2016 University of Connecticut - Storrs Research and Extension and Connecticut Agricultural Experiment Station - Research Combined Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The state of Connecticut has two organizations that jointly develop a Plan of Work and Report of Accomplishments: The Connecticut Agricultural Experiment Station (hereafter designated CAES) and the University of Connecticut Storrs Agricultural Experiment Station and Cooperative Extension System (hereafter designated UConn).

The 2016 report includes six program areas. CAES and UConn jointly address program areas 1-4. These include: (1) food safety, (2) food security and food systems, (3) human and animal health, and (4) sustainable environments. The remaining two programs areas, (5) 4-H/youth development, and (6) community and economic development, are conducted by UConn.

This report offers specific examples of successful research and Extension/public engagement programs conducted by CAES and UConn. Funds are allocated separately to the two institutions. Accordingly, we have separately detailed successes from these programs. We believe that this approach formalizes accountability for funds received by each institution.

In this 2016 report, we highlight the following accomplishments:

Food safety research and education focused on improving safe food practices by producers, processors, and consumers; and developing approaches and techniques for inactivating foodborne pathogens.

During the reporting period, research and outreach in food security and food systems provided Integrated Pest Management training to growers, reduced food insecurity, increased the percent of locally grown food purchased by consumers, and increased resilient food systems across scales.

Human and Animal Health programs addressed knowledge of residents and the media on ticks, mosquitoes, bed bugs and mold; and using novel dietary approaches to reduce chronic disease development.

Sustainable environment programs addressed homeowners' knowledge of watershed protection, and soil and water quality; reduced the number of lakes and ponds with invasive aquatic plants; improved climate mitigation strategies and their adoption; developed new knowledge in land use resource protection; and improved greenhouse management and production.

Youth development in Connecticut was primarily conducted through 4-H and focused on creating safe, healthy, well-educated children and teens through clubs, after-school programs, and interactive learning experiences. Science, technology, engineering and math (STEM) curricula are an integral part of the youth development and activities.

Community and economic development programs addressed in the individual and community levels. Examples include: financial education training, economic development of communities through greenways, and development of individual and community leadership and parenting skills.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	68.0	{No Data Entered}	78.0	{No Data Entered}
Actual	63.5	0.0	87.8	0.0

II. Merit Review Process

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

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

2. Brief Explanation

The Merit Review process for CAES and UConn uses a combination of internal and external review. The peer review, conducted by disciplinary scientists, ensures the scientific merit and relevance of proposed projects. Administrators in the respective organizations also review new Hatch or Extension projects. The Director (or a designee of the Director) provides final approval on all submitted projects. External peer review is used when publications or proposals generated from existing projects are submitted to journals or funding agencies, respectively.

Both organizations rely heavily on stakeholder input to identify new areas for research and Extension/engagement programs. Stakeholders often are involved in the co-creation of knowledge through applied research programs in both organizations. This engagement with stakeholders provides a unique and critical relevance review - stakeholders help define and shape projects that are directly relevant to their production systems or environmental sustainability.

III. Stakeholder Input

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

- 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 specifically with non-traditional groups

- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public

Brief explanation.

CAES and UConn organize multiple conferences, workshops and public meetings throughout the year. These events create opportunities for research and Extension faculty and staff to disseminate results of programs to stakeholders. However, these events also serve as opportunities to gather input on existing or planned programs. For example, Plant Science Day, organized by CAES, brings over 1,000 visitors (including more than 100 children) to the Hamden research facility. Similarly, more than 300 agricultural producers attended UConn's Fruit and Vegetable Growers Conference. These events offer producers, businesses, and citizens the opportunity to interact directly with scientists and Extension professionals. These informal direct contacts with citizens and businesses inform and shape current and future research and Extension activities.

Formalized stakeholder input is gathered from Advisory groups that meet once or twice throughout the year. Advisory group members represent all facets of agriculture, health, environmental sustainability, and youth development as appropriate for CAES and UConn. Scientists and Extension professionals from CAES and UConn also serve on advisory groups across the state. Participation on these advisory groups informs and shapes research and Extension programs.

Collaboration between CAES and UConn on specific projects and/or workshops and conferences ensures that stakeholder inputs captured by one organization are shared and influences program development in both organizations.

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
- Open Listening Sessions
- Use Surveys

Brief explanation.

Formal and informal stakeholder input is gathered across the state (and at national or international meetings) by CAES and UConn. Presentations, interviews, workshops, and conferences offer informal opportunities to meet with impacted stakeholders and gather input. Methods include survey instruments that collect feedback from participants about existing programs, email surveys to potential stakeholders regarding new or proposed programs, and direct comments captured following sponsored events.

Both CAES and UConn work directly with grower organizations and environmental groups across the state. We receive direct input from these organizations. CAES and UConn also partner with multiple state agencies that address agriculture, health, and natural resources.

As an example, Connecticut is experiencing tremendous growth in the number of microbreweries in the state. CAES worked with the microbrewery industry to create a research program on barley and hops; research is now active and supported by a well-attended annual meeting for microbrewers. Similarly, UConn organized meetings for new and beginning farmers and ranchers to understand their needs and shape Extension programs. Feedback from these producers led to a "bucket list" that highlights must-do actions for new and beginning farmers and ranchers.

CAES and UConn seek out members from underrepresented groups to participate in programs and provide input into strategic areas for research and Extension. UConn has developed several

Extension programs that are offered in Spanish to encourage greater access and participation by Spanish-speaking audiences. Specific ethnic and minority stakeholders requested CAES assistance on specialty crops; subsequent experiments were conducted on several cultivars of 4 specialty crops.

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
- Survey of selected individuals from the general public

Brief explanation.

Both organizations use survey instruments to collect input from program participants. This information is used to improve programs and identify new program areas. Survey data is collected from workshop participants, conference attendees, and audiences for scientific talks.

CAES and UConn partner with state and federal agencies on multiple projects and programs. Direct input from state and federal agencies is a key method for collecting input from these groups.

Both organizations are active on social media including Facebook, Twitter, blog sites, and YouTube. These outlets are used primarily to push information. However, feedback, comments and responses to social media provide opportunities for public input on research and Extension programs.

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.

Stakeholder input is used to update program goals and outcomes. Existing programs employ adaptive management strategies that incorporate new information gathered from stakeholder input. We learn from our stakeholders and use that knowledge to update goals and outcomes for our programs. New program areas such as research on the Zika virus were added to research and Extension portfolios for CAES and UConn. Stakeholder input also is used to inform research proposals submitted for funding.

Brief Explanation of what you learned from your Stakeholders

We learned that stakeholders are very insightful and have the capacity to co-create knowledge that is critical to their economic and environmental sustainability. We learned that our programs are more effective when they address and account for stakeholder input. We learned that addressing agriculture, health, and sustainability issues across the state has relevance to regional, national, and

international challenges.

IV. Expenditure Summary

Institution Name: Connecticut Agricultural Experiment Station -

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	979243	0

Institution Name: University of Connecticut - Storrs

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
2232008	0	1275620	0

Institution Name: Connecticut Agricultural Experiment Station -

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	979243	0
Actual Matching	0	0	4995131	0
Actual All Other	0	0	729836	0
Total Actual Expended	0	0	6704210	0

Institution Name: University of Connecticut - Storrs

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	2009262	0	1051596	0
Actual Matching	2009262	0	1051596	0
Actual All Other	4546853	0	4664679	0
Total Actual Expended	8565377	0	6767871	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

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
307	Animal Management Systems	0%		20%	
311	Animal Diseases	0%		17%	
503	Quality Maintenance in Storing and Marketing Food Products	0%		20%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	50%		3%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	50%		30%	
723	Hazards to Human Health and Safety	0%		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	4.0	0.0	3.4	0.0
Actual Paid	1.8	0.0	9.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: University of Connecticut - Storrs

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
232873	0	60534	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
232873	0	60534	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	293545	0

2. Institution Name: Connecticut Agricultural Experiment Station -

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	80684	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1401219	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	25227	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research under this program is developing more efficient and sensitive analytical methods to detect toxic chemicals and heavy metals in food and other related consumer products, and to determine if these products contain allowable amounts of these constituents. Decisions on whether or not foods are "safe" depends contaminant-specific tolerance levels established by the US Environmental Protection Agency (EPA) or the Food and Drug Administration (FDA). Progress was made on all objectives in this program. The activities, services, and events are designed to assist a broad, diverse group of stakeholders by disseminating scientific information to the public through the media, publications, and exhibits. People will have equality of service, ease of access to scientific results, and the ability to see laboratories and field plots. The outputs include numbers of food and consumer product samples tested, scientific publications, and talks and interviews. For example, the Department of Analytical Chemistry reported out results on more than 2,903 samples in the current period, with 80% being food or food-related. The following activities were executed: (1) new analytical methods were developed or validated and new instrument platforms were evaluated, (2) information on analytical test results was shared with stakeholders at open house events, in scientific displays at agricultural fairs, and in scientific publications, (3) oral presentations were given to civic groups and professional societies, and (4) laboratories were opened to allow adults and youth to meet staff members, see analytical equipment, and ask questions about programs and findings. Direct interactions with a broad base of stakeholders allows public input on the program. Non-traditional stakeholders are reached at agricultural fairs and other public venues when they visit displays. Results of

these activities lead to specific outcomes, such as removing tainted or adulterated food items from the markets and greater public awareness of research on food safety.

Extension also works in classrooms and on farms to provide local and regional growers and processors with the tools they need to reduce the possibility of contamination; to prepare food safety plans; and to prepare for audits that will ensure that locally produced food that ends up on tables in New England is as safe as possible. Collaborating with partner agencies, curriculum and training sessions were developed and presented for the Food Safety Modernization Act (FSMA) and Good Agricultural Practices (GAP). Extension programming specifically targeted new FSMA regulations for producers and processors. Our advisory group includes farmers and regulators, and continues to meet and gather information regarding education. There is multi-state collaboration and participation with regional Extension programs on outreach and education. We also educate home cooks, consumers and food service personnel through a website, courses, and workshops.

2. Brief description of the target audience

Target audiences include all individuals with a stake in providing a safe food supply. Audiences for this planned program include state and federal public health officials and regulators, state and federal legislators and their staff members, food producers and importers, managers of supermarkets, educators, extension specialists, researchers in the food sciences, and the general public. Women, members of minority organizations, and children are examples of under-represented and under-served groups who receive benefits.

