping. A survey was administered to attendees at the 2012 Central Jersey Turf and Ornamental Institute event (n = 173). 40% of those surveyed responded that their clientele had already inquired about organic or ?all natural? landscaping practices. 57% of overall respondents answered "yes" or "maybe" when asked if they wanted to become certified organic landscapers. 73% of landscaping company owners responded that they would like to become certified organic landscapers compared to 58% of crew managers and 43% of crew staff. 33% believed that being certified in organic land care would help their businesses, and 33% of respondents believed their customers might be willing to pay more for organic landscaping.

What has been done
An Organic Land Care Certificate Course, a 5-day education program with over 20 speakers lecturing on a variety of topics inlcuding: the history of the organic movement, basics of soil, alternatives to turf, site analysis/design, organic turf management, organic weed and pest management, water resources issues, planting and plant care, and wildlife management, among others. Fourteen participants attended this year's class. Organic Land Care Working Group - This program has been evolving with the assistance of an organic land care working group with members consisting of professional landscapers, other landscaping industry members, Rutgers personnel, New Jersey Department of Environmental Protection employees, and Environmental Protection Agency representatives. Curriculum materials include: Organic Land Care website, Organic Land Care Best Practices Manual (in press), Organic Land Care for Homeowners fact sheet and checklist (in revision).

Results
The objective of the organic land care program is to reduce non-point source pollution through the education of professional landscapers, homeowners, and job skills training recipients, among others, about practices to minimize the impact of landscaping activities to the environment and people's health. The attendees at the 2016 certificate course were satisfied with the 5-day program and, on average, rated the overall program content at a 4.72 on a 5-point scale. The overall teaching and instruction was rated at a 4.72 on the same scale. The 2016 certificate course participants (n= 11) stated intent to reduce synthetic fertilizer use by an average of 51% and intent to reduce synthetic pesticide use by an average of 58%. Respondents also reported that they planned to implement a number of organic land carepractices, with 91% planning on top-dressing lawns with compost and 91% planning on overseeding turf, as well. 82% intended to only apply fertilizer based on soil test results and the same percentage planned on returning mowed grass clippings to the lawn. Other respondents planned on removing invasives and installing native plants, installing rain gardens, reducing stormwater runoff, and reducing irrigation. Focusing on the science, patience in transitioning, and understanding there are no "one size fits all" organic programs have been important lessons learned by experienced practitioners.

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

Mosquito Control Activity - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mosquitos are more than just a nuisance; they pose a real public health risk to the U.S. population. Mosquitos transmit viral diseases that harm both humans and animals, including West Nile virus, Eastern Equine Encephalitis and, recently, more exotic diseases such as chikungunya, dengue fever, and zika, all of which have arrived in the United States. Since mosquitos frequent shoreline areas with abundant wetlands and coastal salt marshes, effective mosquito control is also crucial to the economic health of those shoreline communities where tourism is an integral part of the local economy.

What has been done
The State of New Jersey has charged the New Jersey Agricultural Experiment Station with the responsibility for developing and implementing effective mosquito population surveillance methods, as well as the ongoing surveillance of arboviral disease. NJAES extension personnel work closely with county health departments, county mosquito control agencies, county and local health offices, and other agencies throughout the state.

Results
NJAES researchers have made significant progress in the development of new autodissemination technologies that attract mosquitos and then expose them to insect growth regulators (chemicals that disrupt reproduction cycles). Researchers continue to test and improve an autodissemination station and a patent was issued for this technology in 2016. A new gel formulation of the insect growth regulator was developed and tested. Field tests indicated that this new gel formulation was highly effective in reducing mosquito populations in test areas. Patent applications were submitted for this gel formulation and for a new technology for attracting mosquitos to autodissemination stations. This autodissemination technology is an efficient and effective mosquito control technology which will reduce the use of area spray technologies that are less effective and that potentially expose the public to toxic chemicals. More design elements to improve manufacturing, packing, and transportation are anticipated in the coming year. For the past several years, NJAES researchers have focused on the development of drone technology for surveillance and larvicide spraying in inaccessible areas. In 2016, NJAES researchers developed

new drone-mounted mosquito control technologies, including a small tablet dispenser which is an inexpensive and efficient mosquito larval control technique for inaccessible areas. A patent application was submitted for this technology. NJAES researchers are also now focused on the development of smaller drone technologies for use in urban areas, constructing a micro-sized applicator and larval collector. This is an important new direct ion in drone technology, as urban populations are especially vulnerable to mosquito species that carry dengue fever and Zika. Other NJAES research is focused on identifying hibernation behavior and insecticide resistance, among other traits, in the Asian Tiger Mosquito at different latitudes and environments in the U.S.; this will inform public health risk mapping and strategies for the viruses carried by these mosquitos. NJAES continued to conduct surveillance for mosquitoes in all 21 counties of New Jersey, as well as for both endemic mosquito-borne arboviruses (Eastern Equine Encephalitis and West Nile Virus) and exotic mosquito-borne arboviruses. Each week during the mosquito season, weekly update surveillance data is posted, alerting county and state mosquito control agencies to epidemiological events early enough in the amplification process for intervention to help prevent human involvement. Local and county agencies use population, species, and disease incidence data from these surveillance reports to inform their mosquito control spray patterns and other control tactics. NJAES extension personnel also continue to improve the surveillance tools currently available and they maintain a historical record of populations and patterns of infections and disease. This activity impacts New Jersey residents by monitoring and assessing the threat posed by mosquito-borne diseases. NJAES extension personnel provide and encourage environmentally sound, scientifically based, and professional control by county mosquito control districts, that meets state mandates for mosquito control. They conduct training courses for mosquito professionals and individual county site visits to assist local mosquito control officials in improving and updating their programs.

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

Protecting Human Health and Urban Environment Through Integrated Pest Management Progrmas -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
2016	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. In the U.S. bed bugs re-emerged as a common pest after near 50 years absence. Bed bugs are one of the most difficult urban pests to control. Pest management professionals rely heavily on insecticide sprays and dusts to control bed bugs. Cockroaches contaminate food and produce allergens that are asthma triggers. Historically, conventional insecticide spray treatments caused development of insecticide resistance among cockroach populations. Despite the availability of highly effective cockroach management tools and methods, German cockroach infestations remain prevalent in apartment buildings. 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. Reducing pesticide applications and more effectively controlling for urban pests will minimize food contamination and adverse impact to human health from pesticide use and pest infestation.

What has been done
Through basic and applied research on pest biology, behavior, ecology, and various control techniques, NJAES and RCE faculty design, test, and disseminate new and improved pest management solutions.

