

2018 University of Rhode Island Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

In this report we describe the activities and impacts of programs associated with the Rhode Island Agricultural Experiment Station (AES) and Rhode Island Cooperative Extension (Extension). These are collectively referred to as the land-grant programs at the University of Rhode Island (URI). The AES and Extension are collaborative elements within the College of the Environment and Life Sciences (CELS) at URI. Administrative oversight of the AES and Extension is provided by the Dean of CELS. Day-to-day management of the land-grant programs is provided by the Associate Dean for Extension and Agricultural Programs and Associate Dean for Research. The programs and projects supported within URI's land-grant portfolio span a wide range of disciplines, from the natural sciences to the social sciences. URI's land-grant programs are focused around a portfolio of five programs. They are as follows: 1) Food Safety and Nutrition; 2) Sustainable Energy, Climate Change and the Environment; 3) Food Production and Sustainability; 4) Youth, Families and Communities; and 5) International Programs. The AES and Extension are integral components of the mission of the College and the University. The collaborative relationship with our federal partner, NIFA, has enabled our scientists, staff and students to leverage additional resources that provide contemporary knowledge, essential services, and innovative programming for all Rhode Islanders.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	36.0	0.0
Actual	16.4	0.0	15.7	0.0

II. Merit Review Process

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

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

2. Brief Explanation

Extension completed a comprehensive strategic planning process in FY 2017. The strategic plan may be viewed or downloaded from the Extension web portal (<https://web.uri.edu/coopext/>). Members of the strategic planning committee, which combined internal and external experts, examined current Extension programs for impact and relevance as they developed goals and objectives for the strategic plan. Goals

and objectives from the new plan will be reflected in URI's next Plan of Work, which will be submitted to NIFA in 2019. We will also design and implement an evaluation process to document evidence of program merit. Extension programs are integrated with ongoing university research to provide the most rigorous, up-to-date information to program participants and beneficiaries. Experiment Station-funded research projects undergo institutional peer review prior to submission to NIFA for review and approval. This multiple-step process includes an assessment of the project's fit and relevance to the Plan of Work, an evaluation of the technical merit of the proposed work, and consideration of how well the peer reviewer's comments were addressed in the final proposal. Faculty joining multi-state projects participate in a modified process through which their work is evaluated by the Director for relevance to the Plan of Work, and by leaders of the multi-state project for technical merit and relevance to the goals of the project.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals

Brief explanation.

Stakeholder input was captured through a variety of mechanisms throughout the year. Stakeholder feedback was sought after most Extension workshops and meetings to ensure that our programs were meeting stakeholder needs. Research faculty routinely presented the results of their work to interested industry and community groups (as well as the academic community) and used feedback from those groups to inform their future research directions.

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

1. Method to identify individuals and groups

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

Brief explanation.

CELS hosts three committees that play a role in identifying individuals and groups who are stakeholders and in collecting input from them. Two of those committees, the Research Committee and the Cooperative Extension and Outreach Coordinating Committee, are responsible for advising and assisting the Dean and Associate Deans in planning and reviewing programs for the college. A combination of faculty/staff and external partners serve on these committees and are expected to consider the needs of a broad set of stakeholders in formulating their recommendations. The third

committee, the Agricultural Industry Advisory Group, advises the Dean on issues related to CELS, including its land-grant programs. The College also utilizes Rhode Island's CARET representatives for stakeholder input.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

Brief explanation.

As stated previously, stakeholder input is captured using a variety of mechanisms throughout the year. These include discussions and surveys of participating stakeholders at Extension workshops and meetings, as well as discussions before, during, and after faculty presentations of their research to interested industry and community groups. Input was also collected through the discussions and work of the Research Committee, the Cooperative Extension and Outreach Coordinating Committee, and the Dean's Agricultural Industry Advisory Group. The College also utilizes input from Rhode Island's CARET representatives, who are from the green industry and the agricultural community.

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 was used to inform decisions throughout the year, including priority setting and action planning. Our researchers and Extension experts incorporated stakeholder input into their thinking, planning, and program/project development. The Dean and Associate Deans used stakeholder input to inform decisions related to budget development and staffing. All parties use stakeholder input to identify emerging issues, which can result in the redirection of research and extension programs, and the acquisition of extramural resources when available.

Brief Explanation of what you learned from your Stakeholders

Stakeholder input was used to establish five focus areas for the new Cooperative Extension strategic plan. They are as follows: 1) food systems and agriculture; 2) water resources; 3) land stewardship; 4) healthy lifestyles; and 5) energy literacy. These priorities will be reflected in Rhode Island's new Plan of Work. As reported last year, food systems and agriculture is a growing area of interest in the state. In FY 2018, URI hosted the third annual Rhode Island Food System Summit that drew hundreds of participants from government, business and community partners. URI also continues to work toward full implementation of the Rhode Island Food Center at URI, which was first announced at the 2017 Food System Summit. Please see <https://web.uri.edu/food-center/> for more information about the Food Center.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1133222	0	1610223	0
Actual Matching	1052740	0	1427229	0
Actual All Other	0	0	0	0
Total Actual Expended	2185962	0	3037452	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	76777	0	361708	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Food Safety and Nutrition
2	Food Production and Sustainability
3	Sustainable Energy, Climate Change and the Environment
4	Youth, Family and Communities
5	International Programs
6	CELS-CARES

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Food Safety and Nutrition

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
703	Nutrition Education and Behavior	17%		50%	
704	Nutrition and Hunger in the Population	17%		4%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	33%		8%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	33%		38%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	1.5	0.0	2.5	0.0
Actual Paid	0.5	0.0	1.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
53926	0	196212	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	91348	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

Food Safety:

- Implement HACCP training for RI school food service operations
- Provide HACCP and sanitation education programs to a variety of food processors
- Host an annual Food Safety Conference for public and private stakeholders
- Maintain a Good Agricultural Practices (GAP) Program for commercial growers of fruit and vegetables
- Maintain RI Food Safety Manager courses
- Develop internet-based training on Food Safety issues
- Evaluate the molecular biology of food borne pathogens.
- Develop and implement food preservation classes for consumers
- Conduct research aimed at combating microbial contamination
- Extension education to farmer market managers

Nutrition:

- Data collection.
- Fitness testing and body composition analysis.
- Survey and questionnaire completion.
- Blood analysis and dietary intake calculations.
- Facilitate partnership with diverse communities.
- Refine curricula and teacher training programs.
- Test interventional modalities for health maintenance and obesity prevention.
- Analyze data and evaluate outcomes.

Food Security:

- Assess the diet quality of targeted low-income, vulnerable populations.
- Assess the food security status of targeted low-income, vulnerable populations.
- Assess the food resource management and food safety practices of the target audience.
- Develop and implement assessment tools, curricula, print materials and social marketing campaigns.
- Evaluate the effectiveness of interventions and materials related to behavior change.
- Facilitate and strengthen community partnerships.
- Seek external funds to support program goals.

2. Brief description of the target audience

Food Safety:

Food industry and food service workers and managers, food processors, consumers, agricultural producers, home gardeners, school administrators, school-aged children and their caregivers, special needs students, teachers, community volunteers, Master Gardener volunteers.

Nutrition:

Lean and obese adults; ethnic men and women; low-income school age children and families.

Food Security:

Low-income, Food Stamp eligible and participating families, children and older adults.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3238	242678	11750	4546

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

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	3	22	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer reviewed publications

Year	Actual
2018	25

Output #2

Output Measure

- Number of abstracts published
 Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of professional training sessions offered
 Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of volunteers trained

Year	Actual
2018	155

Output #5

Output Measure

- Number of conferences hosted
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of school based training sessions completed
Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of websites developed and/or refined
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of students trained

Year	Actual
2018	100

Output #9

Output Measure

- Number of intervention studies implemented
Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of workshops completed
Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Number of scientific/professional presentations

Year	Actual
2018	28

Output #12

Output Measure

- Number of theses/dissertations completed
Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Number of public service announcements
Not reporting on this Output for this Annual Report

Output #14

Output Measure

- Number of social marketing activities
Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of fact sheets, bulletins and newsletters
Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Number of video productions
Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of social media activities
Not reporting on this Output for this Annual Report

Output #18

Output Measure

- Number of trainings or workshops (including professional, volunteer, industry, school-based, etc.) conducted?

Year	Actual
2018	825

Output #19

Output Measure

- Number of outreach resources (fact sheets, bulletins, newsletters, videos, public service announcements) written or produced.