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	3260	31320	700	910

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed
n/a

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	34	34

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Expert services, consultations

Year	Actual
2016	90

Output #2

Output Measure

- Formal Extension outreach programs

Year	Actual
2016	27

Output #3

Output Measure

- Face to face general group education sessions/workshops

Year	Actual
2016	61

Output #4

Output Measure

- Fact sheets, bulletins and newsletters written or edited

Year	Actual
2016	2

Output #5

Output Measure

- Training of undergraduate, graduate and post doctoral students

Year	Actual
2016	75

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge about food safety
2	Number of state and federal regulatory agencies making decisions on test results
3	Improve food safety through adoption of safe food practices by producers, processors and/or consumers
4	Approaches/techniques developed for inactivating foodborne pathogens

Outcome #1

1. Outcome Measures

Number of stakeholders gaining knowledge about food safety

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1580

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is great concern over the contamination of food with toxic pesticides or heavy metals. Regulators, food producers, retail operators, consumers, and consumer advocacy groups want assurances that foods contain safe levels of these constituents. Federal and state regulators request analyses of foods and enforce laws by recalling contaminated products from commerce. These programs include fresh and manufactured foods, as well as animal feeds, including raw and processed products. For chemicals such as mycotoxins, which are metabolites produced by mold and other fungi that can contaminate food, severe toxicity is evident at very low concentrations (parts per billion) and detection at such levels in complex foods is difficult. For certain pesticides, long term exposure to low doses may be linked to chronic disease. As new methods and analytical platforms become available, these protocols must be validated and shown to be both accurate and robust. As new analytes become of concern, protocols must be adopted and validated so as to accurately detect and quantify these contaminants. Federal legislation encourages that laboratories conducting such analyses achieve ISO 17025 Accreditation so as to ensure data quality and integrity.

What has been done
The Department of Analytical Chemistry at CAES received a 5 year cooperative agreement in 2012 to bring its pesticide surveillance program and a new program measuring arsenic in food under ISO Accreditation. This surveillance program is part of the FDA led Manufactured Foods Regulatory Program or MFRP. Technical methods that were validated according to ISO guidance involve unknown pesticide analysis by simultaneous gas chromatography with triple quadrapole mass spectrometry (GC-MS/MS) and liquid chromatography with high resolution mass spectrometry (LC-MS/MS), as well as total arsenic analysis by inductively coupled plasma mass spectrometry. Importantly, all three analytical platforms were acquired with FDA funding.

Results

In late 2016, CAES, Department of Analytical Chemistry was granted ISO/IEC 17025 accreditation by the American Association for Laboratory Accreditation (A2LA) after a thorough assessment and review of its quality management system and competence to perform chemical testing in food. This achievement of International Organization for Standardization (ISO) accreditation demonstrates the Departments competence to manage and perform activities defined by its Scope of Accreditation (A2LA Certificate #4133.01).

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of state and federal regulatory agencies making decisions on test results

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Department of Analytical Chemistry at CAES is asked by other state and federal agencies to analyze specific fresh and manufactured foods for adulteration with pesticides and heavy metals as part of surveillance activity to ensure safety of the food supply. When foods are found to be contaminated with these constituents at unacceptable levels, regulatory agencies may remove or prevent food products from entering the marketplace.

What has been done
The Connecticut Department of Consumer Protection (CT DCP) collects over 100 food samples per year from grocery stores, corner markets, big box stores and other food retailers. The CAES Department of Analytical Chemistry conducts chemical analysis that consists of extraction in solvent or digestion acid with simultaneous analysis for pesticides by both liquid and gas chromatography with mass spectrometry (LC-HRMS; GC-MS), as well as for arsenic by inductively coupled plasma mass spectrometry (ICP-MS).

Results
In October of 2016, the CAES, Department of Analytical Chemistry detected 1.8 mg/kg of the pesticide thiabendazole on imported Malanga (an ethnic root crop). This is a no tolerance pesticide violation and was the second time CAES reported violative pesticide residues on this crop in 2016. As a result, the FDA issued a federal Import Alert for the product and firm.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Improve food safety through adoption of safe food practices by producers, processors and/or consumers

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	387

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Produce has become the number one cause of foodborne illness in this country. Outbreaks have been traced to farmers and packing facilities of all sizes. As a result, customers are requesting that produce farmers submit to a Good Agricultural Practices audit. In addition, in January 2016, the Food Safety Modernization Act Produce Safety rule was enacted.

Produce farmers need to determine if they must comply with the FSMA rule, what parts of the FSMA rule they need to comply with, and by when. They also must determine their eligibility for exemptions. All those that must comply with the standards outlined in the FSMA rule must attend a Produce Safety Alliance approved training program. Farmers may need additional help as they navigate through this process due to limited resources of both personnel and funds. Farmers who do not need to comply with the FSMA rule may need to prepare for and submit to a GAP audit.

What has been done

UConn Extension's food safety program activities addressing this issue include:
* UVM grant project; survey developed and administered
* Development of NECAFS proposal; identified as CT collaborator on the project
* Participation in NE-PHRESH, New England Post Harvest Research and Education group
* Produce safety email list generated
* Farm visits: Owen Jarmoc; Beckett; H2O Farm
* Participation in Produce Safety Alliance educator group
* GAP course (UConn Extension and URI Extension)
* 3 FSMA Info sessions

Results
* A total of 387 people and farms were reached through educational outreach activities. Of participants responding to an evaluation, 79% provided examples of changes they plan to make in farm food safety as a result of attending this program.
* 17 Connecticut farms are currently listed on the USDA/AMS website as having passed a USDA GAP/GHP audit, including one farm trained in 2016. Those who are GAP audited are able to sell products to distributors, supermarkets, and others who require a GAP audit.
* Economic benefits to farmers include reduced insurance costs, and costs resulting from recalls and outbreaks. Benefits to customers include reduced loss of productivity due to illness and cost of medical care, and public health benefits. Evidence indicates that attention to safe food handling also results in higher quality products.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Approaches/techniques developed for inactivating foodborne pathogens

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	480

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Salmonella Enteritidis (SE) is the number one poultry-borne pathogen in the United States, and it can infect humans when they consume contaminated eggs. There is no fully effective vaccination for the pathogen. No researchers have used plant products, through Plant Derived Antimicrobials (PDAs) to treat the infection where it starts, in chickens. Until now SE that is present in the intestines of birds can spread to their ovaries and contaminate egg yolks before shell formation. SE that is transmitted to the yolk in this way is the most difficult to control successfully, making it an important research objective.

What has been done

A Hatch research project at UConn studied the addition of a natural plant compound to chicken feed to control the spread of SE in contaminated egg yolks. An antimicrobial treatment that can be applied through feed represents the most practical and economically viable method for adoption on farms. Also, the project is studying the same antimicrobials as egg washes because SE from the infected hens' feces can contaminate eggshells after the chickens lay them. Information on both the use of PDA's for SE and aflatoxin control was disseminated to small flock owners via email communications and 12 in person meetings with approximately 480 people in attendance, presentations at the Aviagen International Poultry Management School, the National Egg Quality School, the Poultry Respiratory Disease Coordinated Agricultural Project conference, and the Connecticut Poultry Association through their regular meetings and via email communications.

Results

PDAs were found to control the growth of Salmonella Enteritidis (SE) in broilers, on meat from chickens and on eggshells. The PDA's were also found to control SE in laying hens, and to control aflatoxin growth and toxicity in poultry feed. The results of using PDA's in controlling SE and aflatoxins in poultry and poultry feed will help poultry farmers reduce the use of other antibiotics in poultry as the Veterinary Feed Directive becomes effective. The long term benefit of this project is to control SE and prevent food borne illness from contaminated eggs, and reduce the use of antibiotics in poultry production.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

At CAES, one scientist vacancy within this planned program remains open but budgetary constraints have prevented hiring an additional Ph.D. position to work on emerging contaminants of concern in food. Separately, four Postdoctoral Research Scientists that are funded on federal grants (US FDA, USDA AFRI) continue to work directly under this program. These are critical positions because the discipline requires the testing of toxic organic chemicals and heavy metals in a range of products by a number of advanced methods on sophisticated equipment. Other staff scientists and technicians, who were working entirely on state projects with state funds, have been reassigned to part-time status on Hatch-funded programs. Although objectives and goals were met, we do note that competitive federal grant-funded positions are now a critical component of this program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information on research and service results was obtained during the program by written and oral comments received at public meetings, the CAES annual open house event, guided tours of the laboratory, civic groups' meetings, professional conferences, and at research exhibits. Observations made during interactions with stakeholders revealed positive sentiment about program effectiveness and value.

Extension programs were evaluated with a post-program evaluation form, which identified new awareness and/or knowledge of concepts and plans to implement changes in safe food handling behaviors. Plans are in development for a follow up survey to participants in FSMA information sessions.

Key Items of Evaluation

The key items of evaluation and data collection were stakeholders' written and oral responses concerning food analyses; constructive written feedback from grant peer-reviewers for competitive grants; and responses and corrective actions by the State of Connecticut, USDA, and US FDA to remove suspect or adulterated products from commerce. Google Scholar indicated that articles written in previous years by CAES scientists were recognized and cited by scientists in this field (total citations exceeded 1237 during the reporting period).

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Food Security and Food Systems

☑ 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
202	Plant Genetic Resources	10%		0%	
205	Plant Management Systems	25%		0%	
206	Basic Plant Biology	10%		50%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		0%	
216	Integrated Pest Management Systems	10%		0%	
601	Economics of Agricultural Production and Farm Management	10%		0%	
603	Market Economics	0%		25%	
604	Marketing and Distribution Practices	5%		0%	
605	Natural Resource and Environmental Economics	5%		0%	
607	Consumer Economics	10%		0%	
609	Economic Theory and Methods	0%		25%	
704	Nutrition and Hunger in the Population	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	5.0	0.0	20.3	0.0
Actual Paid	3.1	0.0	18.1	0.0
Actual Volunteer	16.8	0.0	0.0	0.0

2. Institution Name: University of Connecticut - Storrs

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
288860	0	90141	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
288860	0	90141	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
444057	0	432478	0

2. Institution Name: Connecticut Agricultural Experiment Station -

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	589130	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	2505458	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	375860	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research objectives are to develop pest control methods requiring decreased pesticides, to understand mechanisms of pathogen infection and disease, and to isolate high yield crop cultivars that are inherently resistant to insect and plant pathogens. Significant progress was made on these objectives during the reporting period. Activities, events, services, and new crops assisted a diverse group of stakeholders domestically and internationally by providing products and information that will be used by growers and the general public to solve problems. Activities included: (1) scientists conducted workshops or special meetings for stakeholders, (2) scientists partnered with stakeholders and participated as members or officers in over 154 organizations and societies, (3) experiments were performed on both research farms and growers' properties, (4) cultivar trials on specialty melons, kabocha winter squash, okra, and hops were completed, (5) pathogens of tree species were investigated, (6) stakeholders received information and training on IPM strategies, (7) written information on research findings was disseminated by scientific displays at agricultural fairs and through talks to civic groups, (8) staff members utilized traditional and social media to provide information on scientific discoveries, (9) staff members educated teachers and thereby, indirectly reached youth, and (10) diagnostic plant and insect services were provided to stakeholders. Field experiments solved problems or provided information on new crops. Outcomes included reduced pesticide use, greater understanding and control of insect or plant disease pathogens, development of resistant cultivars, the introduction of new specialty crops, and increased farm income. Researchers directly addressed 20,348 citizens' inquiries and conducted 32,475 diagnostic tests

during the reporting period. Scientists serve as members or officers in at least 154 professional organizations, which enables stakeholders to directly comment on research and findings. Non-traditional stakeholders were reached at agricultural fairs when they visited or inquired about displays, as well as through traditional and social media. The annual CAES open house event allowed over 1,060 stakeholders, including 100+ children, to hear oral presentations on research results and to offer comments. Approximately 756 talks, including 167 involving the media, were given to stakeholder or professional groups to convey research findings and to receive direct public feedback. Scientific publications in peer-reviewed journals (90) or articles written for the general public (30) reached traditional and non-traditional groups of stakeholders.