Results
NJAES researchers evaluated the residual efficacy of four liquid sprays and four ready-to-use aerosols that are commonly used in the U.S. against bed bug. A field collected strain with moderate resistance level to pyrethroids was used. Study findings reveal that the efficacy of the available products varies and the substrate type can affect the effectiveness of an insecticide product. This information will be disseminated to pest management professionals to inform their pest control strategies. Bed bug elimination often requires a combination of several tools and methods. One of the more challenging obstacles in eliminating a bed bug infestation is addressing personal items that are infested but cannot be treated with pesticides. Investigators studied the use of portable heat chambers for disinfesting bed bug infested items that cannot be treated with traditional pesticides or laundered. Results indicate that 4.3-8 hours treatment time is sufficient to kill all stages of bed bugs hiding in a suitcase using a portable heating chamber. The minimum time required to kill bed bugs is affected by the tightness of the materials packed in the

suitcase. Loosely placing items in the heat chamber is recommended for faster kill of bed bugs. This is the first study showing using portable heat chambers is a safe and cost-effective method for disinfecting bed bug infested materials. To develop more effective cockroach management strategies, NJAES extension specialist investigated the prevalence of these pests and evaluated a community-wide integrated pest management program (IPM) in a low-income community over a 7 months period. The community-wide cockroach IPM program reduced cockroach counts by 96% at the 4th visit (7 weeks after initial treatment), which is similar to previous studies in low income communities. By providing effective extermination, the percentage of residents who used pesticides was reduced by 79% (from 91% to 19%). NJAES researchers evaluated the effectiveness of three commonly used gel bait products used against German cockroach populations. Significance resistance was detected. Their resistance levels varied among strains and the bait type. Rotating the treatment materials and methods is necessary to achieve effective control and slow down cockroach resistance management. Bed bug infestation patterns in 2,372 low-income apartments within 43 buildings in four New Jersey cities were examined. A cost-effective bed bug monitoring protocol was developed which involves a combination of resident interviews, brief visual inspections, and monitoring with bed bug monitors. Assuming $50 per hour labor rate, the average per apartment cost for the building-wide bed bug monitoring protocol was $12 per apartment. Forty-nine percent of the infestations detected by the protocol were in apartments whose residents were unaware of the bed bug activity. Results suggest an urgent need to suppress bed bug infestations in these communities and reduce further bed bug dispersal among communities. Adopting the monitoring protocol proposed in this study will save at least 36% labor cost and 94% material cost compared to reliance on bedbug monitors alone.

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

Understanding Epichloe Festucase Endophyte-Mediated Dollar Spot Resistence in Strong Creeping Red Fescue - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dollar spot is one of the most problematic diseases for many turf grasses, particularly in creeping bentgrass, often requiring repeated applications of fungicides. Considerable research is focused on ways to improve dollar spot resistance in creeping bentgrass, such as development of more tolerant cultivars and development of better cultural management practices. A new approach to improving the control of dollar spot is to determine the basis for resistance in another biological system, that of fungal endophyte-infected fine fescue. In addition to creeping bentgrass, dollar spot can also be a problem on strong creeping red fescue. However, when strong creeping red fescue is infected with the symbiotic fungal endophyte Epichloë festucae, the plants exhibit resistance to dollar spot. How infection by the endophytic fungus confers disease resistance to the host red fescue is not known. Understanding the basis of dollar spot resistance in endophyte-infected fine fescues may suggest new approaches to dollar spot management in other grass species.

What has been done
NJAES researchers have used laboratory studies to purify and characterize the antifungal protein and to determine if it has any effects on the dollar spot pathogen study.

Results
In 2016, a patent application was filed for the antifungal protein produced by an endophytic fungus that may be a component in the disease resistance seen in endophyte-infected fine fescue.The endophyte antifungal protein has been purified from infected plant tissue and researchers confirmed that it did exhibit activity against the dollar spot fungus in a plate assay. This finding was confirmed in several different assays conducted on a larger scale. These recent results support the notion that this protein is a component of the disease resistance seen in endophyte-infected strong creeping red fescue.

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

Outcome #8

1. Outcome Measures

Lead Poisoning Prevention and Nutrition -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since 2000, 225,000 young children in NJ have been poisoned by lead. Children with 5 ug/dl lead levels in their blood are 30% more likely to fail 3rd grade reading and math scores, seven times more likely to drop out of school and six times more likely to become involved in the juvenile justice system.

What has been done
Lead poisoning in NJ is disproportionately impacting children of color and lower income families. Research by Isles, Inc., Trenton, NJ shows eleven cities in NJ and two counties (Mercer and Essex) with dangerous levels as compared to Flint, Michigan "Lead Poisoning Prevention & Nutrition" was developed to train MCH public health educators, NJ teachers and school nurses on how nutrition effects a person that has ingested lead through water, food or home environment contamination. Participants learned how a healthy, balanced diet can help reduce the risks of lead poisoning. Lead is a poisonous metal that our bodies cannot use. Lead poisoning can cause learning, hearing, and behavioral problems, and can harm the human brain, kidneys, and other organs. Lead in the body stops good minerals such as iron and calcium from proper functioning and may be permanent. A two hour training of 210 maternal and child health educators, school nurses, FCS professionals indicated the program met 95% of their needs, expectations, and 96% learned new information. Follow-up at one year indicated 85% were actively using information learned within their workplace with participants promoting the testing of school water in Plainfield, NJ and Newark, NJ. Resolutions at the NJ state government level and local county governments continue to promote a decrease in lead levels in children's blood from 10 ug.dl to 5 ug/dl recognizing there is NO safe level.

Results
A train-the-trainer program developed for public health educators, school nurses, teachers to educate individuals and families they work with. The lead problem occurs more often in low income communities but can target all populations in the country. Schools now have mandated testing of their water as legislation was passed and signed by the governor in 2016. Bottled waster is used in county schools until water in school is within levels that are acceptable. Individual knowledge gained was over 95% and important for those who work with families and children in low-income areas.

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

North Jersey Ornamental Horticulture Conference Turf Day - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The landscape of NJ is comprised of 890,425 acres of turf, according to a 2001 Rutgers University study of the turf industry. Turf makes up 19% of the state's total acreage. Golf Courses, commercial properties and residential neighborhoods create a demand for professional turf management services. Professional turf managers care for 39% of the turf acreage. The 2,442

service providers who maintain commercial and residential properties contribute $400 million dollars in payroll and benefits to the state?s economy. They also contribute $691 million in cash expenditures. This competitive industry needs to be apprised of university research on best turf management practices to distinguish themselves from competitors and minimize the use of pesticides and fertilizers thus protecting our natural resources. The industry Professionals who apply pesticides to turf, trees and ornamental plants are required to be licensed by the NJ Department of Environmental Protection (DEP). Professionals must participate in DEP approved recertification programs to keep their licenses. The recertification programs keep the professionals aware of current and proposed regulations, plant pest and disease issues and the safe and appropriate uses of pesticide products. Industry professional who apply fertilizers to turf must become certified fertilizer applicators to be in compliance with the 2012 state fertilizer regulations. Rutgers Cooperative Extension provides the industry with training and manages the professional certification program.