Year	Actual
2018	14

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Improved awareness of safe food handling practices by consumers, students, educators, volunteers and/or health care providers. Indicators are number of training sessions offered and attendance at training sessions.
2	Improved knowledge of safe food handling practices among commercial growers of fruit and vegetables, food industry producers/processors, and/or food service personnel. Indicator is the number of training participants who report an increase in understanding of food safety concepts.
3	Increased understanding of motivators and barriers of making healthy food choices and the impact these food choices have on lipoprotein metabolism and metabolic syndrome in young adults. Indicator is number of publications and presentations.
4	Increased understanding and behavior change with regard to decreasing dietary intakes and increasing physical activity level, and the impact of these changes on body fat mass, physical function, and coronary heart disease risk factors in obese older women. Indicator is number of publications and presentations.
5	Improved dietary practices from baseline in one or more domains (diet quality, food security, food resource management, or food safety) in EFNEP and FSNE families and older adults. Indicator is number of people reporting improved practices.
6	Improved understanding of the molecular mechanism of bacterial cell division to improve food safety. Indicator is number of publications and presentations.
7	Improved understanding of the contributors to healthy eating among low-income preschool children, especially feeding practices. Indicators are the number of publications and presentations.
8	Improved understanding of the metabolism and evolution of <i>Shewanella</i> species to improve food safety. Indicators are number of publications and presentations.
9	Improved understanding of how factors within the food environment influence nutrition-related outcomes. Indicators are number of publications and presentations.

Outcome #1

1. Outcome Measures

Improved awareness of safe food handling practices by consumers, students, educators, volunteers and/or health care providers. Indicators are number of training sessions offered and attendance at training sessions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Improved awareness of safe food handling practices by consumers, students, educators, volunteers and/or health care providers is addressed by this work. Food safety issues concerning food commodities keep evolving, and information to target audiences requires continuous implementation and updating. The "local" food movement has continued to foster interest in home food preservation as well as increasing food safety concerns. Finally, issues related to quality and safety regarding all food commodities, as well as new food products, need to be addressed.

What has been done

The general public, students, volunteers, and to a lesser extent healthcare professionals and educators, were targeted through a variety of venues offered such as, but not limited to, hands-on preservation workshops, volunteer training and the seafood cook-off. Additional student involvement came via classroom guest lectures/reviews. Finally, the URI Food Safety website was completely updated and most page views appeared to be related to consumer-related topic information. In addition, data analysis for research to assess RI consumer knowledge and attitudes toward RI local seafood was fully completed and a manuscript was submitted for consideration by a peer review journal.

Results

For outreach activities, learning changes are revealed in any evaluations that were conducted as learners self-assess either knowledge gained and/or usefulness of training. Learning changes related to student classroom interaction are not evaluated; however, the questions asked are often an indicator of insight into the subject information and comprehension. In addition,

ServeSafe review is important to student exam passing rate (23 passed out of 26). As reported in the previous reporting period, a RI Consumer survey was very successful and with N=968 respondents or 21% response rate. This survey gathered a lot of information regarding seafood preferences, attitudes and purchasing habits. Its primary objective was to assess awareness and recognition of the RI State Brand logo for local seafood: 88% did not recognize or were unsure of the brand. However, the majority of respondents indicated that a branding logo would encourage purchasing and willingness to try local seafood. Furthermore, 72% of respondents indicated that they would be willing to pay a little more if the seafood were local. Efforts were made, through discussion and presentation, to promote collaborative outreach efforts among key RI stakeholders (i.e. RI Department of Environmental Management, Food Policy Council, Seafood Marketing Collaborative, Commercial Fisheries Center) regarding local seafood.

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 #2

1. Outcome Measures

Improved knowledge of safe food handling practices among commercial growers of fruit and vegetables, food industry producers/processors, and/or food service personnel. Indicator is the number of training participants who report an increase in understanding of food safety concepts.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This is to address improved knowledge of safe food handling practices among commercial growers of fruits and vegetables, food industry producers/processors and foodservice personnel. There is a need for food safety information and training opportunities throughout the diverse RI

community of farmers, processors and foodservice/food industry personnel as well as regulatory personnel. Federal and state food safety regulations mandate specific training so that the RI industry can be in compliance. Newer federal regulations, specifically FSMA rules such as the Produce Safety Rule and Preventive Controls for Human Food, require outreach efforts to prepare producers/processors for compliance and implementation per regulatory mandate or buyer requirements, particularly smaller farms and entrepreneurs. Participation in voluntary food safety programs (i.e. Good Agricultural Practices for farmers) is becoming an expectation for businesses and non-profits. This program has regional impact for training and will for the future for all commodities - seafood, meat/poultry, fresh fruits/vegetables and all other processed commodities.

What has been done

As trained supervisory/lead instructors for FSMA Produce and Preventive Controls for Human Food Rules and Seafood and Meat/Poultry HACCP rules, members of the Food Safety Education Program are able to deliver required and requested educational workshops with help of the food safety network in the Northeast. Training sessions and workshops are being offered, in collaboration with our southern New England food safety colleagues, for 1) RI GAP voluntary on-farm food safety and Produce Safety Alliance (PSA) training (for produce rule compliance) farmer training; 2) Preventive Controls for Human Food for regulatory compliance for processors; and 3) Seafood and Meat/Poultry processors for regulatory compliance. We have also served food service personnel with the annual Food Safety Task Force Conference and food service training when requested. Resources/presentations on food safety for Farmers Market managers and vendors are ongoing.

Results

A survey targeting food processors/manufacturers working at shared-use processing facilities (e.g., incubator kitchens and commercial kitchens) was developed and implemented as part of a USDA funded project with UMass. The results of the survey will guide the development of a curriculum for the target audience regarding food safety controls for processed food products. The survey is still open to collect responses. The survey was designed to assess the demographic information of the food businesses, their knowledge of and attitudes toward food safety and food safety-related training needs. Preliminary data show that respondents are making a variety of food products and selling through a diversity of channels. A majority of respondents appear to have implemented food safety practices (both written protocols and implemented practices) but responses are still too low to make conclusions. While knowledge does not meet mastery (80%), overall knowledge was higher than expected and attitudes toward food safety appear to be good. Survey responses are low and efforts are currently underway to improve the response rate. Outreach efforts have been extremely successful in participation and evaluations. Furthermore, these outreach efforts, teaching standardized, national curricula, are critical to target audiences who need to comply with FDA, USDA and state regulations.

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 #3

1. Outcome Measures

Increased understanding of motivators and barriers of making healthy food choices and the impact these food choices have on lipoprotein metabolism and metabolic syndrome in young adults. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This project is part of the multi-state project NC1193. The long-term goal of this project is to promote healthful eating to prevent excessive weight gain in young adults by identifying environmental and behavioral contributors that may assist in primary prevention of excessive weight gain.

What has been done

We continued to develop the environment and behavioral instrument as well as refine and validate the Healthy Campus Environmental Audit and Behavior Environment Perceptions Survey for college campuses. We adapted and tested the environment and behavior instruments in low-income communities. We developed and piloted the novel and comprehensive Healthy Community Index on college campuses and adapted it for use in low-income communities.

Results

The initial version of the Behavior Environment Perceptions Survey for college campuses has been developed and psychometric evaluation completed indicating the instrument is reliable and valid. Validity testing and additional cognitive testing are continuing but we anticipate submitting an instrument development manuscript in the coming year. The instrument development work for low income communities has started. Development of the Index is progressing.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
703 Nutrition Education and Behavior

Outcome #4

1. Outcome Measures

Increased understanding and behavior change with regard to decreasing dietary intakes and increasing physical activity level, and the impact of these changes on body fat mass, physical function, and coronary heart disease risk factors in obese older women. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our multi-state project seeks to improve the health trajectory of older adults. The older adult population is the fastest growing population in the U.S. and more research is needed to keep them healthy and independent to reduce public health care costs.

What has been done

This year we have focused on publications to identify research gaps.

Results

We have identified research gaps and possible external funding opportunities.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
703 Nutrition Education and Behavior

Outcome #5

1. Outcome Measures

Improved dietary practices from baseline in one or more domains (diet quality, food security, food resource management, or food safety) in EFNEP and FSNE families and older adults. Indicator is number of people reporting improved practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Adult, adolescent and child statistics in RI indicate that nutrition education is needed to improve obesity-related chronic disease. One-fifth of RI adults consume vegetables less than one time daily and 35% consume fruit less than one time daily. Only half achieved recommended weekly physical activity, and in 2016 35.5% of RI adults were overweight and 27% were obese. Almost 40% of RI adolescents consume vegetables or fruits less than one time daily, and only a quarter met the recommended amount of physical activity. RI has the 5th highest overweight and obesity rates for children aged 10-17 with 16.8% overweight and 10.7% obese. Young children in RI eligible for WIC had an obesity rate of 16.7%. An analysis in 2016 of electronic medical records for children in Providence under age 18 indicated obesity rates for the following child age ranges: 24% of children ages 2-5, 30% in ages 6-11, and 25% ages 12-17. Hispanic children accounted for 78% of patients served in this cohort and 27% were obese. By encouraging this population to adopt healthy eating behaviors, the risk of obesity and its related diseases will be reduced resulting in better health across the lifespan.