Extension activities in the Food Security and Food Systems planned program included urban agriculture, risk management, business planning, IPM training, and educational outreach through consultations and publications. Urban agriculture and IPM training that targeted Hispanic adults distributed over 7,000 pounds of locally produced organic vegetables - a 43% increase over the previous year. Students donated 1,600 volunteer hours in the urban garden and served 250 low income families. IPM training in vegetable production, fruit production, and greenhouses to relevant stakeholder audiences is provided throughout the state. Agricultural risk management and water use assessments and training were also offered. Extension educators worked with stakeholder organizations, including the Connecticut Food System Alliance, New Connecticut Farmers, and Connecticut Farm Bureau Association. Extension educators produced online resource materials such as fact sheets, impact statements and newsletter articles for agricultural audiences, local and regional newspapers, and trade publications. Our team also conducted 3 Hatch research projects related to this planned program area.

2. Brief description of the target audience

Target audiences included consumers, farmers and producers; agencies and organizations that serve or handle food; food related businesses and processors; farmers' market staff and vendors, seafood industry processors, dealers, harvesters, and importers; regulatory personnel, researchers, and policy makers. Additional audiences include high school teachers, the media, food bank personnel, beekeepers, maple syrup producers, seed companies, water company officials, and citizens. Women, minority organizations, and children are target audiences of this program. Efforts were made to reach these groups through interactions with teachers, partner organizations, stakeholders, and students.

All activities are designed to ensure that stakeholders have equality of service and access to research findings. Direct contacts are derived from persons served or those in attendance at meetings, as well as those directly requesting service in our inquiry offices. Indirect contacts with youth were obtained from educators receiving assistance and information that could be incorporated into science curricula.

3. How was eXtension used?

Several CAES staff members are registered in eXtension with consumer horticulture, youth, pesticide environmental stewardship, bee health, grape, eOrganic, and urban IPM communities of practice. New findings, fact sheets, links to Station material, and answers to questions have occasionally been provided to the national eXtension service (www.extension.org). The UConn Home and Garden Education Center is registered as an eXtension Ask the Expert and responded to 398 phone calls from 28 states and 4 countries during the reporting year.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	44665	73093	22468	14364

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed
n/a

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	7	64	71

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Face to face general group education sessions/workshops

Year	Actual
2016	186

Output #2

Output Measure

- Individual consultations

Year	Actual
2016	292

Output #3

Output Measure

- Fact sheets, bulletins and newsletters written or edited

Year	Actual
2016	29

Output #4

Output Measure

- Training of undergraduate, graduate and post doctoral students

Year	Actual
2016	87

Output #5

Output Measure

- Formal Extension outreach programs

Year	Actual
2016	193

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of homeowners, growers, students and/or media reporters gaining knowledge on insect pests and plant pathogens
2	Number of growers gaining information on IPM practices
3	Reduce food insecurity in the state of Connecticut and across the Northeast.
4	Increase the percent of locally grown food that is purchased by Connecticut citizens.
5	Increase sustainable, diverse and resilient food systems across scales
6	Improved national and global capacity to meet growing food demand.

Outcome #1

1. Outcome Measures

Number of homeowners, growers, students and/or media reporters gaining knowledge on insect pests and plant pathogens

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	30452

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Creeping bentgrass is one of the most commonly used grass species on golf course putting greens in the United States. Since 2009, grass decline with symptoms of wilting, necrosis, and etiolation were constantly observed on creeping bentgrass of many golf courses in the transition zone of the United States. This disease, named after the symptom Bacterial Etiolation and Decline (BED), was diagnosed to be caused by a bacterial pathogen Acidovorax avenae subsp. avenae (Aaa). However, how this disease was started and spread throughout the U.S. was unknown. Understanding the disease emergence will provide valuable information in future disease mitigation and prevention.

What has been done
In collaboration with Dr. Paul Giordano and Dr. Nathaniel Mitkowski, 28 Aaa strains were collected from diseased creeping bent grass from 14 states of the U.S. Draft genomes of 12 of the Aaa strains were sequenced, assembled, and annotated. The phylogeny of these turfgrass pathogenic Aaa strains was compared to the previously characterized Acidovorax strains. Using comparative genomic approaches, we also analyzed the gene conversion events as well as selective pressure that occurred within these isolates.

Results
Genomics analyses suggested that the BED disease in the United States was caused by a genetically divergent pathogen population, belonging to two different lineages. Our results suggested that the pathogens of BED emerged through parallel evolution rather than the previously thought cause of contaminated seed supplies. These results provided insights into how to restrict the spread of this important disease on golf courses and develop effective detection and management options.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of growers gaining information on IPM practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	162

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Bacterial diseases re-occur annually because antibiotics and plant defenses fail to eliminate all bacteria. One contributing factor is that bacteria have antibiotic toxin modules called toxin-antitoxin (TA) systems that may cause them to enter a dormant state in stressful conditions, allowing a small percentage of cells to survive. The remaining cells, or persister cells, can serve as inoculum for new infections, or even as the source of antibiotic resistance mechanisms. Extremely little is known about the makeup or role of TA systems in plant pathogens. Understanding which systems are critical in plant pathogenesis could allow them to be employed in designing more effective ways to use antibiotics, or in identifying the best potential biocontrol strains.

What has been done
A project at CAES is in progress to explore the role of TA systems in plant pathogens. Researchers have combed through hundreds of plant pathogen genomes to analyze the presence of TA systems and predict what special virulence properties they may have. These gene sequences were analyzed for prevalence within each species, diversity, and the presence of signals indicating they might be secreted.

Results

Over three thousand predicted TA systems were identified in the plant pathogen genomes. Analysis of the number of each toxin type by bacterial genus and species revealed large differences in the number and diversity of systems among bacterial groups. Each type of toxin-antitoxin system also showed substantial variation between different bacterial groups. A representative TA toxin was cloned and tested for antibiotic tolerance activity in E. coli, establishing protocols for testing persistence. The apple fire blight pathogen Erwinia amylovora was chosen as a model bacterium for the next studies, which will determine the impact of deleting all the TA systems on antibiotic tolerance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Reduce food insecurity in the state of Connecticut and across the Northeast.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	16000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Contemporary food systems are shaped to generate profits and power for those who can maximize sales via the large scale production and distribution of inexpensive food. The problem is this system places far less value on the principles of sustainability, environmental integrity, economic vitality, and social equity. A Sustainable Food System can meet our needs for fresh, healthy, affordable food today without jeopardizing the ability of future generations from doing the same. This is a global issue that we are tackling locally, statewide, and regionally in New England. In Connecticut, 12% of households experience food insecurity, 33% of children are overweight or obese (more than half of whom are Hispanic and Black), an estimated one out of 5

residents eat no vegetables daily, 33% of our census tracts live more than a half mile from a healthier food retailer, and only 10% of our cropland is used to harvest fruit and vegetables.

What has been done

Outreach and Training Programs included:
- Put Local On Your Tray, A new program with the Connecticut Department of Education designed to promote local food in school cafeterias. During this reporting period the program completed the design of a full suite of educational graphics (posters for dairy, greens, seeds, seedlings, beets, carrots, zucchini, berries, and corn), and also implemented a pilot harvest-of-the-month program with 4 school districts (Region #4, East Hartford, Middletown, and Windham).
- Three service-learning programs (Connecticut Food Justice VISTA Project, Summer Meals Outreach Team VISTA Project, and FoodCorps Connecticut

Tools and Unique Workshops included:
- CSA Price Study: Our CSA Price Study has tracked prices by county for the last 4 consecutive years to inform producers of average pricing of CSAs. During this reporting period we conducted the 2016 CSA Price Study, with new analysis of organic vs. non-organic prices.
- Local Sourcing For Your Institution: Meet The Farmers & Expand Your Local Foods Program. Held on March 1, 2016. Guest Trainer: Simca Horowitz, Farm to Institution New England
- Taking Diversity & Inclusion to the Next Level for VISTA Members and FoodCorps Service Members, Sept 30, 2016. Guest Trainer: Rick Pinderhughes of Visons, Inc.

Results

The impact of these combined efforts are to increase public awareness and support of local food systems, improve access to healthy, affordable food, increase stakeholder collaboration, and foster emerging leaders in the field.
- 16,000 free summer meals were served with assistance through the VISTA project
- 50 adult individuals are better able to serve their organization and community as a result of service learning, training, and internship opportunities in the field
- 557 volunteers were recruited to assist with education, outreach and referrals in food justice programming
- 319 volunteers were recruited to assist with healthy school environments and school gardens
- 132 organizations across Connecticut have increased capacity to work with their community and address issues of food insecurity through Connecticut Food Justice VISTA Project

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
607	Consumer Economics
704	Nutrition and Hunger in the Population

Outcome #4

1. Outcome Measures

Increase the percent of locally grown food that is purchased by Connecticut citizens.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1450

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to previous research, the average Connecticut citizen spends 2.5% of their food and gardening purchases locally. The Governor's Councils for Agricultural Development recommended increasing this number to 10% to support agriculture in the state, and strengthen local economies. Strong local food economies also have the power to improve health through knowledge, engagement and access.

What has been done
UConn Extension collaborated with non-profit partner CitySeed on the buyctgrown website, which is a public engagement tool introducing residents to Connecticut agriculture. UConn Extension also operates a Community Supported Agriculture (CSA) tool kit for producers as a guide to operating a CSA in their business. Research is conducted each summer collecting the average price on CSAs for consumers, and the price has remained steady since 2014 at an average of $31 per share, per week.