What has been done

The North Jersey Ornamental Horticulture Conference (NJOHC) has been serving the turf industry for 55 years. The main objective of the NJOHC is to promote the adoption of integrated pest management (IPM) practices by industry professionals. Adoption of IPM practices will reduce the amount of fertilizers and pesticides used on residential, commercial and public properties. The NJOHC is organized by a team of RCE faculty and program coordinators. The three day conference consists of Turf Day, Tree Day and Landscape Day. Each day features five lectures by Extension, industry and regulatory professionals. Each year program evaluations are conducted. Topics are selected based on current events affecting the industry such as new regulations or climate changes and previous years program evaluations. To help professionals comply with the fertilizer applicator laws, an Extension Specialist and Rutgers NJAES Sports Turf Education and Research Coordinator, gave a lecture on the fertilizer regulations that qualified certified fertilizer applicators with require continuing education credits.

Results

On the program evaluation (N=76), Ninety-one percent (97%) of the professionals indicated that they will make more informed pest management decisions as a result of attending the conference. Important concepts learned were identified by participants as: NJ Turf Fertilization Application Requirements 78% (59) NJ Pesticide Applicator regulations 70% (53) Selecting fescue grass varieties to reduce pesticide use 43% (33) Managing moths / caterpillars in turf 50% (38) Proper application of insecticides 43% (33) Practices to improve soil health and water quality 46% (35) Seventy-one (71) participants indicated that they have attended the North Jersey Ornamental Horticulture Conference in the past, and 70% changed pest management practices as a result of the training. Some examples of changed practices were: Using cultural methods and working with customers; Integrated pest management (3 responses); Using less pesticides and fertilizers, more focused and targeted applications, I use more organic products to improve the health of the soil and turf. As a result I use less synthetic products. Seventy-nine percent of the participants (79%) who had attended the conference in previous years indicated that their use of pesticide has been reduced as a result of attending the conference. 1-10% reduction: 22 professionals; 11-20% reduction: 10 professionals; 21-30% reduction: 8 professionals > 30% reduction: 5 professionals. When asked if their businesses have saved any money as a result of the training program, 36 indicated yes, 10 no and 11 said the question was not applicable to them. Professionals who attended the program in previous years (N= 71) were asked how the information presented at prior programs affected their business or career. Respondents indicated: 59 have been able to maintain their NJ Department of Environmental Protection Pesticide Applicator License. 46 have been able to maintain their professional fertilizer applicator certification 57 practice IPM. 47 see improved communication with their customers. 45 use the information to train employees. 31

experienced an increase in sales. 7 indicated their attendance helped them get a promotion.

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

Management of Annual Bluegrass on Golf Courses: Improved Practices for Maintenance, Pest Control, and Viable Techniques - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the United States turfgrass, in its many forms, e.g. lawns, parks, cemeteries, sod farms, golf courses, athletic fields, covers > 30 million acres and is a $45 billion industry. Cultivated turfgrass is a widespread feature of suburban and urban landscapes through New Jersey and the United States. 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 rather than working to eliminate it in favor 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. There is an urgent need to gain a better understanding of the biology, and pathogenesis of ABR, develop improved integrated pest management (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.

What has been done
Researchers and extension specialists from the NJAES Center for Turfgrass Center are developing new molecular tools to study Collectrichum cereale (C. cereale) and the anthracnose infection process. The tolerance/resistance of ABG and bentgrass varieties to ABR are evaluated in the greenhouse and field.

Results
A reproducible growth chamber-based inoculation protocol for isolates of the anthracnose fungal pathogen C.cereale infecting annual bluegrass turf (Poa annua) was developed, which has greatly improved the ability to conduct experiments investigating the basic biology of this pathogen. A series of field-based investigations assessed how nitrogen (N) fertility impacts the population and diversity of microorganisms in the soil. Differences among soil-inhabiting microbial communities in annual bluegrass turf were detected throughout the growing season. This documented that microbial populations can change dramatically over the year and that sampling date should be an important consideration when assessing the impact of management practices on soil microbial communities. The complete transcriptome of C. cereale is being sequenced to determine if its pathogenicity increases under low N fertility, and whether changes in pathogenicity correspond to increases in disease severity in the field.

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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	10.0	0.0
Actual Paid	1.2	0.0	4.2	0.0
Actual Volunteer	380.0	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**
158789	0	688326	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1475027	0	1144098	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
61502	0	2059141	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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20256	24893	2500	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	8	38	46

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
2016	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	Pesticide Education and Safety Program (PESP) - 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.

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
2016	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
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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Upland Fruit (Tree Fruit and Grape) Integrated Pest Management Delivery - New Jersey tree fruit production is located in both southern and northern counties. According to the latest agricultural statistics, NJ peach production is valued at $39.6 million and apples at $28.5 million. The industry in southern counties is heavily oriented towards wholesale markets and peach production, while the industry in northern counties is heavily dependent on direct markets and apple production. Retail market fruit production in northern counties is valued at over 15 million. 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. Some large NJ growers may spend up to $350,000 for pesticides alone. Fertilizers also represent a major cost impact. Growers can experience depressed prices from foreign and west coast competition, often leading to deficits in the farming operation. 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. The Food Quality Protection Act has led to restrictions and changes in the types of pesticides that may be used to produce many fruits. Many of the new pesticides are narrow spectrum, that control only one or a few pests and must be used with degree day phenology models and other integrated pest management (IPM) practices. 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 IPM delivery program has been delivered to commercial growers, statewide. The New Jersey wine grape industry has doubled since 2002, with at least 50 wineries and over 100 vineyards. NJ is 5th in the U.S. in wine production, producing 1.7 million gal. of wine, valued between $36-$40 million. Since there has been no IPM programming for grapes, and little baseline data, many grape growers tend to either overuse pesticides or not adequately control pests. Therefore a grant funded pilot IPM program was started in 2015 and continued through 2016 to focus on pest surveys and disease vectors. New invasive species such as the brown marmorated stink bug and the spotted wing drosophila will demand changes in pest management practices and educational and research needs on a regional basis. The objectives of the program are: Maintain or increase crop quality and yield, and marketing ability through modern integrated pest management practices; Develop new and novel techniques for pest management and pest detection, and employ new methods for tree fruit IPM delivery; Provide IPM information to tree fruit growers primarily in Gloucester, Salem, Cumberland, Camden, Atlantic, Hunterdon, Warren, Morris, Bergen, Sussex, Mercer, and Middlesex Counties. Program information is also available statewide to all growers through meetings, demonstration trials, newsletters, and other training methods; Reduce the use of OP, carbamate and other toxic pesticides in favor or reduced risk technologies and alternate management strategies; Minimize non-point source pollution through the reduction of fertilizer and pesticide sources, and enhance water quality through similar means; Reduce farm worker exposure to pesticides; Reduce or minimize production costs; Cooperate with workers in other states to bring IPM information on invasive species, to growers on a regional and national level. An integrated crop management (ICM) program was delivered to commercial fruit growers who produced apples, peaches, nectarines, and grapes. The program reached both primary and secondary participants. Secondary participants attend extension update meetings, and receive other IPM/ICM information through personal visits, fax broadcasts, articles, newsletters and the Internet. Primary participants are those growers who access all the above information and participate in a field scouting program. While some primary participants do self-scouting, the majority contribute funding through acreage participation fees which fund seasonal field scouts, travel, supplies, and laboratory costs. 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. Organized grower meeting contact reached a total of 976 audience members, while on-farm consultations totaled 1,389 visits. The Plant and Pest Advisory Newsletter was changed to a blog format on the Web. A total of 22 weekly articles were written in that format, and accessed world-wide. Acreage impacted by primary participants totaled 80% of all state tree fruit acreage. Over 95% of total state tree fruit acreage was impacted by the program. IPM information reached over 90% of NJ grape growers.