What has been done

EFNEP provides free nutrition education to limited-resource individuals and families throughout the state of RI. Children (5-18 years old) and families with children (under 18 years old) are the primary audience. EFNEP uses a holistic nutrition educational approach. Adult participation should result in individuals and families experiencing improvements in four core areas (diet quality and physical activity, food resource management, food safety, and food security). Families receive a once a week for nine-week hands-on program that is conducted at schools, job training sites and community centers. Trained paraprofessionals deliver the series program to the community. Children in the school setting receive a six-week activity-based learning experience to

positively influence both their own and their family's food choices.

Results

A total of 116 adults completed both baseline and post-assessment questionnaires. Results from the four core areas include:

- 88% of participants showed improvement in one or more diet quality indicators
- 75% of participants showed improvement in one or more physical activity behaviors
- 70% of participants showed improvement in one or more food safety practices
- 47% of participants showed improvement in one or more food security indicators
- 77% of participants showed improvement in one or more food resource management practices

A total of 1193 children and youth completed both baseline and post-assessment questionnaires. Results show:

- 75% of children and youth gained knowledge or improved their abilities to choose foods according to the dietary recommendations.
- 26% of children and youth improved their physical activity practices or gained knowledge of physical activity practices.
- 43% of children and youth use safe food handling practices more often or gained knowledge of safe food handling practices.
- 29% of children and youth improved their ability to prepare simple, nutritious, affordable food or gained knowledge of how to do this.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #6

1. Outcome Measures

Improved understanding of the molecular mechanism of bacterial cell division to improve food safety. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Humans are susceptible to a plethora of microbial diseases from pathogenic bacteria. One important source of pathogenic bacteria is the food supply, including food sources, agriculture and production environments. It is essential that the mechanisms that control bacterial cell proliferation are understood to effectively target those mechanisms for disruption using new technologies.

What has been done

The molecular mechanism of bacterial cell division was investigated by monitoring specific protein interactions and by performing functional analyses in reconstituted cell-free systems. In live bacteria, the architecture of the division machinery and the roles of key cell division proteins in remodeling that architecture was investigated.

Results

We have discovered that interactions among several cell division proteins are critical for maintaining the architecture and dynamics of the division machinery. The discovery of these processes uncovers new strategic targets for the development of novel antimicrobial technologies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #7

1. Outcome Measures

Improved understanding of the contributors to healthy eating among low-income preschool children, especially feeding practices. Indicators are the number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This work is helping to inform an intervention to improve the diet quality of diverse preschool children and their families. This can help prevent chronic diseases.

What has been done

We have conducted three focus groups with parents of preschool-aged children.

Results

We have conducted focus groups; initial themes include the following: Description of family meals: Families are busy and dinner time is hectic; breakfast is easier for most. Many caregivers fear the child being hungry/ going to bed hungry. They want children to eat; some focused on healthy foods but some just food. Coercive strategies are prevalent (spoon feeding, offering food/drink/screen rewards, clean plate rules) with caregivers describing they are more worried about child eating and sitting for meals than they are about having time/money to prepare foods. Moms want to cook meals and have the whole family sit down and eat the same food but some don't think it's possible so they often prepare separate meals. Screens are often present at meals which some parents acknowledge is a distraction but some feel it helps child eat more. Response to intervention: Most caregivers were very positive about the intervention. We need to consider extended family structure. Moms reported wanting help on how to communicate information to other caregivers. Grandmothers feared they would not be able to use the technology for the meal recording. Most did not seem to understand the appetitive trait question but overall like the idea of tailored materials. All would be willing to do the video and saw the value in it but felt it may be embarrassing or their children may become too distracted by the phone. Also felt that culturally relevant foods would be important to them. All felt like there is an information overload with email and text. They do not want email. They do like text messages 1-2 x/week and not on Mondays. All wanted paper materials and liked the graphics on the sample. Expressed desire to connect with other moms. Two groups suggested in-person workshops but acknowledged busy schedules. Like the idea of a facebook page. Also want activities to help get kids involved.

Demographics:

60% Hispanic, 46% Black
39% some college or higher
46% WIC, 69% SNAP
31% Food insecure

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #8

1. Outcome Measures

Improved understanding of the metabolism and evolution of Shewanella species to improve food safety. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Shewanella is a diverse group of microorganisms that widely occur in soil and water, and are often associated with the spoilage of meat and milk products. It is not clear how this group evolves and what leads to the emergence of pathogenicity. Using computational modeling, in this project we will simulate the evolution and metabolic diversity of Shewanella. Through this project, we expect to develop new methods for the detection and prevention of Shewanella contaminants in meat and agricultural products.

What has been done

During the past year, we focused on developing computational technologies for analyzing the metabolism and genomic evolution of Shewanella and extending the application of our tools into analyzing species from all three domains of life. Some of the new organisms we analyzed included the aphid insect, which is a pest species for crops in agricultural production. By applying our newly developed technology to aphids, we aim to understand key molecular pathways for intervening with aphid metabolism and potentially leading to new pest control approaches. We have also performed a global evolutionary analysis of all bacteria on a protein called ComEC that contributes to the acquisition of novel genes and functions among diverse bacteria. This would lead to a better understanding of the evolution of metabolic activities.

Results

The results of the ComEC protein study are now in press in the journal *Frontiers in Microbiology*. We are in the process of constructing draft models for several aphid species, and these preliminary data have led to a recent grant application to the Human Frontier Science Program. These new developments reflect a broader application of our computational tool development and could bring new opportunities for analyzing other critical species in food production and food

safety.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #9

1. Outcome Measures

Improved understanding of how factors within the food environment influence nutrition-related outcomes. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

I conducted this work to better understand key social determinants of health and their role in influencing diet quality. Diet is the leading risk factor for morbidity and mortality in the U.S. and better understanding these determinants may help improve population health.

What has been done

My research program investigates social determinants of diet quality in large population cohorts as well as through environmental assessment. To do this, we analyze survey data to better understand how various factors (e.g. socioeconomic status, race/ethnicity, participation in nutrition assistance programs, or the food environment) influence diet.

Results

Many projects are in the early stages (i.e. we are analyzing the data), but we have submitted abstracts of preliminary results to the American Heart Association Epi/Lifestyle conference, and one manuscript is under review at the Journal of Nutrition Education and Behavior. Preliminary results indicate that disparities in the diet quality of grocery purchases reflect individual-level trends and vary based on socio-demographic factors. This analysis highlights the

interrelationships between SNAP, food insecurity, race/ethnicity, and obesity within a household, demonstrating how the co-occurrence of risk factors may modify associations with diet quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome 1: Unfortunately, volunteer training was not evaluated this reporting period as in others. Participants taking the "hands-on" preservation and demonstration classes rated them 4.8+/- 0.1 (N=13 and 7) and 4.8+/-0.4 (N=20) as a self assessment for overall knowledge gained and usefulness of the workshop in addition to any comments.

Outcome 2: The results of the evaluations reflected that training to the target audiences has been very successful. For Seafood HACCP training, 45 evaluations (out of 63 participants) rated understanding of key concepts and usefulness at 4.56-4.71 on a scale of 5. For the combined RI-GAP/PSA training for farmers, 49 evaluations (out of 53 participants) rated knowledge gain, implementation and instructor effectiveness at 4.5-4.9 on a scale of 5. Finally, Retail HACCP industry participants rated the class 4.3-4.4 on a scale of 5.

Key Items of Evaluation

URI Food Safety training programs are effective and considered valuable by participants.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Food Production and Sustainability

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	21%		0%	
135	Aquatic and Terrestrial Wildlife	7%		0%	
205	Plant Management Systems	36%		25%	
212	Diseases and Nematodes Affecting Plants	4%		3%	
215	Biological Control of Pests Affecting Plants	2%		5%	
216	Integrated Pest Management Systems	16%		5%	
302	Nutrient Utilization in Animals	4%		3%	
305	Animal Physiological Processes	3%		3%	
307	Animal Management Systems	4%		9%	
311	Animal Diseases	3%		16%	
605	Natural Resource and Environmental Economics	0%		6%	
606	International Trade and Development	0%		6%	
609	Economic Theory and Methods	0%		13%	
610	Domestic Policy Analysis	0%		6%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	10.0	0.0
Actual Paid	2.9	0.0	3.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
277365	0	312721	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
331641	0	283992	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 activities are described for the areas in the Food Production and Sustainability program.