Results
Through UConn Extension's involvement, 90 producers and distributors were engaged in selling local foods to schools. An additional 45 farmers acquired new knowledge about selling to institutions. Over 600 farmers received a digital copy of the 2015 CSA Price Study, and had access to new buyers through the buyctgrown.com website.

Since work began educating farmers in 2012, the number of CSAs in the state has increased by 59% - to a documented 110 CSAs during the reporting period. The continual growth also shows an increase in consumer demand for locally grown products.

1200 individuals and 250 businesses have increased awareness and commitment to buying locally grown products through the Connecticut 10% Campaign.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
607	Consumer Economics
704	Nutrition and Hunger in the Population

Outcome #5

1. Outcome Measures

Increase sustainable, diverse and resilient food systems across scales

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	7000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The 2010 census shows that 88% of Connecticut's residents live in urban areas. Looking at records dating back to 1970, the percent of urban residents continues to climb. Connecticut unemployment rates continue to trend slightly above the national average. Food deserts are commonly found in predominantly lower income neighborhoods and communities. In Connecticut, food deserts are mainly found in Fairfield County, where Bridgeport and Danbury are located (two of the poorest cities in Connecticut), which also report the two largest Hispanic populations with 32% and 24%, respectively.

What has been done
UConn Extension implemented an Urban Agriculture and Integrated Pest Management (IPM) training project in Fairfield County, targeting Hispanic adults. Candlelight Farms in New Milford allows students to use an acre of farmland to produce vegetables and Nuestras Raices (Our Roots) from Massachusetts is serving as a mentor.

The urban agriculture program in Connecticut started training urban residents in 2014 to produce organic food locally while at the same time generating extra income. This year-round program consists of three components: classroom instruction, vegetable production, and entrepreneurship.

Results
Program results during the reporting period include:
- 29 urban residents from four cities have completed a year-round urban agriculture training
- Nearly 7,000 pounds of organic vegetables were produced and distributed, especially via the Farmer's Market in Danbury. This was a 43% increase over the previous reporting period.
- More than 250 people from low-income families, primarily from Danbury, were supplied with organic produce during summer 2016.

- Program participants contributed with more than 1600 hours producing and selling organic vegetables. Of the total time, 80% was spent on IPM lower-risk tactics, which reduced the use of organic pesticides to one pint for the entire season.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
607	Consumer Economics
704	Nutrition and Hunger in the Population

Outcome #6

1. Outcome Measures

Improved national and global capacity to meet growing food demand.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Micronutrients are critical in the defense against crop disease. Many host defense products are synthesized by enzymes that are often activated by micronutrients. Microelement availability in neutral and slightly acidic soils can restrict a sufficient supply of micronutrients like Cu, Mn, or Zn into root tissue. Foliar application is rarely effective since most micronutrients are not basipetally translocated. However, nanoscale micronutrients (<100 nanometers) can travel downward in plants and subsequently enhance yield and suppress disease. The use of nanoparticles (NP) of metal oxides Cu, Mn, and Zn as micronutrient formulations may offer a highly effective novel platform for crop disease suppression. Nanotechnology has the potential to play a critical role in global food production, food security and food safety.

What has been done
Research at CAES was initiated to explore the role of NP metal oxides Cu, Mn, and Zn, for suppression of Fusarium wilt of tomato and watermelon Pythium root rot of chrysanthemum, and

Verticillium wilt of eggplant. Transplants were foliarly treated once with NP formulations and compared to untreated controls. Both greenhouse and field experiments were conducted with eggplant and watermelon transplants in 2015-2016.

Results

NP of Cu and Mn oxides continued to show the greatest effect on plant growth and yield when compared to other NP or controls. NP of CuO were compared the other forms of Cu at the same rate on watermelon. Increased watermelon yield was observed in 2015 and 2016 in Hamden and in 2016 in Griswold when NP of CuO were applied to young transplants. Transcriptomic analysis of watermelon roots suggest polyphenol oxidase activity has been activated which in turn may increase defense barriers in root. We estimate that one treating transplants with NP of CuO to plant an acre would cost less than $45.00, but could potentially increase vegetable yield by 30-50 percent.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
607	Consumer Economics
704	Nutrition and Hunger in the Population

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

A number of scientists have IPM and related investigations as part of their research and all goals laid out under this planned program were met. In addition, new scientists hired in this program in 2014-2015 continue to expand their active lines of research within this planned program. As such, meeting and/or exceeding future targeted outcomes is anticipated.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Researchers conducted a number of evaluation studies during this reporting period and verified that there were knowledge changes in stakeholders. Moreover, 162 site visits and 531 talks enable direct evaluation of acceptance of new crop cultivars, IPM strategies, and cultivation practices.

Depending on the program activity, Extension used a variety of formative and summative assessment tools. In our service learning programs, we used mid-year

evaluations and end-of-year evaluations for service members, and we also use progress reporting tools to record direct and indirect impacts on clients. In our farmer training programs, we used post-workshop evaluations. In our farm-to-school pilot programming, we used an evaluation tool designed for K-12 students in response to taste tests. Urban agriculture participants are administered pre and post-tests at the beginning and end of each module (botany, soils, entomology, vegetable production, and IPM).

Key Items of Evaluation

Google Scholar verified recognition of published articles within this program written by research staff. There were 669 citations for this planned program; direct contacts within the program exceeded 21,000, including nearly 1,042 with youth. Indirect contacts exceeded 9,000; including over 1,500 youth. On-site observations and evaluations verified success in increased use of IPM and new cultivars, as well as control methods.

In Extension, our core impact areas during the reporting period are 1) advancing business models and practices that will help food producers succeed and be profitable; 2) helping consumers connect to fresh, healthy, affordable food through local food system practices and consumer education; 3) developing the next generation of food system leaders through training, internships, and service learning; and 4) supporting stakeholder networks that are working on strategies that support the values of sustainability in our food system.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Human and Animal Health

☑ 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
302	Nutrient Utilization in Animals	0%		1%	
303	Genetic Improvement of Animals	0%		2%	
305	Animal Physiological Processes	0%		7%	
311	Animal Diseases	32%		26%	
315	Animal Welfare/Well-Being and Protection	0%		2%	
501	New and Improved Food Processing Technologies	0%		4%	
610	Domestic Policy Analysis	0%		5%	
701	Nutrient Composition of Food	0%		7%	
702	Requirements and Function of Nutrients and Other Food Components	0%		15%	
703	Nutrition Education and Behavior	15%		14%	
704	Nutrition and Hunger in the Population	5%		4%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	30%		0%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		4%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		2%	
723	Hazards to Human Health and Safety	15%		4%	
724	Healthy Lifestyle	3%		3%	
	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	1.0	0.0	9.8	0.0

Actual Paid	0.5	0.0	10.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: University of Connecticut - Storrs

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
72561	0	457072	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
72561	0	457072	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
813604	0	2157998	0

2. Institution Name: Connecticut Agricultural Experiment Station -

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	290084	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	835386	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	151761	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

At CAES the primary research objectives include investigating the mosquito vectors of encephalitis and related viruses, blood meal sources in mosquitoes, if biological control strategies can control vectors, and which vertebrates serve as reservoirs for arthropod-transmitted pathogens. Surveillance activities were expanded to include the Zika virus. Research on the role of mosquito midgut proteins and other metabolites in controlling flavivirus susceptibility were continued, as was a project assessing the potential of a host-targeted vaccine for Lyme disease control. Investigations on the role of invasive plants such as Japanese Barberry as refuges for disease-carrying ticks continued, as did assessments of the relationship of deer populations to tick-borne Lyme disease prevalence. Investigations on bed bug presence and control were continued. Activities focused on the success of control methods were coordinated with public health officials and a tick IPM working group. Public forums on tick-borne diseases and bed bugs were held. CAES scientists helped organize and participated in a national symposium on integrated tick

management. A new CDC-funded Center of Excellence was formed and is entitled "Northeast Regional Center for Excellence in Vector-Borne Diseases," which is a partnership with Cornell University, Columbia University, and the New York State and Connecticut Departments of Public Health. Significant progress was made on all objectives, and measured outputs benefited federal, state, and local public health officials, physicians, veterinarians, and the general public. The primary state-generated outputs are noted below and include education sessions/workshops, publications, training of students, and outreach programs. All program activities strongly emphasize public service to traditional and non-traditional stakeholders. An annual open house event allowed 1,060 citizens, including over 100 children, to view presentations of research findings and to offer direct feedback to CAES staff. These planned activities have and/or will lead to specific measurable outcomes, such as more rapid and effective monitoring of disease causing agents and to more effective methods of control for disease carrying arthropods so as to decrease instances of human illness.

UConn Extension and Storrs Agricultural Experiment Station included research and outreach programs and activities focused on human and animal health. These include: characterizing the connection between dietary components and the potential biochemical nutritional bases for disease; developing evidence-based programs for improving healthy lifestyles; conducting workshops and webinars; providing training to relevant stakeholder audiences, counseling, and assessments; producing online resource materials such as fact sheets, impact statements and news articles. Our Connecticut Veterinary Medial Diagnostic Laboratory had 4,472 active private clients, and worked with 22 State of Connecticut agencies and 363 UConn and UConn Health faculty and departments. Faculty also responded to a disease outbreak on a Connecticut farm by organizing a statewide agritourism educational workshop with presenters from CDC, USDA APHIS, Connecticut Department of Public Health, Connecticut Department of Agriculture, and UConn Extension.

Participation in 10 Hatch Multistate research projects, and 14 Hatch projects occurred during the reporting period.

2. Brief description of the target audience

Target audiences include all individuals with a stake in preventing disease and improving the health of humans and animals. This includes producers, processors, retailers, regulators, members of the scientific community and consumers. This program benefits a broad range of stakeholders, including local and national public health officials, elected officials, regulators, and the public at large. Underserved audiences are included in the target audience, and actively engaged through programs, partners, and stakeholders.

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	8688	13237	140	1581

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

Year:	2016
Actual:	4

Patents listed

1. Live Attenuated Antigenically Marked Classical Swine Fever Vaccine. Patent. (May 31, 2016). UConn.

2. Attenuated African Swine Fever Virus Strain Induces Protection Against Challenge With Homologous Virulent Parental Virus Georgia 2007 Isolate. Patent. (May 24, 2016). UConn.