Results

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 16 growers in southern counties. Growers return every year to the program, even though they pay participation fee for program support. During 2016 primary participants in northern counties contributed just over $19,000 for programming on 445 acres. Growers in southern counties supported the program with over $30,000 on farms which managed over 3,500 acres of tree fruit. Grape IPM programming involved a pilot program with 9 participants. 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. Demonstrations were conducted on commercial farms to encourage use of alternative practices. Alternative practices include use of mating disruption and reduced

risk pesticides. 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. In total, 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 completed in 2016 as part of the fertility component. Over 75% of areas sampled were shown have sufficient to excessive phosphorous levels, which led to decreased phosphorous use on those sites. The invasive insect, brown marmorated stink bug (BMSB) has set pest management programs back 30-40 years. A grant funded research and demonstration project showed that growers could treat field edges while using mating disruption and ground cover management to reduce insecticide use by up to 75% compared to most commercial practices now being used for BMSB.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Turfgrass Entomology Program - In the USA (in New Jersey), turfgrass in its many forms, e.g. lawns, parks, cemeteries, sod farms, golf courses, athletic fields, 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. In fine turf, the annual bluegrass weevil is a pest of increasing importance and difficulty to control in New Jersey and the Northeastern USA with spreading and intensifying broad insecticide resistance. The black cutworm is perennial and cosmopolitan pest of on golf courses. 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. Preventive applications of insecticides have become the standard for these pests but are expensive, of limited compatibility with IPM, and do not work well against some white grub species and often require several applications per year for the annual bluegrass weevil. 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

The target audience are turfgrass professionals (golf, athletic fields, landscapers, sod growers, etc.), County Ag Agents, and homeowners (mostly through County Ag Agents and master gardeners). Activities include: a. teaching (Cooperative Extension Talks, local and regional turf conferences, Continuing Education courses, Field days), b. turf insect management recommendations (publications and by email/phone/personal), c. publications (trade journal and newsletter articles, fact sheets, bulletins). 2. Research activities: The overall objective is to develop and implement ecologically-based IPM for turfgrass systems with emphasis on sustainability and non-chemical control approaches. Activities include: a. Development of sustainable control options for the annual bluegrass weevil: NJAES Researchers are developing non-destructive monitoring/prediction tools for the weevil based on semiochemicals that may also be developed into control tools. The researchers are studying 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/cultivars. NJAES Researchers are studying the extent of insecticide resistance, insecticide resistance mechanisms, insecticides and weevil stages affected and are developing effective assays to monitor the resistance. b. Development of sustainable control options for turfgrass lepidopteran pests: We are testing commercial products based on different entomopathogenic nematode species for control of black cutworm and sod webworm larvae in turfgrass. Against the black cutworm several nematode products can provide adequate field control and may be an option for areas where chemical insecticide use is restricted. NJAES Researchers 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: After isolating a new species of entomopathogenic nematode, S. scarabaei, from turfgrass areas in New Jersey, researchers have demonstrated that it is superior as a white grub control agent to presently available nematode species for curative and especially for long-term suppression of white grubs. Researchers continue to explore the biology and ecology of this species. d. Testing of new insecticidal compounds. NJAES Researchers 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

The non-chemical annual bluegrass weevil control options are emerging. This research will give valuable alternatives to the present heavy use of insecticides. They will not only be less hazardous and at the same time reduce pressure for insecticide resistance development. Researchers found that bentgrass species, especially creeping bentgrass, are more tolerant of weevil feeding and are also partially resistant. The most effective and sustainable strategy to reduce problems with this pest should hence be to replace annual bluegrass with creeping bentgrass wherever possible . The researchers non-destructive monitoring techniques for the

weevil have a great potential for major reductions in insecticide application. Observations on biology/ecology of the pest will help improve the timing and the efficacy of any management activities. 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. NJAES Researchers 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. Commercially available entomopathogenic nematode offer an effective alternative to chemical pesticides, and split applications and light irrigation (syringing) during hot, dry periods increase nematode efficacy. Nematodes use will not only be less hazardous but also reduce the pressure for insecticide resistance development. 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. The entomopathogenic nematode species S. scarabaei has the potential to replace the use of insecticides for white grub control in many turfgrass situations. If the white grub suppression proves to be as persistent as our long-term field experiment suggests, applications of S. scarabaei would also be considerably less expensive than chemical insecticide use. Currently, a company is commercializing this species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Pesticide Education and Safety Program (PESP) - 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

2016 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. Integrated Pest Management Program (IPM): During 2016 the IPM programs coordinated by Rutgers Cooperative Extension encompassed production agriculture in the areas of blueberries, grapes 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.

What has been done

PESP: Approximately 30,000 applicators were recertified by this program in 2016. In addition, New Jersey initially certifies an average of 2,000 commercial applicators each year. This requires initial training in CORE and CATEGORY materials. New Jersey also registered approximately 2,000 commercial pesticide operators in 2010. 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 also offered initial CORE training sessions in English and Spanish for commercial operators and applicators. Finally, this program provides training to school employees and master gardeners so they understand the proper use of pesticides and the issues surrounding their use. IPM: Work was done to develop management strategies for use against the brown marmorated stink bug (BMSB) in vegetables and tree fruit. In addition, 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. Overall, IPM adoption in 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 (carrots, cole crops, hightunnel tomato production, pumpkins, peppers, snap beans, staked tomatoes, sweet corn, and sweet potatoes). 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 the BMSB working group.

Results

PESP: As a result of the program, several thousand private pesticide applicators, and commercial pesticide applicators and operators were provided with basic information that allowed then to conduct their jobs in a safe manner. In addition, information and training provided by this program gave growers and other applicators the skill set necessary to successfully complete their state pesticide licensing exams. In doing so, the application of pesticide in the state is a safer operation that is being done in a manner that does not create a hazard to applicators, workers or the general public. IPM: As a result of this program, benefits were seen in the areas of fruit, grape, greenhouse, nursery and vegetable production systems. The various programs were able to document the following benefits: Pesticide use in tree fruit was reduced for Oriental fruit moth

control. Grape growers were educated about the pests they face and how to effectively manage them. Growers in the vegetable IPM program received more timely information that resulted in less pesticide use, Nursery growers were better able to predict pest outbreaks and more effectively manage these outbreaks, Greenhouse growers were better able to manage pests and reduce insecticide and fungicide use because of the scouting program provided by the greenhouse IPM program. Growers were able to effectively manage BMSB in tree fruit and vegetables.