Aquaculture and Fisheries

- Develop and share strategies to create sustainable fisheries.
- Conduct training programs for key stakeholder groups.
- Perform applied aquaculture research.

Health and Well-being of Livestock

- Examine the role of nutritional factors on the immune system function in livestock.

Community Gardening

- Extension education for community decision makers, agricultural, residential and engineering/regulatory community will be conducted.
 - Outreach to school children and to the urban population center in the state.
 - Establish demonstration sites for research and Extension programs.
 - Develop and disseminate publications, fact sheets, and web sites.

Agriculture/Horticulture

- Study and promote commercial farm viability.
- Develop and deliver training for green industry professionals and gardeners emphasizing the use of plants that require less water, labor, nutrients, and pesticides.
 - Expand markets for resource-conserving products.
 - Reduce pest-induced damage to horticultural and forest plants, while maintaining environmental quality by minimizing the use of agrochemicals.
 - Develop novel non-chemical methods of controlling invasive plant species.

Economics, Markets and Policy

- Evaluate economic and market factors in fisheries and aquaculture management.
- Develop behavioral economic models to predict interaction with federal policy and statistical methods to facilitate agricultural economic research.
- Evaluate the effects of financial management on agricultural operations.

2. Brief description of the target audience

The target audiences are described for the areas in the Food Production and Sustainability program.

Aquaculture and Fisheries

The RI and New England aquaculture industry, RI State Aquaculture Coordinator, the fishing industry, producers and distributors, scientists and researchers, the RI Department of Environmental Management and Coastal Resource Management Council, and policy makers

Health and Well-being of Livestock

Livestock farmers in the Northeast and 4-H youth

Community Gardening

Community and public decision makers (local, state and federal agencies); general public; agricultural producers; residential and engineering/regulatory community members; school aged children; urban populations; municipal planners; private sector firms engaged in watershed management, landscaping, onsite wastewater treatment and private wells; various NGOs (land trusts, environmental organizations)

Agriculture/Horticulture

Agricultural producers of fruits and vegetables, turf grass and ornamental plants, the RI Department of Environmental Management (RI DEM) Division of Agriculture, the RI Nursery and Landscape Association (RINLA) and the New England Sod Producers Association; local nurseries; the RI Golf Course Superintendents Association; nurserymen, landscapers, tree farms and arborists; the Rhode Island Greenhouse Growers Association; the RI Farm Bureau; the New England Nursery Association and New England Floriculture, Inc.; the New England Regional Turfgrass Foundation (NERTF); and individual golf course superintendents and sod producers throughout Rhode Island.

Economics, Markets and Policy

Fishers, environmental economists, and policy makers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	50160	1531985	28808	75100

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

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	6	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer reviewed publications

Year	Actual
2018	6

Output #2

Output Measure

- Number of books and monographs
 Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of abstracts published
 Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of conference proceedings published
 Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Number of technical documents, fact sheets, bulletins and newsletters produced
 Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of training manuals (includes instructional CD's) produced

Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of scientific/professional presentations

Year	Actual
2018	31

Output #8

Output Measure

- Number of workshops (including short courses) completed

Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Number of conferences hosted

Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of websites developed and/or refined

Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Number of public presentations

Not reporting on this Output for this Annual Report

Output #12

Output Measure

- Number of public service announcements

Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Number of students trained

Year	Actual
2018	178

Output #14

Output Measure

- Number of theses/dissertations completed
Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of biological control agents released
Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Number of new germplasms developed
Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of trainings or workshops (including professional, volunteer, industry, school-based, etc.) conducted

Year	Actual
2018	569

Output #18

Output Measure

- Number of volunteers trained

Year	Actual
2018	1815

Output #19

Output Measure

- Number of outreach resources (fact sheets, bulletins, newsletters, videos, public service announcements) written or produced.

Year	Actual
2018	84

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased understanding of immunity and muscle growth in aquacultured species. Indicators are number of presentations and publications.
2	Growth of Rhode Island's shellfish aquaculture industry. Indicators are number of farms, number of farmers employed and farmgate value of the aquaculture crops.
3	Improved strategies for parasite control in small ruminants. Indicator is new, sustainable non-chemical methods of parasite control.
4	Rhode Island citizens adopt sustainable gardening practices. Indicator is number of people reached through the URI Master Gardener program.
5	Food insecure populations in Rhode Island learn to grow their own food. Indicator is number of successful school and community gardens created and supported.
6	Students in grades K-5 increase their knowledge and skills about the environment, horticulture and science. Indicator is number of students trained.
7	Rhode Islanders implement best practices for composting at their homes. Indicators include number of people who complete URI Master Composter training; number of trained URI Master Composters who report intent to implement composting best practices; and number of public education hours completed by URI Master Composters.
8	Improved understanding of landscape management practices related to invasive plant removal for biodiversity and habitat protection in Rhode Island. Indicator is number of green industry, environmental and regulatory professionals trained.
9	Increased understanding of economic and market factors in fisheries and aquaculture management. Indicators are number of publications, presentations, and stakeholder meetings.
10	Rhode Island homeowners plant native trees, shrubs, and grasses. Indicator is number of native trees, shrubs and grasses identified and improved for homeowner use.
11	Improved management tactics for control of plant-parasitic nematodes. Indicators are number of publications, presentations, and stakeholder meetings.
12	Increase knowledge about agricultural finance and risk management, including the role of Federal farm policy, commodity markets, and farmer risk management choices. Indicators are number of publications and presentations.
13	Improved understanding of biophysical and geochemical factors affecting shellfish-seaweed integrated multi-trophic aquaculture in Rhode Island. Indicators are number of publications and presentations.
14	Improved biological control of arthropod pests and weeds in the Northeast. Indicators are number of publications and presentations
15	Improved understanding of mechanisms to reduce antimicrobial resistance in food animal production systems. Indicators are number of publications and presentations.
16	Improved understanding and control of crop damage by green iguanas in Puerto Rico. Indicators are number of publications and presentations.

17	Improved understanding of molecular mechanisms involved in conferring resistance to ribosome-targeted antibiotics. Indicators are number of publications and presentations.
18	Increased regional food security through intensive urban food production. Indicators are number of publications and presentations.
19	Viability of agriculture in the state of Rhode Island and in southern New England is strengthened. Indicators are number of training sessions conducted that address issues related to sustainable agriculture, value-added products and/or agri-tourism and percentage of participants that report intent to implement new ideas, behaviors or practices.

Outcome #1

1. Outcome Measures

Increased understanding of immunity and muscle growth in aquacultured species. Indicators are number of presentations and publications.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Growth of Rhode Island's shellfish aquaculture industry. Indicators are number of farms, number of farmers employed and farmgate value of the aquaculture crops.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Improved strategies for parasite control in small ruminants. Indicator is new, sustainable non-chemical methods of parasite control.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Gastrointestinal nematodes (GIN), especially *Haemonchus contortus*, limit small ruminant (SR) production on pasture. All grazing SR become infected with GIN by ingesting larvae on pasture. The species responsible for the majority of parasite induced deaths in small ruminants in the eastern U.S. is *Haemonchus contortus* (barber pole worm), a blood-feeding abomasal parasite that may cause fatal anemia. Drug resistance to GIN, especially barber pole worm continues to increase for all available dewormers. There is a toolbox of alternative methods of parasite control for small ruminant producers. One of the newer areas that has shown promise is the use of natural plant products with deworming activity - such as the pasture forage birdsfoot trefoil, as well as cranberry vine. Another tool underutilized by producers is factoring innate parasite resistance into their breeding decisions. The overall goal of our research is to identify alternative anti-parasitic plant compounds as well as factoring parasite susceptibility into breeding decisions and promotion of the National Sheep Improvement Program (NSIP) to seedstock producers interested in generating estimated breeding values targeting superior performance traits and parasite resistance.

What has been done

In addition to face-to-face integrated parasite control (IPC) workshops, efforts continued in the advertisement and administration of the online training of small ruminant producers on best management practices for IPC that included FAMACHA® training and certification, valuable tools for the detection of barber pole worm infection in sheep and goats. Additionally, workshops were conducted in conjunction with the National Sheep Improvement Program to educate interested producers on the program, which enables producers to factor parasite susceptibility into breeding decisions and use estimated breeding values to balance parasite resistance with other important production traits. Extension outreach has been conducted with producers, professionals and organizations through electronic listservs, the project Facebook page and website (widely shared), and through distribution of project post cards. Expansion of current research evaluating the anti-parasitic effects of cranberry vine on gastrointestinal nematode infection in lambs continued.