3. Attenuated African Swine Fever Virus Vaccine Based in the Deletion of MGF Genes. Patent. (May 12, 2016). UConn.

4. Live Attenuated Antigenically Marked Classical Swine Fever Vaccine. Patent. (September 10, 2015). Not included in last year's report. UConn.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	6	124	130

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Faces to face general group education sessions/workshops

Year	Actual
2016	350

Output #2

Output Measure

- Individual consultations

Year	Actual
2016	61

Output #3

Output Measure

- Fact sheets, bulletins and newsletters written or edited

Year	Actual

2016	3

Output #4

Output Measure

- Training of undergraduate, graduate and post doctoral students

Year	Actual
2016	680

Output #5

Output Measure

- Formal Extension outreach programs

Year	Actual
2016	19

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of residents gaining knowledge of ticks, mosquitoes, bed bugs, and mold
2	# of media reporters gaining knowledge of ticks, mosquitoes, bed bugs, and mold
3	Human and animal health improved through adoption of dietary and other behavioral activities by practitioners and consumers.
4	Identify novel dietary approaches to reduce chronic disease development.
5	Identify novel dietary approaches to reduce coronary heart disease (CHD)

Outcome #1

1. Outcome Measures

# of residents gaining knowledge of ticks, mosquitoes, bed bugs, and mold

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	14961

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The prevalence of Lyme disease, human granulocytic anaplasmosis (HGA), and human babesiosis cases continue to increase in the United States. There were 36,307 confirmed and probable cases of Lyme disease reported to the Centers for Disease Control and Prevention in 2013. In 2013, the CDC officially acknowledged that the true number of Lyme disease cases was >300,000 human cases per year. Without antibiotic treatment, persons can suffer from dermatologic, joint, cardiac, or neurological disorders. The mean cost per Lyme disease patient is about $1,965 (in year 2000 dollars). We found that the prevalence of babesiosis agent in Connecticut blacklegged ticks appears to be increasing with 11.0% of 2,503 ticks tested infected in 2015. The pathogen for babesiosis attacks red blood cell and human disease can be fatal. The application of pesticides remains one of the primary methods for tick control in the residential landscape, and there is growing interest in biological, natural, and cultural methods in an integrated approach to reduce the risk of tick bite and disease. Bed bug and related inquiries remained the leading inquiry with 33% (n= 2,782) of the identifications performed by the Insect Information Office, a 23-fold increase since 2007.

What has been done
Field research was initiated in 2013 and completed in 2016 on an integrated tick management project to determine if an IPM approach could reduce the abundance of the tick Ixodes scapularis and the entomological risk of tick-borne disease (TBD). This tick is the main vector for the Lyme disease, HGA, human babesiosis, a hard-tick relapsing fever, Powasan encephalitis, and several other agents. The strategies include spraying the entomopathogenic fungus Metarhizium anisopliae, rodent targeted bait boxes, and deer reduction. Studies using a rodent-targeted Lyme disease vaccine bait were initiated in 2015. A non-vaccine marked bait study in 2014 found that over 90% of white-footed mice utilized the bait.

Results

Results from the first year of the study showed that natural product application and rodent bait boxes reduced nymphal blacklegged tick encounters on residential properties by an average of 66%. Reduced abundance or activity of nymphal ticks is of paramount importance in reducing risk of human infections during May and June in Connecticut. These studies will have impact as guidelines to an effective IPM approach to tick management are needed for residents and communities to respond to the increasing risk for TBD.

4. Associated Knowledge Areas

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

# of media reporters gaining knowledge of ticks, mosquitoes, bed bugs, and mold

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Reporters and other members of the media often seek information on mosquitoes, ticks, bed bugs and associated pathogens. There is also interest in information on how arthropod vectors impact the spread of disease. Zika, West Nile, Eastern Equine Encephalitis (EEE), and related viruses constitute ongoing threats to human health by causing severe illness or death. Since its introduction into the United States in 1999, West Nile virus has sickened over tens of thousands of people resulting in nearly 2,000 deaths. During this reporting period, there were 10 human cases of West Nile virus in CT; no deaths were reported. The first human fatality of EEE virus occurred in CT during 2013. Emerging viruses such as Zika and Powassan create great concern among the general public. Public health officials have requested studies on the ecology of mosquitoes and viruses and biological control of mosquitoes

What has been done
There were at least 75 reporters who sought information on bed bugs, mosquitoes and encephalitis viruses by interviewing CAES scientists. Stakeholders specifically note concerns over

viruses such as Zika, West Nile and Eastern Encephalitis that cause human illnesses. Last year more than 179,000 mosquitoes were tested for viruses. Viruses cultured from mosquitoes were identified by advanced molecular techniques. Results were conveyed to the general public via press releases, social media and through coordinated efforts with the Connecticut Department of Public Health. Tens of thousands of residents and stakeholders were kept informed of recent research findings and the significance of new scientific advances

Results
Seventy-five separate interactions with the press resulted in dozens of articles on bed bugs, ticks, mosquitos and other disease carrying arthropods. The original articles were re-distributed by dozens of additional media venues that ran the original stories and content. These results had impact because mosquito control programs targeted the most important mosquito species and state residents took precautions to avoid mosquito bites. The long-term benefit continues to be healthy human and domestic animal populations, as well as situational awareness regarding new emerging diseases such as the Zika virus.

4. Associated Knowledge Areas

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Human and animal health improved through adoption of dietary and other behavioral activities by practitioners and consumers.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Identify novel dietary approaches to reduce chronic disease development.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Heart disease is a leading cause of death in the U.S., contributing almost 600,000 deaths per year. Atherosclerosis is a major contributor to heart disease, and is characterized by an accumulation of cholesterol and formation of plaque in the artery wall. Blood high-density lipoprotein-cholesterol (HDL-C) levels are strongly protective against future risk of heart disease. However, in certain chronic inflammatory diseases like obesity and atherosclerosis, normally protective HDL particles become dysfunctional and may actually worsen disease outcomes. In light of increasing obesity and heart disease incidence in the U.S., there is a need to identify novel dietary approaches aimed at preventing HDL dysfunction associated with these chronic inflammatory diseases.

What has been done

Several studies in humans and animals suggest that plant-derived anthocyanin pigments may benefit HDL metabolism and reduce inflammation. Black elderberries are a rich source of anthocyanins and are grown in Connecticut, and many other U.S. states. While elderberries have long been used as medicinal foods by both Native Americans and Europeans, there has been surprisingly little research on the health effects of black elderberry consumption. A Hatch funded research project is examining whether black elderberry has protective effects against HDL dysfunction in chronic inflammation.

Results

Dietary anthocyanins have been shown to reduce inflammation in animal models and may ameliorate inflammation-related complications, such as atherosclerosis. Black elderberry (Sambucus nigra) contains high amounts of anthocyanins (~1300 mg/100 g), a subclass of polyphenols, relative to other edible berries. Current data suggests that Black Elderberry (BEE) supplementation improves HDL-C and HDL function, while also upregulating the expression of genes in the liver involved in the endogenous antioxidant defense.

Future studies will consider the effects of BEE supplements to promote HDL functionality in humans with chronic, low-grade inflammation, such as those with metabolic syndrome or diabetes. We hope that findings from our molecular nutrition studies will support further research in humans, and translate into nutritional recommendations that will help to reduce heart disease.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components

Outcome #5

1. Outcome Measures

Identify novel dietary approaches to reduce coronary heart disease (CHD)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Epidemiological studies have not been able to establish a link between egg consumption and risk for coronary heart disease (CHD). This situation could be explained partially by the fact that eggs, in addition to dietary cholesterol, also contain lutein, a potent antioxidant and anti-inflammatory carotenoid. Previous studies conducted at UConn have shown that lutein protects against atherosclerosis and hepatic steatosis in a guinea pig model for both diseases. In addition, plasma concentrations of lutein, in humans, as well as macular pigment density significantly increase following egg consumption.

What has been done
A Hatch funded research project is studying the protective role of lutein as an antioxidant in populations at risk for CHD. Studies included evaluation of the effect of consuming 1 egg per day (200 micrograms lutein) on plasma lipids, lipoprotein subfraction and size and reverse cholesterol transport in type 2 diabetic individuals. And the evaluation of the effect of consuming 1 egg per day (200 micrograms lutein) on plasma glucose, insulin sensitivity, glycosylated hemoglobin, adiponectin and homeostasis model assessment.

Results
Study results indicate that the intake of 1 egg/day appears sufficient to increase large LDL particle concentration and biomarkers associated with HDL function. However, intake of 2-3 eggs/day supports greater improvements in markers of HDL function and antioxidant capacity. Overall, intake of up to 3 eggs/day improves these biomarkers associated with lipoprotein function and CVD risk in a young, healthy population. Further, up to 3 eggs per day does not increase plasma concentrations of trimethylamine oxide (TMAO) a marker of coronary heart disease associated with choline intake. Results suggest that regular egg consumption (2/day) at breakfast as compared to oatmeal intake may result in improvements in markers of HDL functionality, decreases in inflammation and increased plasma lutein and zeaxanthin in healthy populations.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Staffing changes)

Brief Explanation

A combination of federal and state grant funds were available for this program, although shifts in scientists' work times from state projects to Hatch projects did occur. There were no delays in re-hiring temporary workers on grant funds, which is critical as traps and other techniques used require technical expertise not present among the general public. A new CDC-funded Center of Excellence will likely have significant positive impact on outputs from this program. There were no changes in public policy, priorities, or research areas that impacted this program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

As in previous years, during program and post-program evaluations were conducted to assess effectiveness. Verbal feedback from municipal and public health officials, as well as the general public, indicated significant ongoing interest in work conducted and results generated under this planned program.