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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	5.0	0.0
Actual Paid	0.2	0.0	3.0	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**
19588	0	122999	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
453937	0	755559	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
23144	0	542296	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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	112	3000	230	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	15	16

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
2016	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.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Characterizing the Physical Environment of the Coastal Ocean and Its Relationship to Ecosystem Indicators-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. One important water quality measure is the amount of oxygen in the water. Very low oxygen conditions can starve species like fish of oxygen, resulting in large die-offs of fin fish or shellfish. 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.

What has been done
NJAES researchers are using continuous ocean observations enabled by rapid advances in technology (Autonomous Underwater Vehicles or AUVs) to describe the physical environment, including temperature, salinity, and water quality (dissolved oxygen levels) at varying ocean depths. This allows us to define the physical environment at the necessary temporal and spatial scales to describe the critical interactions with the ecosystem, from phytoplankton and bacteria to fishes.

Results
During this reporting period NJAES researchers deployed several glider (AUV) missions on behalf of the New Jersey Department of Environmental Protection (NJDEP) along the New Jersey coast to map the subsurface dissolved oxygen (DO) concentration in near real-time within the near coastal ocean. These deployments gathered essential data used by the NJDEP to meet required reporting requirements on coastal water quality to the U.S. Environmental Protection Agency (USEPA). This data was reported to NJDEP in real-time throughout each deployment. The use of glider technology greatly reduces the cost of gathering this data and the costs to NJDEP of meeting their reporting requirements to USEPA. The use of gliders to monitor ocean conditions also improves the real-time observation of conditions that are constantly and sometimes rapidly moving and changing. When an adverse event (say, an algae bloom) is reported, gliders are deployed to "scout" large areas of coastal waters to detect whether and how this disturbance is moving and affecting underwater conditions. This data collection assists and augments data gathered by boat-based NJDEP personnel, making the data collection process more efficient and

enabling NJDEP to respond more effectively.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding Ecological Aspects of Shellfish Pathogens to Improve Management - Shellfish are important components of estuarine and coastal ecosystems and play significant roles in maintaining healthy ecosystems. Many species provide a renewable resource to local and regional economies through fisheries and aquaculture. Shellfisheries and shellfish aquaculture are dependent upon good water quality and healthy ecosystems. A variety of molluscan shellfish, such as oysters, hard clams, surf clams, ocean quahogs and scallops are fished and farmed in New Jersey and the surrounding region. Nationally, molluscan shellfish aquaculture is a 328+ million dollar industry supporting thousands of small farms and sustainable green jobs in rural areas. Molluscan shellfish production increased 69% from 2005 to 2013. Farm-raised oyster production is increasing rapidly in the Northeast and mid-Atlantic regions and other species are soon to follow. In comparison, NOAA reports molluscan fisheries landed $1,003,904,518 worth of shellfish in 2014, indicating that shellfisheries are likely worth several billion dollars to the US economy annually. Fished or farmed shellfish are exposed to a plethora of ecological interactions, including parasitism, which can dramatically reduce production or affect human health. Shellfish can filter vast amounts of water, which is magnified by the extensive

assemblages that they can form in either natural or culture situations. As a result, shellfish contribute to ecosystem functioning by filtering water and providing habitat via the structures/assemblages formed by their shells. As filter feeders, shellfish can accumulate contaminants that are harmful to humans (e.g., Vibrio bacteria). Therefore, understanding shellfish ecology and pathology is of critical importance to the sustainable management of shellfish aquaculture and fisheries while protecting human health. 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. 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.

What has been done

NJAES researchers at our Haskins Shellfish Research Laboratory conduct laboratory and field studies to study shellfish parasite life history and ecology, including spatial and temporal relationships between shellfish pathogens and environmental correlates. They also examine the ecological processes involved in maintaining self-sustaining oyster populations with minimal impacts from disease, develop disease-resistant shellfish populations, develop detection assays for shellfish pathogens, and assist the shellfish industry and regulatory agencies.

Results

Work continued on a study to examine how harvest practices affect Vibrio concentrations in oysters. Recent findings indicate that harvest practices that are currently employed along the east coast do not appear to increase risk of exposure to Vibrio bacteria. Once validated with support leveraged from National Sea Grant, this knowledge should inform regulations designed to protect human health that will also maximize efficiency and farm operations. Funding was obtained from USDA APHIS to hold a scoping meeting on the requirements to develop a coast-wide shellfish health database that can be used to facilitate and control movement of seed. This will minimize the risk of spreading disease without compromising commerce. This included participation by industry, regulators, extension personnel and researchers/pathologists. The collaborative work with USDA APHIS has highlighted the need for a more regionally coordinated interstate shellfish seed transport system to protect both cultivated and wild stocks of shellfish from inadvertent transfer of pathogens when such transfers increase disease risk. Several funding sources have recognized and prioritized this problem helping to direct resources toward a solution.

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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.0	0.0
Actual Paid	0.6	0.0	3.9	0.0

Actual Volunteer	1800.0	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**
106901	0	226829	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
779011	0	861717	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1717043	0	31402	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, developed collaborative educational products and provided leadership to the CoP.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	36600	11130	36065	0

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

Patent Applications Submitted

Year: 2016

Actual: 1

Patents listed

13/693,024

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	3	16	19

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
2016	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	A Genome-Wide Screen To Identify Novel Genes For Resistance To Fusarium Head Blight - MEDIUM-TERM- Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
5	Home Food Preservation -MEDIUM-TERM- Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
6	On-Farm food Safety -MEDIUM-TERM - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
7	Food Safety Training for Paterson Public Schools - MEDIUM-TERM- Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Enhancing Microbial Food Safety by Risk Analysis-The Centers for Disease Control and Prevention has reported that an estimated 48 million cases of foodborne illness, 128,000 hospitalizations, and 3,000 deaths occur each year from foodborne microorganisms. In addition to human suffering, foodborne illnesses also have a substantial economic impact in the United States. The annual cost of foodborne illness in the U.S. is estimated at $89 billion for loss of productivity, other economic losses and medical expenses. Predictive microbiology and quantitative microbial risk assessment (QMRA) are rapidly developing scientific disciplines that use mathematical equations, numerical data, and expert opinion to estimate the presence, survival, growth, and death of microbes in foods. These models allow for the prediction of the safety of a product, based on the entire sequence of events up to consumption. They provide a framework for identifying critical data gaps and evaluating the effectiveness of risk-reduction strategies

What has been done
An NJAES extension specialist develops and validates predictive risk assessment models for appropriate commodity/pathogen pairings. These developed models are validated using real-life scenarios, whenever possible. The models generated for one commodity can be used to guide a series of experiments to validate the model for different, closely related commodities. This information can be used to develop interventions to prevent/mitigate food safety threats. Food manufacturers operate under a variety of regulatory, economic and environmental pressures. Since retaining a strong manufacturing base still an essential component for economic growth, an NJAES Extension specialist provides technical assistance for small and medium-sized companies, helping to keep them in business while assuring the safety of the food supply.