Results

109 new participants began the online training program with 60 completing it and receiving certification for a 55% completion rate. Participants live among 39+ states and 4 Canadian provinces with the highest participation being from NY, MO, Ontario Canada, TX, VT, FL, MA, MD, and PA. The online presence has generated inquiries from veterinarians who have obtained more information and resources to train, certify and provide FAMACHA cards to clients. We have also had interest in group participation in the form of a facilitated workshop, or within a 4-H club or student class. Producers, students and professionals participated in four integrated parasite control workshops (CT, MA, VT); and in seven workshops that provided detailed information about the NSIP program and the benefits and resources available to producers as part of enrollment and membership. In addition, presentations on integrated parasite control and selective breeding for parasite resistance were emphasized. These workshops were conducted in CT, MA, ME, NH, RI and VT. At least two producers enrolled in the NSIP program as a result of project workshops and outreach, another is in progress, at least 12 producers are planning to enroll, and at least six producers are utilizing or plan to utilize NSIP breeding stock. Seventeen producers (10 NSIP members) collected and submitted 804 fecal egg count samples for analysis to help identify animals with parasite resistance. Participating producers are adopting or

improving on-farm parasite control strategies, as well as gaining new knowledge and attitudes about parasite control. Work continued on the in vivo characterization of the possible anti-parasitic effects

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases

Outcome #4

1. Outcome Measures

Rhode Island citizens adopt sustainable gardening practices. Indicator is number of people reached through the URI Master Gardener program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The URI Master Gardener Program (URIMGP) creates a more informed public, enabling people to be better stewards of their private property for the benefit of human health and environmental quality. This program reaches over 30,000 individuals each year with unbiased, science-based information by creating a network of specially-trained volunteer educators. This addresses the societal issue of the spread of misinformation and lack of connection to the natural world. By encouraging environmentally-sound gardening practices, this program addresses the environmental issues of habitat and biodiversity loss, the spread of invasive species, and stormwater pollution.

What has been done

The URIMGP educates public audiences through various methods including through workshops, the gardening hotline, demonstration garden projects, informational and soil testing booths at events, and large outreach events such as the Project Open House and Gardening Symposium. These educational services are free and open to public audiences and are held throughout Rhode Island and surrounding communities. Many of the educational programs engage special populations including military veterans, food pantry clients and children and adults with developmental disabilities. In addition, the URIMGP educates youth through the school garden mentor initiative to support the use of outdoor spaces as authentic learning environments. The audience for this effort are the teachers, administrators, parents and school children grades K-12 in over 60 public and private schools in Rhode Island and surrounding communities.

Results

The year-end survey revealed that 88% of people who interacted with URIMGP volunteers learned something new in 2018. Over 300 people completed the survey for a 20% return rate. In addition, 50% of respondents created or enhanced habitat for beneficial insects, birds and other organisms after learning from the URIMGP. Other top behavior changes included 42% now identify problems before taking action in the garden, 41% use native species, and 80% of school contacts are more successful gardening in a school setting. A number of other behavior changes have been identified, as well..

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Food insecure populations in Rhode Island learn to grow their own food. Indicator is number of successful school and community gardens created and supported.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Demand for locally produced food has increased in recent years due to consumer interest in where and how their food is grown and raised. Food security remains a major problem in Rhode Island where 12% (56,000 households) are food insecure. 53,000 Rhode Islanders seek assistance from food pantries. Additionally, a food insecure population has been identified among URI college students and graduate student families.

What has been done

The URI Master Gardener Program (URIMGP) engages in various efforts to engage and educate food insecure populations on growing their own food. Over 60 school gardens throughout the state are now supported by URIMGP volunteer "school garden mentors" who provide technical guidance, connections to curricula, access to plant donations and other support. These gardens provide authentic learning environments for over 14,000 children to learn about food growing.

Vegetable demonstration gardens host free public workshops throughout the growing season in Providence, Pawtucket, Bristol, South Kingstown, Kingston, Middletown, Newport and Warwick. Many demonstration gardens are located within community gardens to provide opportunities for informal coaching and many grow thousands (over 10,000 lbs in 2018) of pounds of produce for donation to local food pantries. These gardens provide targeted education for food pantry patrons and vulnerable populations. For example, in 2018 a new handicapped-accessible garden was established at a House of Hope residence in Warwick for formerly homeless individuals to engage them in growing and preparing healthy food with expansion planned for 2019. The St. Vincent De Paul food pantry clients who receive fresh produce grown by URIMGP volunteers visited the Roger Williams Park Community Garden in Providence for gardening classes. URI Graduate Village families, a food insecure population, were coached in their community garden and picked apples at East Farm.

This year we also began an initiative to diversify and reach new audiences with our educational services. We recruited Spanish-speaking Master Gardener educators and developed a container gardening presentation and educational materials in Spanish. We held a few pilot kiosks that educated Spanish-speaking populations at local schools and public events. We also established a relationship with the Rhode Island Food Bank and held three private workshops at food banks and other locations serving low-income residents. A container gardening demonstration was held at Ahepa Senior Housing. An additional container gardening workshop was taught in Spanish for clients of the Elmwood Community Center food pantry in Providence. Finally, we delivered thousands of seeds to Puerto Rico home gardeners and farmers through a partnership with the Jane Goodall Institute and the Seed Sort Program. We continue to evolve and bring science-based information where it is needed.

In addition to educational programming, the URIMGP connects school children and adults to resources to grow their own food. The free seed program distributed seed packets to 1948 schools, community gardens, organizations and individuals to enable them to grow fresh food. Seed starting classes taught by URI Master Gardeners were also held for seed recipients. The URIMGP greenhouse grew and donated vegetable, herb and pollinator-supporting plants to school gardens, providing educational resources and coaching during distribution.

Results

88% of survey respondents learned something new after interacting with URI Master Gardeners in 2018. 42% of clients increased the amount of food grown as a result of interacting with URI Master Gardener volunteers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Students in grades K-5 increase their knowledge and skills about the environment, horticulture and science. Indicator is number of students trained.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Overall achievement for the New England Common Assessment Program in 2017 was reported at just 29.1% for all RI public school students. Only 41% of fourth graders tested as "proficient" in science (Rhode Island Department of Education, NECAP Science Results, 2017). To help boost science proficiency in RI elementary school students, URI Cooperative Extension provides K-5 elementary schools with the opportunity to engage in hands-on environmental science explorations through URI Learning Landscape field trips in Kingston, RI.

What has been done

URI Learning Landscape field trips are an environmental education program for elementary school children that aligns activities with Common Core and Next Generation Science Standards. URI Cooperative Extension implemented a spring program for grades K - 5 at the URI Botanical Gardens in Kingston during the months of April, May and June, 2018. Learning Landscape field trips are led by URI staff, undergraduate student educators, and trained URI Master Gardener volunteers. URI staff trained a cadre of undergraduate student educators and Master Gardener

volunteers to provide environmental education lessons and hands-on activities at 8 themed "stations" for 850 elementary school children who participated in the program.

Results

As a result of Learning Landscape field trips, students were exposed to a variety of environmental topics including plants, birds, mammals and insects native to Rhode Island and their associated adaptations; soils and plant health; hydrology and transport of human-derived non-point sources of pollution; and energy sources and sinks. Each lesson topic was aligned with instructional standards in an effort to increase knowledge relative to testing requirements. In addition to student-related outcomes, teachers in attendance were provided with lesson plans to deliver in the classroom and outdoors following their field trip to reinforce concepts presented through the program and increase student success.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
205	Plant Management Systems

Outcome #7

1. Outcome Measures

Rhode Islanders implement best practices for composting at their homes. Indicators include number of people who complete URI Master Composter training; number of trained URI Master Composters who report intent to implement composting best practices; and number of public education hours completed by URI Master Composters.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Improved understanding of landscape management practices related to invasive plant removal for biodiversity and habitat protection in Rhode Island. Indicator is number of green industry, environmental and regulatory professionals trained.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rhode Island's coastal regulatory agency is charged with maintaining the quality of habitat in coastal edge environments to preserve biodiversity and promote climate resiliency for future generations. Invasive plants threaten the ecological quality and diversity of coastal areas. Much of the work conducted in coastal edge environments is done through the acquisition of permits by green-related industry and environmental professionals. The Invasive Plant Management Certification Program seeks to empower these professionals with science-based information so that their invasive plant management work enhances coastal edge environments and increases biodiversity.