Key Items of Evaluation

Researchers collected data mainly by on-site evaluations conducted following talks to specific civic or professional groups, as well as at our annual open house and other public venues. Significant direct interactions with traditional and social media, as well as with stakeholders, continued. Direct interactions were 5,831 individuals, including 102 youth; there were 75 direct interactions with reporters and the media. During this reporting period, there were a total of 700 citations in Google Scholar for scientists in this program.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Sustainable Environments

☑ 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%		12%	
112	Watershed Protection and Management	10%		10%	
123	Management and Sustainability of Forest Resources	10%		2%	
131	Alternative Uses of Land	10%		5%	
132	Weather and Climate	10%		5%	
133	Pollution Prevention and Mitigation	0%		4%	
135	Aquatic and Terrestrial Wildlife	0%		10%	
141	Air Resource Protection and Management	0%		5%	
202	Plant Genetic Resources	0%		7%	
205	Plant Management Systems	10%		20%	
212	Diseases and Nematodes Affecting Plants	0%		5%	
215	Biological Control of Pests Affecting Plants	10%		2%	
216	Integrated Pest Management Systems	20%		3%	
605	Natural Resource and Environmental Economics	0%		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	4.0	0.0	6.9	0.0
Actual Paid	9.1	0.0	7.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: University of Connecticut - Storrs

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
802556	0	443849	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
802556	0	443849	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1492234	0	1677662	0

2. Institution Name: Connecticut Agricultural Experiment Station -

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	19345	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	253068	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	176988	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research objectives are to identify processes that control pollutant fate in the environment, to develop methods to remediate contaminated soil and water, to characterize the spread of invasive aquatic plant species, and to identify methods to control invasive aquatic plants. The fate and remediation program covers both fundamental and applied aspects, and deals with pesticides, volatile organic compounds, dyes, hormones and hormone-mimicking compounds, pharmaceuticals, petroleum hydrocarbons, munitions chemicals, and engineered nanomaterials. Studies conducted include: bioavailability of polycyclic aromatic hydrocarbons in soil using an in vitro human gastrointestinal model; design of carbon catalysts for trapping and degrading the quarantine and pre-shipment fumigant, methyl bromide; and novel approaches for water treatment based on peroxide chemistry. The Invasive Aquatic Plant Program (IAPP) tracks occurrences of invasive aquatic plants, test novel controls and provide public outreach via talks, workshops and an invasive aquatic plant webpage; an online repository for aquatic vegetation maps, herbarium specimens, and research results. IAPP has surveyed over 250 lakes since 2004, and found approximately 60 percent contain one or more invasive plant species. IAPP has published numerous research articles, and presented at hundreds of public education events. IAPP boasts one of the largest

"Long Term Ecological Research" lake databases in the US. Outputs include; new scientific findings, scientific publications, newsletters, bulletins, talks and interviews. In addition, a large number of state residents are served directly by visitations to infested lakes and ponds, identification of problems, and assistance with management. Cases of sudden vegetation dieback (SVD) have been observed across coastal wetlands of the Northeast. When the plants die, SVD sites have the potential to switch from net sinks of carbon from the atmosphere to net sources. We are monitoring cases of SVD throughout Connecticut and Rhode Island, and, we are measuring soil gas fluxes to determine the extent that SVD affects soil carbon cycling, as well as characterizing how the soil microbial communities respond to SVD.

Extension outreach efforts were conducted through multiple programs. New analytical methods were used to remove pollutants from soil and water in greenhouse irrigation systems and nutrient management. Soil analysis through our laboratory and technicians determined the need for fertilizers in nutrient management programs for dairy farms, fruit production, and home gardeners. Evaluation of invasive plants for strategic management practices is conducted through research projects and results are disseminated through peer reviewed articles, reports, fact sheets, workshops, and webinars. Further outreach education and public engagement is conducted on land use, climate adaptation, geospatial technologies, sustainable landscapes, and invasive plants. The mobile app for rain gardens has been expanded to include 20 states, increasing by 7 from the prior reporting period. Mobile apps for Stormwise and IPM are nearing completion. Training is provided to relevant stakeholder audiences through workshops and webinars, online materials, and individual consultations. Additional training methods using online learning are under development for the pesticide safety education program and geospatial technology. Educators also participated in 6 Hatch Multistate projects and 11 Hatch projects.

2. Brief description of the target audience

Many audiences have a stake in providing sustainable environments including farmers, lake associations, boaters, homeowners, water company officials, environmental organizations, extension specialists, corporate and municipal officials, state environmental and agriculture agency staff, pesticide producers, researchers, city and town volunteers, and the general public. As with all programs, additional efforts were made to contact a broad base of under-represented and under-served groups, including members of minority organizations, women, and children.

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	32213	166620	2010	330

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed
n/a

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	15	46	61

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Face to face general group education sessions/workshops

Year	Actual
2016	516

Output #2

Output Measure

- Individual consultations

Year	Actual
2016	581

Output #3

Output Measure

- Fact sheets, bulletins and newsletters written or edited

Year	Actual
2016	150

Output #4

Output Measure

- Training of undergraduate, graduate and post doctoral students

Year	Actual
2016	274

Output #5

Output Measure

- Formal Extension outreach programs

Year	Actual
2016	166

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of homeowners gaining knowledge about watershed protection and soil and water quality
2	Number of lakes and ponds surveyed and/or cleared of invasive aquatic plants
3	Improved climate mitigation strategies and their adoption
4	Development of new knowledge in land use resource protection
5	Increase knowledge and use of geospatial technologies
6	Increase Knowledge in Urban Forest Management
7	Improve greenhouse management and production

Outcome #1

1. Outcome Measures

Number of homeowners gaining knowledge about watershed protection and soil and water quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	900

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pollution affects human safety and health, and threatens the vitality of the natural environment. We have addressed broad issues related to understanding the fate and biological accessibility of pollutants in the environment and the development of novel methods for removing pollutants from waste streams and decontaminating water and soil.

What has been done
Projects on fate and remediation of chemical contaminants carried out in 2016 include the design of carbon catalysts for trapping and degrading the quarantine and pre-shipment (QPS) fumigants; bioavailability of polycyclic aromatic hydrocarbons (PAH) in soil using an in vitro human gastrointestinal model; and novel approaches for water treatment based on peroxide chemistry.

Results
Activated carbon (AC) is widely used as an adsorbent in water and air purification. We showed that AC can also catalyze base hydrolysis of alkyl bromides. In the context of QPS fumigants, AC therefore serves as both trap and catalyst for hydrolysis of methyl bromide to harmless byproducts, methanol and bromide salts. Modification of the surface with quaternary ammonium surfactants greatly increases the surface-catalyzed rate. Studies on bioavailability of PAHs in soil were carried out on PAH-bearing soot particles aged with soil for up to 30 days. These studies found that only a small percentage of PAHs are transferred from the soot to the soil during a 30 day incubation, having no effect on bioavailability; that soil reduces the bioavailability of PAHs in the soot alone by competing with the epithelium absorbent for PAH in the digestion fluid, and that dissolved organic matter in the soil pore water had negligible effect on PAH bioavailability. Studies on water treatment found that hydrogen peroxide and monoperoxysulfate generate singlet oxygen in solution, under some conditions, catalyzed by phosphate ion. Singlet oxygen reacts rapidly with many organic contaminants and is highly toxic to many microorganisms.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of lakes and ponds surveyed and/or cleared of invasive aquatic plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	19

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Extensive growth of invasive aquatic weeds, such as Eurasian watermilfoil (Myriophyllum spicatum) and Brazilian waterweed (Egeria densa) can significantly reduce water quality and alter native aquatic habitats. Stakeholders requested assistance with determining the species of aquatic vegetation and for integrated weed control.

What has been done
Staff mapped native and invasive aquatic vegetation in 3 new and 12 previously surveyed water bodies. The effects of ten years of winter drawdown on invasive plants were quantified in the state's largest lake, as was a recent introduction of the plant eating grass carp (Ctenopharyngodon idella). Tests on controlling a new introduction in the state - Brazilian waterweed (Egeria dense) - in Fence Rock Lake with bottom placement of herbicide were successful and no regrowth occurred in 2016.

Results
After 11 years of surveillance, nearly 60 percent of Connecticut lakes and ponds have been shown to contain invasive plants. These plants cover approximately 10 percent of the combined area of all Connecticut lakes and the problem is increasing. The coverage of Eurasian watermilfoil shows a negative relationship to drawdown depth and duration in Candlewood Lake. Tests on controlling Brazilian waterweed found bottom placement of the herbicide Diquat resulted in near complete control the following year. We have largely restored Bashan Lake to preinfestation conditions after years of selective fall herbicide applications. Long-term benefits will be protection of native lake ecosystems and prevention of associated economic losses.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Improved climate mitigation strategies and their adoption

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Connecticut Public Act 12-101 includes revisions to the Coastal Management Act stating that living shoreline techniques to control erosion need to be considered as alternatives to hard structures such as sea walls. This series of three workshops sought to address what living shorelines are, where and what types might be appropriate for Connecticut, and issues with the regulatory framework. While focused on Connecticut, living shoreline issues are relevant in New York and southern New England.

Outreach and education efforts on living shorelines is needed to assist municipalities and consultants with what techniques are appropriate for Connecticut and what will or will not be permitted by municipal, state and federal regulatory agencies.

What has been done
A living shoreline design charrette was held on September 15, 2016 at Harkness Memorial State Park in Waterford. This charrette was the culmination of a three part living shoreline workshop series as part of the Climate Adaptation Academy. The first two workshops provided information on living shorelines, what they are (with speakers from national and state agencies), how the concept might be utilized in Connecticut, examples and issues, such as ice during the winter months.

Results
Participants who attended the workshops have a greater understanding of what living shorelines

are, their purpose and where they are appropriate for installation. Participants also have knowledge of resources (both people and online information) they can use to ask specific questions. The workshops have also helped in defining where there are still issues and roadblocks to implementation.

283 people attended the three workshops (many attending all three) including consultants, municipal, state and federal officials and resource managers.

The workshops are part of a larger effort on living shorelines. We also had 600 plants at two living shoreline projects planted with 100 volunteer hours.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
205	Plant Management Systems

Outcome #4

1. Outcome Measures

Development of new knowledge in land use resource protection

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Local land use commissioners make decisions that can affect its citizens for generations. Many commissioners are unaware of the complex laws and procedures which govern their decision making which may lead to decisions that are vulnerable to legal challenges.

What has been done
The Land Use Academy (LUA) provides basic and advanced training to give land use commissioners the tools to make better decision. The training covers basic legal issues as well as how to read site and subdivision development plans.

Over 1500 land use commission makers and staff representing 150 of 169 towns in Connecticut have taken the training with UConn over the past four years.

Results
While it is difficult to say how many municipalities have not been sued as a result of using the information provided in the training, the following small sample of comments from the evaluation forms provide an indication of the impacts:
1.Thank you for the opportunity to learn how to be a better member of my town's planning commission.
2.This day was an eye opener of what I need to understand going forward.
3.I find this training to be very valuable as a P+Z commissioner. It helps us volunteers do a better job and understand nuances that is generally gained through experience on a commission.
4.Complex topics. I need to take this much more seriously. It is quite easy to make mistakes. Sharpies can put much of this over on us unless we are vigilant.
5.Have been on Planning and Zoning Commission for 4 months. Found course to be very useful in providing an understanding of what I do not know.
6.This should be mandatory for Commissioners.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
132	Weather and Climate

Outcome #5

1. Outcome Measures

Increase knowledge and use of geospatial technologies

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increase Knowledge in Urban Forest Management

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	34

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Connecticut state law mandates that every municipality appoint a tree warden to exercise care and control over all public trees in their domain. Tree wardens, as well as deputy tree wardens, need to be skilled and trained in best urban forestry practices to enhance community well-being regarding public safety, economic enhancement, and social cohesion.