Results

An NJAES researcher conducted a risk assessment for Staphylococcus aureus and staphylococcal enterotoxins in fluid milk in China. It was determined that the key process to minimizing the risk of milk-borne staphylococcal intoxication appears to be the control of storage conditions during the period after heat treatment and before consumption In another study looking at effective methods to inactivate Salmonella in wash water used for processing lettuce, research findings indicate that, when chlorinated water was used, no measurable Salmonella transfer occurred if the sanitizer was ≥ 10 ppm. Bacterial cross-contamination from surfaces to food can contribute to foodborne disease. The cross-contamination rate of Enterobacter aerogenes on household surfaces was evaluated using scenarios that differed by surface type, food type, contact time, and inoculum matrix . Contact time, food, and surface type all had highly significant effects on the log percent transfer of bacteria. Some of these transfers (surface bacteria to food) occur almost simultaneously, in contradiction to the so-called "five second rule." Activities directed towards food safety also include the provision of technical assistance of specific and direct economic benefit to the food industry. Specific examples of this assistance include a New Jersey food processor with a microbial spoilage issue, a Pennsylvania meat company cooking deviation, a Pennsylvania processed food company with a HACCP revalidation, a cooking validation, and eight separate cooling deviations, a Pennsylvania meat company with a temperature control deviation, a Pennsylvania meat company with a process safety review, a large meat processing company with a cooking variation deviation, an Illinois-based food service company with food safety advice, a New York-based processed food manufacturer with a spoilage issue, a consulting company with two separate reviews of FDA documents, and another consulting company with another FDA document review.

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 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Chlorine Dioxide Releasing Packaging Systems to Improve Microbial Safety of Fresh-Cut Produce - Chlorine dioxide (ClO2) is traditionally applied in the washing of fresh produce in order to remove dirt and inactivate microorganisms on the surface. This washing process has been found to be effective for lettuce, cabbage, green bell pepper, baby carrot, apple, tomato, mungbean sprout, and blueberry. However, the washing process has two disadvantages: (1) due to high surface tension of water, ClO2 in the aqueous phase cannot access the hard-to-reach areas such as pores and crevices on fresh produce where microbes are usually attached, and (2) once the washing process is completed, ClO2 is no longer available to combat the surviving microbes. Scientists are now exploring the use of ClO2 gas treatment to complement the washing process. ClO2 gas can penetrate areas inaccessible by washing. In fact, the use of ClO2 gas treatment iseffective in microbial inactivation for a number of fresh produce products including lettuce, cabbage, green bell pepper, baby carrot, apple, tomato, and blueberry. ClO2 is unstable and explosive, complicating transportation and storage of this gas. Hence use of this gas in food processing requires that ClO2 be generated onsite upon demand in the food manufacturing plant. Installing a ClO2 generator is either not feasible or too expensive for many fresh produce companies. A better approach is to develop an innovative ClO2 releasing packaging system to release ClO2 in a slow and controlled manner.

What has been done

An NJAES researcher is developing a packaging system that can generate and release chlorine dioxide in a controlled manner to improve the quality and microbial safety of fresh-cut produce. These package systems may be used alone or in combination with other technologies such as modified atmosphere packaging and controlled release packaging to provide the most cost effective solution for any particular application.

Results

NJAES supported research has resulted in a novel packaging system to generate chlorine dioxide (ClO2) to improve the microbial safety of fresh produce. This packaging system places a fresh produce product, such as tomato, into a package imbedded with sodium chlorite (NaClO2) that will generate ClO2 via a chain reaction: carbon dioxide (CO2) and moisture from the respiration of the fresh produce react with each other to produce carbonic acid (H2CO3), which in turn reacts with NaClO2 to generate ClO2. Using fresh tomatoes as the food model, this research obtained experimental evidence to support the validity of this process. In addition, three forms of delivery systems (sachet, gum arabic paste, and electrospun fiber) were tested to embed sodium chloride (NaClO2), using fresh tomatoes inoculated with 105 CF Salmonella spp. on their surfaces. Each of these systems proved effective in improving microbial inhibition under practical conditions, compared to the control, without significantly affecting the sensory attributes of the tomatoes. The sachet can be placed inside the package; the gum arabic paste and electrospun fiber can be applied as a coating on the package.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
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 #4

1. Outcome Measures

A Genome-Wide Screen To Identify Novel Genes For Resistance To Fusarium Head Blight - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fusarium head blight (FHB) caused by Fusarium graminearum is one of the most important cereal diseases worldwide. Trichothecene mycotoxins, which are virulence factors of Fusarium, accumulate in the grain, presenting a food safety risk and health hazard to humans and animals. Controlling or eliminating FHB in small grain cereal crops will enhance crop yields and improve the safety of the nation's food supply.

What has been done
An NJAES researcher is using activity tagging and other genetic methods to identify genes that confer resistance to Fusarium.

Results

The NJAES researcher has developed and patented a method of identifying genes in plants that confer resistance to fungal mycotoxins and a transgenic plant which exhibits increased resistance to a disease caused by a mycotoxin-producing fungus.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
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

Home Food Preservation -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Interest in home food preservation, canning, freezing and dehydrating, has increased as more people plant home gardens, participate in CSA's or buy from local farm markets. They want to preserve the extra produce for later in the year. Many people have never preserved food at home and others are using outdated or unsafe recipes and procedures.

What has been done
RCE Extension faculty taught sessions on general canning, freezing, dehydrating at several different locations reaching over a hundred people in Somerset County. Goals of the sessions were for participants to understand the food safety rationale and requirements for safe home food preservation; identify sources for
safe, tested recipes; and understand and follow proper procedures for canning, freezing or dehydrating food. Curricula from the USDA National Food Preservation Center and the Ball

Company was used. Some workshops included demonstration or hands-on practice and video while others used power point lecture and video and equipment discussion and display. Workshops ranged from 1 to 2 hours. The workshops on jam and salsa included giving participants a small jar of product to take home. A food preservation exhibit including equipment, canned food products and resource list was used at The Great Tomato Tasting, an annual RCE event at a research farm in Hunterdon County, attended by about 1600 people. The exhibit attracted much attention and generated questions about procedures. Some comments included: "I don't use a water bath canner and the jars seal" or "why can't I can my family's salsa recipe?" and "I never add lemon juice to my canned tomato products." Clearly, there is much need for education.