What has been done

URI Cooperative Extension delivered the two-day Invasive Plant Management Certification Program on campus to 25 green industry, environmental and regulatory professionals. The training included information on best invasive plant management practices for residential and commercial properties to preserve biodiversity and increase climate resiliency. Case study examples were presented to show the principles delivered through lecture in action, and participants were encouraged to share their work examples with program organizers for distribution among those certified through the program (a broader group of over 300 individuals).

Results

Green-related industry and environmental professionals were equipped with science-based knowledge to utilize in preparation of permit applications for coastal invasive management projects that will increase biodiversity on coastal landscape through the incorporation of native plant revegetation, invasive plant removal and best practices for landscape management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #9

1. Outcome Measures

Increased understanding of economic and market factors in fisheries and aquaculture management. Indicators are number of publications, presentations, and stakeholder meetings.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The influence of genetic modification technology is expanding in the seafood industry, ranging from GM seafood (salmon) to farmed fish being fed GM-origin feed. Given the experience of GM with agricultural goods, it is inevitable that this technology will spread across the seafood product-scape. But what about the consumers' preference and reactions to GM seafood? With the new GM food labeling policy about to be in place, the analysis of consumers' demand for GM seafood is timely and has high policy relevance.

What has been done

We developed a survey with input from internal stakeholders. The survey was then published and conducted on the Amazon Mechanical Turk (MTurk) platform to solicit responses nationwide. We collected about 1,000 responses.

Results

Collected data are currently being analyzed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
606	International Trade and Development
609	Economic Theory and Methods
610	Domestic Policy Analysis

Outcome #10

1. Outcome Measures

Rhode Island homeowners plant native trees, shrubs, and grasses. Indicator is number of native trees, shrubs and grasses identified and improved for homeowner use.

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Improved management tactics for control of plant-parasitic nematodes. Indicators are number of publications, presentations, and stakeholder meetings.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This work is conducted to reduce pesticide inputs on amenity turf and improve the profitability of Green Industry growers.

What has been done

We investigated various pesticide application techniques, examined alternative chemistries and rates, and evaluated long-term effects of cultural practices.

Results

We identified new pesticides and minimal rates required to control nematode pathogens in turfgrass systems. These results were shared with Green Industry professionals via conferences, workshops, and telephone consultations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Diseases and Nematodes Affecting Plants

Outcome #12

1. Outcome Measures

Increase knowledge about agricultural finance and risk management, including the role of Federal farm policy, commodity markets, and farmer risk management choices. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The work addresses problems arising in farm business management and farm risk management.

What has been done

Conducted research in the area of improving farm risk management.

Results

The results are early stage. We have a preliminary model suggesting that farmers can be classified into "optimistic", "neutral" or "pessimistic" groups according to their forecast of future yields. We find that recent severe loss experience is the key predictor of membership in the "pessimistic" group.

4. Associated Knowledge Areas

KA Code	Knowledge Area
609	Economic Theory and Methods

Outcome #13

1. Outcome Measures

Improved understanding of biophysical and geochemical factors affecting shellfish-seaweed integrated multi-trophic aquaculture in Rhode Island. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The work addresses a need for information about sustainable aquaculture production, which leads to financial and social security for US citizens by supplying nutritious food.

What has been done

We identified potential sites where aquaculture could be implemented. We also developed a promising bioenergetics modeling approach for kelp using dynamic energy budget theory and operationalized it.

Results

We have proven that we can successfully grow kelp in Rhode Island waters in different environmental settings. This has been met with enthusiasm among current shellfish farmers and resulted in numerous inquiry emails and calls of interest from industry and other scientists in New England.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems

Outcome #14

1. Outcome Measures

Improved biological control of arthropod pests and weeds in the Northeast. Indicators are number of publications and presentations

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Classical biological control addresses the problems of exotic insects and introduced invasive plants by reuniting these pests with their natural enemies. It offers the potential for long term sustainable management of pests across widespread areas and may reduce pesticide usage.

What has been done

Swallow-wort biocontrol: research on the biocontrol agent, *Hypena opulenta*. Swallow-worts are the only host plant for this moth species, and the caterpillar feeds on swallow-wort foliage. Developed new rearing methods for *H. opulenta* to be able to conduct field release experiments. Investigated the induction of defensive chemicals in swallow-wort plants when *H. opulenta* caterpillars are feeding on the plants. Received our USDA permit to release *H. opulenta* in the US, and released approximately 2,000 larvae in cages in MA in August 2017 and 1,000 larvae into cages in RI in Sept. of 2017.

Lily leaf beetle biocontrol: Collaborated with research and outreach personnel from CT and NY to introduce three biocontrol agents for lily leaf beetle. Each year undergraduate researchers collect parasitized larvae of these biocontrol agents from RI and MA and rear them until parasitized cocoons are removed from rearing containers. These are kept overwinter in incubators, and in the spring, adult parasitoids can be sent to our collaborators for release. In 2018 we sent lily leaf beetle biological control agents to two sites in NY, three sites in CT, one site in VT, and five sites in WA.

Phragmites biocontrol: We received eggs of two species of biological control agents, *Archanara neurica*, and *Archanara geminipuncta*, from our colleague in Switzerland to begin rearing these species for our *Phragmites australis* biological control program.

Winter moth biocontrol: Winter moths were first detected in Rhode Island in 2004, spreading throughout the state by 2012. We released adult flies of a biological control agent, *Cyzenis albicans*, in Goddard Park in Warwick, RI (600 flies) in 2011. No flies were released in 2012. Approximately 2000 adult *Cyzenis albicans* were released in Bristol and Jamestown in 2013; South Kingstown and Cumberland in 2014; Lincoln and Little Compton in 2015; and Charlestown in 2017. The 2017 release followed a new protocol of placing a predator-proof cage with *Cyzenis albicans* puparia that were overwintered in peat moss. As of 2017 parasitism has been found in three of the RI release sites. In 2018 there were no additional releases made, but all release sites were monitored for parasitism. We have not received the results yet.

We also conduct outreach/implementation activities for mile-a-minute, lily leaf beetle, and knapweed biological control. In 2018 we released 5,000 *Rhinoncomimus latipes* weevils as biological control agents for mile-a-minute weed, for a total over the last eight years of over 74,000 released in 22 sites in RI. Each year we also visit and monitor both the plants and insects at each release site. We receive lily leaf beetle larvae from homeowners in RI and inform them if they have parasitoids or not, and answer email questions about control of the lily leaf beetle. For our knapweed biocontrol program, in 2018 we released 2,100 *Larinus obtusus*, biocontrol agents of knapweed. We began releasing these agents in 2015, and each year we visit each release site and monitor both the plants and insects at each release site. We have a website for the URI biological control lab, and this is a vehicle for providing outreach for all of the activities mentioned in this report.

Results

Swallow-wort biocontrol: The approval by USDA for release of *Hypena opulenta*, in addition to the successful rearing of *H. opulenta* in the URI biocontrol lab, finds us at the beginning of a highly anticipated biological control program for swallow-worts. We have a large network of cooperators in Rhode Island and throughout the northeast for biological control of swallow-worts. We have been educating stakeholders about the project and preparing for releases of *H. opulenta* in many states. In 2018 we succeeded in making releases in three states, and providing insects for releases in an additional two states. The implementation of this biocontrol program will lead to a decrease in herbicide use for control of swallow-worts in many states.

Lily leaf beetle biocontrol: Releases of lily leaf beetle parasitoids have resulted in a decrease in the lily leaf beetle populations in many neighborhoods throughout Rhode Island and Massachusetts, as reported by homeowners. Lily growers who had pulled up their bulbs due to the lily leaf beetle are now growing them again. We are also working with states like CT, NY, and WA, who have the lily leaf beetle as a new pest, and they are initiating biological control in the early stages of the infestation, which should lead to earlier management of the pest. Results from this year's experiments with *L. cheni* indicate that two of the lily leaf beetle parasitoids, *Tetrastichus setifer*, and *Diaparsis jucunda* will not parasitize the weed biocontrol agent, *L. cheni*.

Phragmites biocontrol: The host specificity work for two agents for *Phragmites australis* is complete and the Petition for release request has been submitted. We will conduct additional rearing experiments and will wait for a response from our Petition.

Winter moth biocontrol: We collect winter moth larvae each year and examine them for parasitic fly pupae. In 2014, 2015, and 2016 flies were recovered from the 2011 release in Warwick. In 2016 flies were recovered from one 2013 release site, and in 2017 they were recovered from the second 2013 release site. We anticipate good results from this project, as this fly is providing very

good control of winter moth in southeastern Massachusetts.