What has been done
UConn Extension Tree Warden School, established in 1998, specifically targets municipal tree wardens, deputy tree wardens, and chief elected officials. There are six classes taught six days each fall with a final exam given the last day. There are typically 30 (maximum) students each year (34 in 2016). Since the program began, 4,500 tree wardens have been trained.

Results
As a result of the tree warden school, over 90% of Connecticut municipalities have tree wardens (and there are now almost 100 deputy tree wardens) who have attended the school and passed the final exam since the school began in 1998. Prior to this, for nearly one-hundred years since the tree warden law passed in 1901, tree wardens had rare if no education in urban forestry. The assessments show a steady increase in tree warden knowledge and improved attitudes to their duties and responsibilities. One item that has not changed much since 1991 is that municipal tree budgets have remained flat. Tree wardens are now more aware, knowledgeable, and willing to make best management decisions based on resources available.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #7

1. Outcome Measures

Improve greenhouse management and production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
SDA Economic Research Service data (2006) shows that the greenhouse - nursery industry in the current twelve Multistate Project, NE-1335 member states (AK, AZ, CT, GA, KY, ME, NE, NJ, NY, OH, PA, and TX) generated approximately $4,239,580,000 in sales. Biofilm buildup is a significant problem for greenhouse operations using irrigation systems with fine pores and low quality water sources. Biofilms are complex and dynamic communities of microorganisms that buildup on solid surfaces. Currently, it is unknown how biofilms in irrigation pipes and emitters can affect nutrient solutions used in greenhouse crops and whether biofilms in pipes increase costs associated to nutrient loss or reduced plant growth. Research on managing water and biofilm is essential for the greenhouse industry to grow plants in ideal conditions and achieve sustainability.

What has been done
A UConn scientist participating in Multistate project NE-1335 is studying how biofilms in irrigation pipes and emitters affect nutrient solutions used in greenhouse crops. Water and microbial samples were collected from commercial greenhouses to monitor nutrient content and microbial density on pipes and irrigation water. Under controlled conditions, the researcher conducted two studies to evaluate biofilm accumulation on irrigation pipes and the effect of biofilm on nutrients and plant health of poinsettias.

Results
On the first study, the researcher observed more biofilm on polyvinyl chloride (PVC) pipes compared with polyethylene tubing. The frequency of irrigation did not have an effect on biofilm accumulation. On the second study, the researcher observed lower root rot incidence in poinsettias plants irrigated with pipes containing biofilm compared with new pipes. Results will be used to develop water and nutrient management guidelines for greenhouse crop production, which will contribute to adoption of alternative water sources and water saving techniques.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Other (Staff changes)

Brief Explanation

There were no external factors that negatively affected outcomes during this reporting period. However, the current economy, changes in state or federal appropriations, and resulting staff changes remain the primary external factors that could affect outcomes.

Until 2013, state law did not require tree wardens and deputy tree wardens to have any public tree management qualifications. In 2013, the Connecticut Assembly revised the state tree warden law requiring tree wardens and deputy tree wardens to be qualified. The voluntary program coordinated by UConn Extension became the program of choice ensuring compliance. Since 1998, 472 key municipal people responsible for community forestry activities have passed the final course exam and continue to obtain required continuation education credits to maintain certification. 678 tree wardens total attended follow-up certification workshops. Also, a fourth edition of the Tree Warden Manual was published and distributed to all tree wardens and deputy tree wardens.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Direct stakeholder participation in the invasive aquatic weed program, workshops and town meetings remains a valuable venue for results evaluation.

Post workshop surveys were conducted for the first two living shorelines workshops, and phone interviews were conducted following the third workshop, a design charrette.

An evaluation form is provided to each participant in the Land Use Academy for them to fill out after every session.

A post-school survey is given to the tree warden students each year. In 1991, a state-wide tree warden needs assessment was conducted establishing baseline data on tree warden knowledge and attitudes. This assessment has been repeated in 2001, 2011, and 2016 to compare to assess progress. These assessments have been published in scholarly, peer-review journals and at national professional conferences, and two international conferences.

Key Items of Evaluation

Written information on evaluation forms following workshops, held in different towns, was an important information collection method for program assessments. During this reporting period, there were 1,439 citations (Google Scholar) for scientific articles written by several scientists for the planned program. These citations indicate that knowledge was gained by scientists and used in their studies.

With greater understanding, knowledge and resources, more living shorelines (which provide environmental benefits that hard structures do not) will be implemented in suitable areas along the Connecticut shoreline. By working with property owners on living shoreline designs from the beginning of a project, people will save time and money with the permitting process. Regulators also have a better understanding of the concerns of consultants and property owners with regard to the use of living shorelines. These

workshops also identified areas for future work and collaboration: the definition of a living shoreline in Connecticut needs further refinement, particularly for hybrid structures in which some hard structure (such as rock) is permitted; and a regulatory flowchart is needed showing how a living shoreline permit application would move through municipal, state and federal agencies.

V(A). Planned Program (Summary)

Program # 5

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
205	Plant Management Systems	15%		0%	
307	Animal Management Systems	15%		0%	
703	Nutrition Education and Behavior	15%		25%	
724	Healthy Lifestyle	15%		25%	
806	Youth Development	40%		50%	
	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	7.0	0.0	0.1	0.0
Actual Paid	4.4	0.0	0.0	0.0
Actual Volunteer	43.7	0.0	0.0	0.0

2. Institution Name: University of Connecticut - Storrs

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
416969	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
416969	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
676953	0	14197	0

2. Institution Name: Connecticut Agricultural Experiment Station -

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

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

V(D). Planned Program (Activity)

1. Brief description of the Activity

The 4-H and Youth Development planned program area focused on creating safe, healthy, well-educated children and teens through 4-H clubs, after school programs, and interactive learning experiences. Science, technology, engineering and math (STEM) curriculum are an integral part of the youth development programs and activities. Other programs focus on leadership and citizenship. Activities during this reporting period included: workshops, online materials, curriculum, after-school programs, and 4-H camps and fair. The National Youth Science Day Experiment was held in all eight counties. Adventures in STEM is hosted on the UConn campus with collaborators from the School of Engineering, Digital Media Department, and nutrition club, among others. UConn students present workshops for 4-H and non-4-H youth members. After-school programs are offered in all eight counties, working with varying demographics on STEM based activities, a total of 124 were held in the reporting period. Camps and 4-H fairs are a mainstay of the 4-H program, and continue to attract large numbers of youth participants. The 4-H Farm educational programming is serving a diverse audience, with over 11,000 participants during the reporting period. Youth who visit the 4-H Farm are introduced to agriculture, gardening, STEM, and healthy homes initiatives. Online material in the form of fact sheets, impact statements and news articles are available for each of the county 4-H programs. These include weekly and monthly county 4-H newsletters. Fitness and nutrition club volunteer training is being created in an online course, and nearing completion, to expand the program from four sites to statewide participation.

2. Brief description of the target audience

Youth, their families, school personnel, youth-serving agencies and organizations, community organizations and agencies are all target audiences. Volunteers involved with youth and adults are another target audience. During the reporting period, UConn increased participation among diverse groups through partnerships with schools and other organizations.

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	18760	24282	16940	27879

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed
n/a

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	2	0	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Face to face general group education sessions/workshops

Year	Actual
2016	7

Output #2

Output Measure

- Individual consultations

Year	Actual
2016	148

Output #3

Output Measure

- Fact sheets, bulletins and newsletters written or edited

Year	Actual
2016	3

Output #4

Output Measure

- Training of undergraduate, graduate and post doctoral students

Year	Actual
2016	25

Output #5

Output Measure

- Formal Extension outreach programs

Year	Actual
2016	90

Output #6

Output Measure

- After-school programs (sites) conducted or organized

Year	Actual
2016	124

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth indicating increased knowledge or skills in one or more of the nine 4-H program emphasis areas
2	Number of youth developing knowledge or skills in science, technology, engineering and math (STEM)
3	Increase in the health and wellbeing of youth participating in 4-H program activities
4	Increase positive impact on communities through volunteering

Outcome #1

1. Outcome Measures

Number of youth indicating increased knowledge or skills in one or more of the nine 4-H program emphasis areas

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of youth developing knowledge or skills in science, technology, engineering and math (STEM)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	16940

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The United States ranks 27th among developed nations with college students receiving science or engineering degrees. It is critical to engage youth in STEM related fields of study and introduce them to possible career opportunities in these areas. Nearly all of the 30 fastest growing occupations in the next decade will require at least some background in STEM. Women and minorities are under-represented in science careers and a diverse pool of trained scientists is needed to frame and solve problems and educate others.

What has been done
Connecticut 4-H programs were conducted in 8 county offices by UConn Extension staff along with 1,256 adult and 202 youth volunteers. 4-H members involvement included: select and develop 4-H science curricula, select and train volunteers, market 4-H science to increase interest, conduct non-formal education (learning and teaching, facilitated inquiry and discovery); facilitate question formation and problem solving through guided activities, and teach youth about academic and career choices. Examples of programs conducted include: 4-H Adventures in STEM, National Youth Science Day Experiment, 4-H Dairy and Beef Day, Food and Nutrition Show, and 4-H Robotics Competitions.

Results
4-H science programs successfully expanded skills demonstrated by the 16,940 youth who participated. Collegiate and teen leaders assisted staff and served as role models for youth of various ages. Youth increased awareness of science: in learning about soils, for example, they learned methods to increase yield and how technology impacts modern farming. Youth learned new vocabulary and literacy in scientific methods through 4-H activities. Youth learned through the animal programs the anatomy and physiology of animals. An example is embryology and the chicken egg. Youth apply skills throughout life and bring what they learned home, educating family members, and increasing science literacy in the general population.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems
806	Youth Development

Outcome #3

1. Outcome Measures

Increase in the health and wellbeing of youth participating in 4-H program activities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2143

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is a complex disorder based on genetics, environment, development and behavior. According to the CDC NHANES, 17% of all youth ages 2 to 19 are obese. This rate has not changed since 2003-04. Children from low-income households are at greatest risk for developing obesity given the high calorie, but poor quality diets and limited opportunities for physical activity. Poor diet quality and lack of physical activity over a lifetime place adults at much greater risk for a multitude of chronic diseases such as cancer, hypertension, cardiovascular disease, and diabetes.

What has been done

Healthy living efforts involved in-school, after-school or community based programs specifically dedicated to goals of healthy living and nutrition education. The 4-H after-school clubs reached 1,893 youth and 250 adults through 5 family nights, 5 health fairs, 92 sessions, and 6 chef-led healthy food demonstrations. Other activities included: Cooking Fridays, Camp Food Revolution, Champions 4-H group, and a Summer Garden Story Series.