Results

Participants in all workshops were very satisfied and reported learning new information, especially about the food safety and proper methods of home food preservation. Some shared the unsafe methods that they or family members used: allowing jars to seal without using a water bath or pressure canner; using untested recipes (very common); or using home canned food years later. All planned to can, freeze or dehydrate during the growing season. Participants reported gaining knowledge both in understanding the importance of proper food preservation to ensure safety and the techniques required for a safe and high quality product. Those who said they did not follow proper procedures indicated they would change as a result of learning about potential health risks from improperly canned food. Participants planned to preserve food in the coming year. What was the most important thing learned? - Many variations of: Only use tested recipes; - that I don't have to sterilize jars - follow directions exactly in canning - importance of blanching.

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 #6

1. Outcome Measures

On-Farm food Safety -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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The fruit and vegetable industry is under increased pressure to improve their food safety practices and to obtain a third party audit confirming they are improving their practices. This is even more important with the enactment of the Food Safety Modernization Act which will be implemented over the next several years. Fresh produce growers who average over $500,000 in produce sales will need to start complying January 2018; growers between $250,000 and $500,000, January 2019 and $25,000 and $250,000, January 2020. The industry must find out: 1. What are the issues that need to be addressed i.e. agricultural water quality, worker health and hygiene, biological soil amendments (manure and compost use), domesticated and wildlife activity and equipment, tools and building sanitation. 2. How to carry out a risk assessment and prepare an individualized food safety plan 3. How to write standard operating procedures and the role they play in a food safety plan 3. How to develop a recordkeeping and traceability system that is the most efficient for their operation 4. How third party audits are carried out 5. How to evaluate different third party audit firms 6. How the Food Safety Modernization Act will impact their operations and what modifications may be need to comply with the act.

What has been done

The project was initiated at the request of the produce industry in 1999. Growers received letters from supermarkets requesting they have food safety plans and third party audits in place for the 1999 growing season. Growers did not have an understanding as to what was required. Fundamentals for training needs were solicited from individual growers and buyers to help design the project. The goals and objectives: Train the produce industry (wholesale/retail growers and distributors) in basic food safety; Train wholesale/retail growers on how to carry out a risk assessment on their operations; write a food safety plan and prepare for a third party audit; Train first level buyers on food safety and how to prepare for third party audits; Have growers and buyers who participate in food safety training pass their third party audits; Train growers in the requirements of the Food Safety Modernization Act and how to prepare for it. Determine research needs in the food safety area; sesign and carry out research that directly benefits the fruit and vegetable industry. The project was delivered through the following methods: presentations at produce industry meetings across the state; monthly and weekly newsletter articles; Factsheet publication; Website with training materials available for self-training and new food safety information is reported; Facebook page; In-depth training sessions growers and buyers (4-6 hours); One-on-one critiques of food safety plans on individual farms (mock/second party audit) ; Webinar presentations; CD-Rom written to help first level buyers develop their food safety plan. PowerPoint presentations developed and updated as new information becomes available on areas such as: Food safety considerations for community gardens, Master Gardener Train the Trainer Program; Agricultural Food Safety Research and Education; Importance of Food Safety in Vegetable Production; Water Testing and Treatment, Writing Standard Operating Procedures, etc. Since the inception of the program in 1999 there has been continual consultation with growers and the produce industry at the wholesale and retail level. This has been accomplished through individual contacts and evaluations at each training session. The team receives questions almost daily by telephone or email. The responses to these questions then are used to develop

presentations and articles for the wider audience. The program continues to be conducted in the same manner since its inception with the addition of social media. Growers continue to express the desire for direct contact sessions.

Results

Six (42 hours) training session were held in 2016 for 167 individuals. The audience was diverse in the fact that some growers had not been involved in food safety in the past. Sessions were divided between beginner and advanced growers. This allowed the team to better tailor the program to the group. Also, a session was held for organic growers who are new to food safety issues. As part of the training, 27 farm food safety Walk-throughs or mock audits (second party audits) were carried out by Extension faculty. The team carries out pre and post surveys to evaluate the effectiveness of training sessions. Results from those surveys are overwhelmingly positive with 100% of the participants going to recommend the workshops to another person. Comments were received such as "Will implement activities into my operations, in my packing house, in my farm market," "Thank you for all of your assistance with this issue," "My quality of produce produced this year will be improved due to the training and the mock audit. I am very glad that I attended." An online survey was carried out to evaluate training to help modify the program. Surveys were sent to 248 training participants who had taken the in-depth courses with a return rate of 29%, 73 responses. i. 59% had written the needed standard operating procedures ii. 22% had started to write their needed standard operating procedures iii. 16% intended to write their standard operating procedures iv. 50% had completed the writing of their farm risk assessments v. 25% had started to write their farm risk assessments vi. 22% plan to write their farm risk assessments vii. 62% had completed writing their farm food safety plan viii. 19% have started writing their farm food safety plan ix. 19% plan to write their farm food safety plan x. 70% indicated that they had made improvements to their farm worker health and hygiene training program xi. 70% indicated that they had made improvements to their equipment sanitation practices xii. 67% indicated that they had started to test their irrigation and postharvest water quality xiii. 67% indicated that they had improved their produce packing activities xiv. 63% indicated that they had improved their produce harvesting activities xv. 53% indicated that they had implemented a rodent control program xvi. 50% indicated they improved their produce storage areas xvii. 43% indicated that they had implemented a traceability program xviii. 37% indicated that they had improved their product washing procedures xix. 37% indicated that they had improved their product transport procedures xx. 10% indicated that they had improved animal based soil amendment management Five articles were written for the Plant and Pest Advisory Posts advising growers on risk reduction measures, third party audit preparation and educational opportunities. Growers have changed their practices as it relates to food safety. Even if they do not need a third party audit, growers are considering food safety as part of doing business. This awareness has expanded as retail buyers are questioning food safety at the farm level. 1432 growers and produce professionals were reached through live presentations. Approximately 120 operations have passed their third party audit.

4. Associated Knowledge Areas

KA Code	Knowledge Area
404	Instrumentation and Control Systems
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
722	Zoonotic Diseases and Parasites Affecting Humans

723 Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

Food Safety Training for Paterson Public Schools - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the Academy of Nutrition and Dietetics, one in six Americans get sick, 128,000 are hospitalized, and 3,000 die from foodborne diseases. That is approximately 48 million people who are affected each year. Food borne illness can be detrimental for young children, causing disability or even death. Paterson Public School District has 220 Food Service employees who work directly with the food served in their 48 schools serving 25,376 students from early child care to high school. They have not had a structured food safety education program that teaches these employees how to handle food safely.

What has been done
Working with the administration and management of the Paterson Public Schools Food Service during the summer RCE Extension faculty and staff created a professional development program that utilizes food safety certifications that are nationally recognized such as the National Restaurant Association's ServSafe Program. Before the start of the new year a 3 day ServSafe training was conducted for the 49 managers of all the schools. Additionally, Extension faculty and staff conducted a ServSafe food handler's certificate for all the Food Service staff emphasizing the need for hygiene, proper food handling as well as monitoring of food.