Lily leaf beetle outreach: We have regular interaction with stakeholders in our lily leaf beetle biological control program. Many have indicated a willingness to avoid using pesticides to control the lily leaf beetle, and to allow biological control agents to reproduce and spread and provide management of the beetle.

4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #15

1. Outcome Measures

Improved understanding of mechanisms to reduce antimicrobial resistance in food animal production systems. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Controlling bacterial diseases by alternative approaches, as opposed to antibiotics, are urgently needed because many pathogens are generating resistance to antibiotics.

What has been done

I am evaluating kinase inhibitors as potential inhibitors of bacterial pathogenesis. To identify agents that can inhibit bacterial protein tyrosine kinases, we will screen the available agents that block the function of eukaryotic protein tyrosine kinases. Even though the bacterial and eukaryotic protein tyrosine kinases are of different evolutionary origin, their chemical mechanisms are similar, and we hypothesize that some inhibitors against eukaryotic kinases will block bacterial protein tyrosine kinases. To test this hypothesis, commercially available eukaryotic kinase inhibitors will be screened for their ability to block bacterial protein tyrosine kinases and bacterial

protein tyrosine phosphorylation.

Results

This project started only recently, and we are currently cloning the bacterial protein tyrosine kinases that are known to play an important role in bacterial pathogenesis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

Outcome #16

1. Outcome Measures

Improved understanding and control of crop damage by green iguanas in Puerto Rico. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This ongoing research program is focused on assessing the impact of a pest species, the Green Iguana (*Iguana iguana*), on food production in Puerto Rico. The final goal is to quantify the economic impact this species has on agriculture and work to reduce those costs by creating targeted mitigation strategies. At a broader scope, we seek to increase food security by learning about the effects of vertebrate invasive herbivores on agriculture in the tropics.

What has been done

To address the problems that may be associated with the Green Iguana on agricultural production, we designed a project that examines the issue through multiple angles. Our project includes engaging farmers and visiting farms to get first hand reports from the stakeholders. With our outreach we have recently engaged with 10-11 year old students who are designing urban agricultural projects in their community. We did this in their school classrooms in San Juan, Puerto Rico in November of 2018. We brought them information about urban agriculture, how to

mitigate impact by the Green Iguana, and how to maintain their plots alive.

Results

At this early stage of our research, we seek to monitor the abundance of Green Iguanas on farms. We find that our monitoring efforts are markedly affected by weather conditions, with abundances varying between rainy or sunny days. As an outcome, we are working to modify our methods to better estimate Green Iguana abundances.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #17

1. Outcome Measures

Improved understanding of molecular mechanisms involved in conferring resistance to ribosome-targeted antibiotics. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Antibiotic resistance is one of the single most important health challenges we currently face, and there is every indication that this problem will increase in severity in the future. Much of this problem stems from the misuse of antibiotics in human medicine and in agriculture, with insufficient resources and effort devoted to identifying new antimicrobial agents. It is therefore imperative that we investigate the mechanism of antibiotic resistance. Fortunately, developments in the fields of genetics and structural biology have made approaching this problem more feasible than at any time in the past. The majority of antibiotics act by binding to the ribosome, the cell's factory for protein synthesis. X-ray crystallography has revealed the three-dimensional structure of the ribosome at atomic resolution and the precise mode of interaction with many antibiotics. How changes in ribosome structure, through mutation or enzymatic modification of the ribosome,

affect antibiotic binding is a relatively new but critical development in our progress to understanding and combating the antibiotic resistance problem.

What has been done

The goal of this work is to develop an understanding of the mechanism of antibiotic resistance at the molecular level. One important mechanism of resistance is the methylation of ribosomal RNA (rRNA) by enzymes called methyltransferases. While in some instances, methylation confers antibiotic resistance while in other instances, it is the absence of a naturally occurring methylation that is the basis for resistance. From the perspective of understanding antibiotic resistance, both scenarios are of clinical importance. It should be borne in mind that the molecular mechanism of methylation is independent of whether methylation confers resistance or sensitivity, and an understanding of the enzyme-substrate recognition is applicable to both scenarios. However, dissecting enzyme-substrate recognition is experimentally simpler in the latter case. We are focusing on a single rRNA methyltransferase called RsmG, which methylates a specific nucleotide residue of 16S rRNA, and whose absence confers resistance to the aminoglycoside antibiotic streptomycin. Our primary goal is to determine the mechanism by which RsmG recognizes its rRNA substrate, and in so doing, learn basic principles more broadly applicable to rRNA methyltransferases, including those conferring antibiotic resistance.

One of our experimental approaches is to carry out random mutagenesis of the chromosomal copy of rsmG. We have isolated a large number (~100) of mutants resistant to streptomycin and some of these are expected to carry mutations in rsmG. These are currently being sequenced to identify the exact nature of the mutations. In a second approach, we are carrying out systematic, site-directed mutagenesis of RsmG to identify amino acid residues involved in rRNA recognition. In order to carry out these goals, it was necessary to construct a bacterial strain in which the gene for RsmG (rsmG) has been deleted. We have also constructed a plasmid suitable for expressing RsmG in vivo. This plasmid has two replication origins, one for replication in *E. coli* used for molecular biology procedures, and one for our experimental model organism, *Thermus thermophilus*. In addition, this plasmid carries the hph gene conferring resistance to hygromycin B, allowing us to select for maintenance of the plasmid in *T. thermophilus*, and a bgaA gene encoding beta-galactosidase to monitor gene expression from this plasmid. We are now in the process of inserting the rsmG coding sequence between the bgaA and hph genes for expression. We will soon be in a position to conduct site-directed mutagenesis of rsmG to complement our experiments with spontaneous mutants.

Results

At present, most of the outcomes of our work consist of a large collection of spontaneous mutants, which will provide a critical resource in moving forward to the next phase of this project. These mutants are now being sequenced, and these should provide us with mutants bearing amino acid substitutions in the RsmG active site, and in residues important for substrate recognition. Once our RsmG expression plasmid is completed, we will be able to perform site-directed mutagenesis as planned for the second phase of this project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

Outcome #18

1. Outcome Measures

Increased regional food security through intensive urban food production. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food production faces multiple challenges/threats, including a growing global population, climate change, urbanization, and a dwindling natural resource base. Increasing local production could help to address these challenges/threats and increase the resilience of local, regional, and national food systems. State governments have established a regional goal of meeting 50 percent of food needs from local sources by 2060--the '50 by 60' plan--Rhode Island and New England as a whole are highly dependent on imports from outside the region. Making a substantial contribution to regional food goals will require a dramatic increase in production. However, urbanization and development pressures strongly constrain agricultural expansion in the state. Increasing production will require growing food on underutilized, fragmented, and sometimes marginal lands, including 230,000 acres of urban and suburban parcels according to the 50 by 60 plan. Meeting plan goals will also require maximizing production on both new and existing agricultural land.

Existing levels and practices of intensification are unknown, and no model has been developed to assess the state's production capacity under different scenarios of agricultural expansion and intensification. Furthermore, urban and suburban production environments pose unique challenges potentially limiting plant productivity and system sustainability and simultaneously offer opportunities for enhancing productivity, sustainability, and system resilience. Existing research programs have not adequately acknowledged and addressed these challenges and opportunities singly let alone from a systems perspective.

What has been done

To address this problem, we have developed a long term research project consisting of three components:

Food system mapping and modeling. ArcGIS is being used to analyze spatial data for the state of Rhode Island to identify existing and potential urban and suburban land for vegetable and fruit production. Tree cover, LiDAR, and impervious surface layers have been used to create a model that classifies undeveloped land by solar insulation level (full- and part-sun and shade). This insulation layer is being combined with other data layers, including soil classification, transportation networks, and population density and characteristics to model potential production area in the state.

Trials of polyculture systems for intensive vegetable production. Urban and suburban production can potentially be intensified, with greater total yield per unit area, through the use of vertically layered annual polycultures (VLAPs) based on traditional agroecological models. In the summers of 2017 and 2018, replicated VLA polyculture trials were conducted at URI's Gardner Crops Research Center to evaluate the productivity of polycultures of traditional ethnic crops (bitter melon-long bean, bitter melon-leafy amaranth, and bitter melon-sweet potato) relative to monocultures of the same crops.

Trial of intensive vegetable production systems for urban-scale production. In spring 2017, a replicated trial of four different production systems was launched at URI's Gardner Crops Research Center. These systems differ in soil management practices and nutrient sources but all employ a permanent raised bed design, rely on only pesticides approved by the Organic Materials Institute (OMRI) for the control of insects and fungal diseases, have no fallow period, incorporate cover crops when practicable, and rotate the same suite of crops at the same planting densities on an identical rotation schedule. The systems are based on observation of practices in common use in urban to peri-urban environments or of potential promise in enhancing the sustainability and resilience of intensive production systems.