Results

Through UConn Extension's programs, 2,143 youth and adults changed behavior in personal choices related to health and wellbeing. Post-intervention results from two site locations show that intakes were lower for sweets, and fast food, while there were increased intakes of beans and 100% fruit juice. In the first site evaluated, white milk consumption increased and flavored milk decreased. In the second site evaluated, there were increased intakes of white and flavored milk. Overall, students reported making more healthy food choices (especially eating more fruit, vegetables, high fiber cereal, and 100% fruit juice). There were indicator trends for improved flexibility, muscular strength and endurance. The program has expanded to sites in four cities. An online training curriculum for instructors and interactive cooking garden app are being pilot tested.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development

Outcome #4

1. Outcome Measures

Increase positive impact on communities through volunteering

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	87480

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The mission of the Connecticut 4-H Youth Development program is to help youth make good decisions, and develop leadership and citizenship skills, while improving self-confidence. All youth

need support and positive experiences to grow to their fullest capacity and to become productive adult citizens. Research has shown that caring adults also play an absolutely essential role in the healthy development of youth.

What has been done

There were 6,458 projects reported by enrolled 4-H members in service learning and community service activities in 2015-16. Many projects previously reported in this outcome have been continued. Examples include state citizenship day, peer education and mentoring, food drives, public space clean up and maintenance days, collecting school items, senior center visits, and animal shelter volunteering. The Connecticut 4-H mentoring project is in its sixth year. Over 50 trained adult mentors provided supervised experiences for 150 youth aged 9-14 in the cities of Bridgeport and Waterbury for a total of more than 5,000 hours. Parents and staff are surveyed twice a year on their observations of the gains participants have made.

Results

An estimated 87,480 hours of service can be attributed to 4-H volunteer time and community service projects conducted by 4-H members - a 20% increase over the previous reporting period. This number includes volunteer hours provided by the 1,458 youth and adult volunteers conducting the programs - each contributing approximately 60 hours. Based on the value of volunteer hours provided by the Independent Sector estimate of $23.56 per hour for Connecticut, 4-H volunteer time in 2015-16 was worth more than $2.06 million to the communities served. As a result of the 4-H citizenship program, there is a documented increase in the number of alumni returning to contribute their skills through leadership roles at the local and national level. Examples include mentors to 4-H fair associations, leadership roles in national 4-H opportunities, leadership within county clubs, workshop facilitators, UConn student interns, and afterschool programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

While the economy and competing programmatic challenges continue to challenge the planned program area, Extension educators are using competitive grant funds and innovative programming to maintain program outcome levels.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Staff members used the following methods for gathering data:

- Pre- and post-event survey (written and/or interview)

- 4-H Common Measures
- Mail and online surveys
- Focus groups
- Face-to-face interviews
- Participant observations

In addition, the Connecticut 4-H program is still pursuing the statewide implementation of 4-H Common Measures that were developed for national use in the 4-H program, Qualtrics for data collection, and IRB clearance to capture quantifiable data to write and publish scholarly articles.

Key Items of Evaluation

Pre- and post-questionnaires, observation, anecdotal stories from parents and teachers for the 4-H FANs program testimonials include:

- The students involved were engaged and invested. Many of them were able to teach me more about gardening than I taught them! Students took great pride in maintaining the garden.
- The garden beds have helped beautify and transform former blighted areas into areas of student pride around the school.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Community and Economic 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
724	Healthy Lifestyle	25%		50%	
801	Individual and Family Resource Management	25%		50%	
802	Human Development and Family Well-Being	25%		0%	
903	Communication, Education, and Information Delivery	25%		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	1.0	0.0	0.1	0.0
Actual Paid	1.8	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: University of Connecticut - Storrs

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
195443	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
195443	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1120005	0	88799	0

2. Institution Name: Connecticut Agricultural Experiment Station -

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

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

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Community and Economic Development planned program focused on providing Connecticut citizens a link to Extension specialists and current research priority areas identified by our stakeholders. These areas included improving conditions for families and communities through leadership development, community planning, and technology training. Two of our programs celebrated milestones during the reporting period. The Center for Learning In Retirement has been providing lifelong learning opportunities for those over age 55 for 25 years. The People Empowering People (UConn PEP) program has provided family and community development programs throughout the state for the last 20 years.

Specific activities in the planned program include: workshops and health fairs; continued promotion of YouTube videos for children on healthy homes; volunteer training programs; online material such as fact sheets, and impact statements and news disseminated through social media. Researchers also participated in 1 Hatch Multistate project and 2 Hatch projects.

2. Brief description of the target audience

Parents, youth, children, teachers, elected officials and policy makers are target audiences for this planned program. Through collaboration with our partner organizations, such as schools, agencies, and town governments we are reaching larger numbers of diverse and under-served audiences.

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	22407	37423	7605	3960

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed
n/a

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	6	0	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Face to face general group education sessions/workshops

Year	Actual
2016	17

Output #2

Output Measure

- Individual consultations

Year	Actual
2016	52

Output #3

Output Measure

- Fact sheets, bulletins and newsletters written or edited

Year	Actual
2016	5

Output #4

Output Measure

- Training of undergraduate, graduate or post doctoral students

Year	Actual
2016	0

Output #5

Output Measure

- Formal Extension outreach programs

Year	Actual
2016	63

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of program participants indicating increased leadership, parenting, or financial management skills
2	Economic Development of Communities

Outcome #1

1. Outcome Measures

Number of program participants indicating increased leadership, parenting, or financial management skills

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	480

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to research conducted by the Harvard Family Research Project, parental involvement in education is related to a range of benefits for students including: improved school readiness, higher student achievement, better social skills and behavior, and increased likelihood of high school graduation. In addition, they found that parental beliefs, attitudes, values, and childrearing practices, as well as home to school communication, are linked to student success. Schools alone cannot meet students' needs so relationships among families, schools, and communities in support of learning is critical.

What has been done
UConn Extension's People Empowering People (PEP) program provided 480 parents with leadership training sessions at 34 locations. Facilitators provided 10 to 12 training sessions per location on the following topics: values, verbal and non-verbal communication skills, active listening, problem solving, understanding the helping role, understanding ourselves and others as parents, understanding our children, our community and its leaders, action planning, and community opportunity. The program has been active for 20 years and replicated in Michigan, California, Missouri, Vermont, Florida, and South Africa.

PEP participants conducted a variety of community projects including organizing town-wide events, conducting family literacy projects, developing a resource booklet for parents, developing a children's library at a housing project, and collecting funds for a children's playscape. Each participant commits four to eight months to the program. During this reporting period, 480 PEP participants received leadership, parenting, and other skill training.

Results
A research study of 402 participants found the UConn PEP program was effective in influencing positive changes in participants' life skills, personal relationships, and community engagement

among an ethnically diverse sample. Participants reported increases in their ability to express themselves confidently toward others and the sense of control over oneself and environment.

Outside grant funding from 34 partner organizations contributes $13,000 dollars to program support, in addition to matching funds from each of the partner agencies and organizations.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Economic Development of Communities

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Greenways, or corridors of open spaces that protect natural resources, such as watersheds, rivers, and scenic landscapes, connect existing protected areas and provide recreational access. Comprehensive greenway plans can link communities through a network of public trails and pathways that can serve as an alternative mode of transportation. However, multi-use trails are estimated to cost $1,000,000 per mile.

In Connecticut a 44-mile multi-use trail, running through 11 communities has been proposed. Due to the significant costs involved, policy makers need additional information on the economic and health impacts to justify the project.

What has been done

UConn Extension partnered with the UConn School of Business Center for Community Economic Analysis, the Naugatuck Valley Council of Governments and the Naugatuck River Greenways Council on a research project to quantify the potential economic impacts of constructing the

Naugatuck River Greenway (NRG) Trail. Five sections totaling 4.1 miles have been completed. The impact study can be reviewed at: http://s.uconn.edu/3l7 - and is being used by UConn and our partners to educate stakeholders and the public on the value of the project.

A new project, the Connecticut Trail Census, was started in partnership with UConn Extension's Center for Land Use Education and Research, and the Naugatuck Valley Council of Governments. Trail censors were placed at 11 locations throughout the state. Volunteer training and data tabulation will occur during the next reporting period.

Results

A report by the Outdoor Industry Association estimates that 61% of Connecticut residents participate in outdoor recreation each year, generating $6.9 billion in consumer spending, 71,000 direct jobs and $502 million in state and local revenue (Outdoor Industry Association, 2013).

Connecticut residents spend a total of $353,489 annually on trail based recreation and $704,067 on bicycle based recreation. In addition, potential monetary benefits include jobs added in the 11 greenway towns, increases in property values estimated at $41-50,000 per property, depending on location; and, by extension, property tax revenue, and recreational expenditures by trail users. Non-monetary benefits include health benefits due to increased physical activity, and preservation value due to the conservation in perpetuity of the greenway as open space.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Economic factors continue to challenge partner organizations in this planned program area. External grants and partnerships among Extension programs have allowed educators to work through external factors and continue demonstrating outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The People Empowering People program, in partnership with the Center for Applied Research in Human Development (CARHD) administered a questionnaire to all participants before programming began (i.e. pre-test) and after programming finished (i.e. post-test). The pre-test questionnaires contained close-ended questions to measure self-assertive efficacy, sense of mastery, parental satisfaction, family problem-solving communication, and community engagement. The post-test questionnaires included the same questions as

the pre-tests, as well as open-ended questions that asked participants about their overall satisfaction and feedback about the program. Based on the data, CARHD assessed the effectiveness of the programs.

Key findings from the analyses of the close-ended questions were that UConn PEP participants:

1) Showed significant positive changes on self-assertive efficacy and sense of mastery.

2) Showed significant positive changes on parental satisfaction and family problem-solving communication.

3) Showed significant positive changes on community engagement.

4) Overall were very satisfied with the program.

Responses to the open-ended questions indicated that participants found the program to be useful and helpful. They felt that the community project was beneficial to the surrounding communities and provided an opportunity to be involved in their community. Overall, the participants showed improvement in all three targeted areas (individual assets, parent/family relationships, and community engagement) following completion of the program.

Key Items of Evaluation

Evaluation for the multi-use trail program is ongoing, as this is a new program. To date, focus group interviews have been conducted in the 11 towns that the Greenway runs through. Future evaluation will include results from the Connecticut Trail Census, as these will dictate next steps for the project. Focus groups will be re-convened based on the trail census results.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
12011	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)	
170	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.