Results
The target population for this program was two-fold, the first target audience was the 220 Food Service department employees. The servsafe food handler program was conducted in both English and Spanish with a pre-test and post -test to assess any knowledge change. The secondary audience was the Department of Food Service's administration. They were asked them to access change in behaviors as well as institute policies for tighter time temperature

control and improve monitoring of food safety. All the presentations received a mean of 4.85 for overall instruction and 4.80 for overall program content. As a result 98% of all Food Service employees attending the trainings received an 80% or higher on the ServSafe Food handler's exam. Additionally the field managers noticed that the cooks and site managers have been asking for more food safety equipment such as thermometers and ph testing stripes for increased monitoring. Finally the district piloted a new policy in 20 schools that requires the cooks to check the temperatures of all food each time food is taken out of the ovens and the warmers. Previously it was required that the cooks check the temperature of one food when it is taken out of the oven or warmer.

4. Associated Knowledge Areas

KA Code	Knowledge Area
404	Instrumentation and Control Systems
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 relevant 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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	2.0	0.0
Actual Paid	0.2	0.0	1.0	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**
19588	0	75642	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
298387	0	189724	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- 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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2678	18756	1126	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	2	2

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
2016	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	Long Term - Integration of Molecular and Classical Breeding for Turgrass Improvement and Biofuel Production - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sustainable Energy Production Using Duckweed Biomass Through Optimized Waste-to-Fuel Technologies - The quest for renewable energy alternatives to fossil fuels that have low carbon footprints has become a global priority. NJAES researchers are exploring the potential for using the Lemnaceae family of aquatic plants, commonly called duckweeds, as a commercially viable feedstock as a micro-crop for fuel production. Duckweeds are flowering aquatic plants which float on or just beneath the surface of still or slow-moving bodies of fresh water and wetlands. 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
NJAES researchers seek to develop new aquatic agronomic methods for deploying selected duckweed strains as a waste-to-fuel platforms. Identifying optimal strains for biomass production from municipal wastewater and creating a sustainable wastewater-to-fuel pipeline for this process are the first steps in this research.

Results
NJAES researchers have demonstrated the feasibility and productivity of cultivating duckweed at existing wastewater sites. Specifically, NJAES researchers have established a 1,000+ strain stock center for duckweed germplasm, set up methodologies for systematic screening of duckweed strains for growth rate, protein content and starch content, and explored methods for identification of high methionine (an essential amino acid) strains of duckweed as optimal animal feed. Further, this research has created a sustainable wastewater to-fuel pipeline with the duckweed platform and continues to work on optimizing an approach towards an economically viable production and maintenance of duckweed stocks for seeding ponds. This research can potentially play a major role in getting this new crop system adapted and perhaps spark a new source of renewable fuel in the near future. The success of this project will have local impact in New Jersey and elsewhere in the U.S., as well as internationally, by creating a new industry for the agronomic deployment of duckweed micro-crops. This will translate into jobs and societal benefits in the new Green Economy that is rapidly growing worldwide.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sustainable Energy Production Using Duckweed Biomass Through Optimized Waste-to-Fuel Technologies -The quest for renewable energy alternatives to fossil fuels that have low carbon footprints has become a global priority. NJAES researchers are exploring the potential for using the Lemnaceae family of aquatic plants, commonly called duckweeds, as a commercially viable feedstock as a micro-crop for fuel production. Duckweeds are flowering aquatic plants which float on or just beneath the surface of still or slow-moving bodies of fresh water and wetlands. 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 facilitate the creation of a new aquatic cropping system with duckweed, these researchers are also focused on developing the biotechnology that will pave the way toward breeding elite duckweed strains with desirable traits, such as high growth rate and the capacity to accumulate high concentrations of target components such as starch (for bioethanol production) or protein (for animal feed).

Results
To help advance genomic approaches in duckweed production, a highly accurate genome sequence map is essential. NJAES researchers have completed a comprehensive barcode collection for all 37 species of duckweed, as well as a high resolution and validated genome of a strain of Greater Duckweed (Spirodela polyrhiza) using a combination of advanced genomic

technologies. This genetics work should set the stage for genomics-guided breeding of duckweed in the near future. This research can potentially play a major role in getting this new crop system adapted and perhaps spark a new source of renewable fuel in the near future. The success of this project will have local impact in New Jersey and elsewhere in the U.S., as well as internationally, by creating a new industry for the agronomic deployment of duckweed micro-crops. This will translate into jobs and societal benefits in the new Green Economy that is rapidly growing worldwide.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Long Term - Integration of Molecular and Classical Breeding for Turgrass Improvement and Biofuel Production - 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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Energy Policy Act of 2005 issued a mandate for the use of up to 7.5 billion gallons of renewable fuel in gasoline by 2012. This amount will likely increase in the future as we shift our energy demands away from foreign oil supplies. One concern is whether sufficient amounts of biomass can be supplied without impacting the cost of agricultural land, competing with food production and harming the environment. The national strategy is to produce bioenergy crops on marginal cropland where there will be no competition with food production. Although perennial grasses such as switchgrasses are expected to be used as a biofuel crop on marginal land, there has been little research to evaluate their performance on marginal land. Using both classical and molecular breeding techniques, NJAES researchers look to improve perennial grasses for biofuel

for biotic and abiotic stresses and harsh environmental conditions. This research is unique in that it specifically provides strategies for integrating feedstock production onto reclaimed mine land, which will be critical to the enhancement of our economy and critical to the increased use of biomass fuel sources. There is currently no other research on breeding grasses for optimal biomass production on reclaimed mine land. This research will improve the current state of knowledge of biomass yield of perennial grasses on reclaimed mine land and will provide a crucial step in the implementation of perennial grass biomass production in stressful environments.

What has been done
An NJAES researcher is using laboratory and field studies to identify optimum breeding and selection techniques that yield the best performing switchgrass plants on reclaimed mineland in Northeastern US, as well as identify germplasm with improved performance on both prime farmland and reclaimed mineland for use in a switchgrass breeding program. Mapping studies are used to evaluation select for anthracnose resistance in switchgrass in order to determine inheritance of resistance and efficient selection strategies.

Results
NJAES researchers tested 75 lines of switchgrass both at a research farm and on reclaimed mine land to see if high yielding lines of switchgrass on prime farmland soil could also provide high yield on a marginal soil. The yield performance on prime farmland was not highly correlated to the marginal reclaimed mine yields. This means that any switchgrass line that researchers might expect to generate high yields on marginal land must be tested on marginal land. However, researchers have found a small number of switchgrass lines that were high yielding in both locations and have increased seed of these intercrossed lines. Research was also initiated to determine whether anthracnose disease influenced biomass yield. Sixteen cultivars that varied in anthracnose disease susceptibility were tested. Findings to date are inconclusive, due to difficulties in finding the fungicide formulations that would control the disease in switchgrass. Once this experiment is completed, and if anthracnose does influence biomass yield, then researchers can turn to the development of disease resistant grasses that should have higher yields compared to susceptible cultivars.

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 relevant 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.