Results

Food system mapping and modeling. Preliminary results from the solar insulation model indicate that much of the undeveloped land in the state--approximately two-thirds--is in full shade. This, of course, limits expanding conventional vegetable and fruit production without wholesale tree removal. There may be other options that preserve the tree canopy, such as silvopastoralism. Though the model is still being refined, it appears that proportionately more urban land may be in full or part sun than rural or suburban land in the state, suggesting that lack of sun may be less of a constraint in the former than in the latter.

Trials of polyculture systems for intensive vegetable production. The land equivalent rations for the polycultures indicate that the bitter melon-sweet potato and bitter melon-amaranth polycultures do overyield, by up to 60% percent. The bitter melon and long bean polyculture did not overyield, probably because of the direct competition between the two crops, which were grown on the same trellis. The cucumber and squash varieties that were included in the trial appear to be suitable for trellising, much like bitter melon. In the summer of 2019, novel vertically layered polycultures will be trialed with these more conventional varieties and underplanted with leafy, shade-tolerant groundlayer crops with mainstream appeal, e.g., spinach or chard.

Trial of intensive vegetable production systems for urban-scale production. Dunnett's test for multiple comparisons was used in R to compare the experimental treatments to the control. At

55% of the control, the total yield of all food crops in the autochthonous system was significantly lower than the control. Means for the other treatments were not significantly different from the control. The same pattern held true for the total value of all food crops when the same retail price was used for crops in all treatments.

Notably, yields for crops in all systems were similar to, to much higher than, published yields for the region, suggesting that very small plots can be highly productive. Future analyses will focus on the sustainability of these yields across time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #19

1. Outcome Measures

Viability of agriculture in the state of Rhode Island and in southern New England is strengthened. Indicators are number of training sessions conducted that address issues related to sustainable agriculture, value-added products and/or agri-tourism and percentage of participants that report intent to implement new ideas, behaviors or practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our work is performed for the purpose of supporting and advocating for Rhode Island farmers with useful, up-to-date science-based information that will enhance the economic, environmental, and social sustainability of their businesses. At most scales, agricultural enterprises operate on very thin margins, and yet they are essential to society and so, are deserving of support from the taxpayer-funded Land Grant University. At the broadest scale, the maintenance and increase in local food supply is necessary in order to minimize the carbon footprint of human civilization.

What has been done

A significant part of our everyday work is to address farm viability by assisting in identification of production problems and recommending multi-level solution approaches. We have hundreds of interactions every year which concern a broad range of crops, farm operations, and their associated and often unique problems. In fact, Rhode Island may be among the more distinctive cases in terms of its diversity of enterprises, with operations ranging from greenhouse microgreens to market gardens to vineyards to orchards to 400 acre row-crop vegetable farms. These activities take place year-round, with the greater concentration during the growing season (March through October) in the form of direct contacts with traditional stakeholders at their farms, of which there were over 300. Regular contacts with these stakeholders were also regularly maintained through emails, phone calls, and text messages. They also attended several educational meetings put on by URI Cooperative Extension.

Results

There are many issues faced by local growers that we monitor and advise on. There are also great opportunities for producing specialty crops and successfully marketing them due to Rhode Island's proximity to diverse markets. The following is a list (by no means exhaustive) of projects and ongoing outcomes of several areas of our work:

- 1) Ongoing work on foliar feeding of vegetable crops has yielded quality data, resulting in the finding that there is no evidence to support the practice when either organic or synthetic preparations are used on tomatoes. We conducted a recent New England-wide survey to determine prevalence of this practice and found it to be used by approximately 50% of growers surveyed, a surprisingly high proportion. Evidence supports eschewing this practice, which by reducing inputs, increases profit margins.
- 2) Ongoing outreach to RI urban growers continues to expand through workshops on season extension using field tunnels and soil and pest management education. Numerous direct relationships have been established and growers are now asking for access to materials for season extension, unlike the previous year.
- 3) Management of nutrients in vegetable crops is critical to production success. With increasingly common use of products allowable for certified organic practices, the knowledge gap in appropriate application rates and application timing has become apparent. Advice on use of these more complex forms of nutrients (as opposed to synthetic forms) can be commonly found on unvetted internet sites. Optimal use of these nutrient sources is an ever-evolving area of knowledge due to the complexity and local variation of soil processes. Regular communication with growers about this subject is a give-and-take and mutually educational experience. The result has been improved production and plant health, and deepened relationships with stakeholders.
- 4) Education in management practices of insect pests and disease management of vegetable crops continues to be the knowledge area in greatest demand, according to a recent stakeholder survey. Identification and management recommendations are regularly sought by stakeholders several times per week throughout the seven month growing season and are handled through direct contacts, either in person or electronically. Cultural management, biological controls and least toxic materials are recommended, unless efficacy is questionable.
- 5) Spotted wing drosophila (SWD) went from a non-pest to the pest of most concern for small fruit producers in 2012. Since 2012 we have conducted state-wide trapping for SWD and provided small fruit growers with management recommendations and current status of this yearly, devastating pest.
- 6) As some high tunnels have been in continuous use for over 10 years, there is still difficulty in using soil testing as a management tool for production success. This is particularly so for tomatoes, which is the most economically and commonly grown high tunnel crop. URI is

cooperating with other New England vegetable crop extensionists and soil labs to compile soil test, nutrient application and yield data to better understand high tunnel tomato nutrient management.

7) Vegetable crop variety selection is always a concern to growers. Varieties are trialed at the URI Agronomy farm every year and results are shared through our online publications web pages.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Outcome #14: In 2018, we encountered two unexpected difficulties with our Hypena research. The extreme heat of 2018 affected both the lab rearing and the field releases, as extreme heat increases mortality of Hypena larvae.

We believe that we achieved our outcomes as planned, but we struggle to collect completed evaluations on-site immediately following the program to affirm this assumption. Also, contingency plans for inclement weather that reduce participation numbers due to program cancellation must continue to be refined for future programming so as to avoid reduction in participation.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome #3: The majority of online and face-to-face workshop participants planned to adopt or improve at least one parasite control practice and have gained new knowledge and attitudes about parasite control.

Outcome #5: The following client testimonials were submitted from individuals who interacted with URI Master Gardeners in 2018 via the year-end survey. These quotes provide evidence that URIMGP initiatives are improving the success rates of vegetable gardeners and the health of local residents, with far-reaching consequences.

- "I belong to the Wannaknowhow Garden Club at Greene Library and to the Community Garden at Loutitt Library. I became more experienced growing veggies and

flowers in our Community Garden, which produced enough veggies to give to senior residents. I also learned a lot from the Master Gardeners and I feel competent to instruct new gardeners."

- "I have grown vegetables!!!"
- "Keep doing a wonderful program that helps inner city children learn about plants and how to tend to a vegetable garden. Also allows them to eat healthy foods from their hard work of gardening. This program also allows children to reap the benefits of patience. The students never realized how long it takes to grow vegetables, what it takes to grow their own food, and most of all the impact the weather has on growing their own food."
- "Karen helped us find plants that complement our garden and will be able to survive without much attention over summer vacation. She also gave advice on how to improve the vitality of our garden."

• "We used some of the seeds in our classroom. Students were able to take some home. Also, I used some for personal use, increasing the number of vegetables and flowers in my home garden. I loved the planting guide that came with the seeds. It was very helpful."

• "I have attended the master gardener program at the Warwick Library for the past few years and every year I learn something new. I grow vegetables for my family consumption and freeze for the winter months. This program is very popular in this area and I truly enjoy each session."

• "My questions were answered. I shared with my children who help plant our vegetable garden. URI Master Gardeners are always most helpful."

• "I work for Brown University and I had a couple interactions with URI Master Gardeners at Wellness events at work. The Master Gardeners are such valuable resources for information. I look forward to participating in various educational and hands on classes in the future."

Outcome #6: The program received high results (5 on a Likert-type scale of 1-5) from the few returned surveys. Given the low return rate, we do not know for certain if this program met its objectives based on survey results.

Outcome #8: Fifteen permits were obtained by Certified Invasive Managers for projects to restore biodiversity in coastal areas, totaling approximately 80 acres of coastal habitat.

Outcome #14: I receive many emails thanking us for conducting this research and requesting participation in our biocontrol projects.

Outcome #19: Workshop evaluations indicate that growers increased their knowledge of pest identification, scouting techniques, use of microbial inoculants, and LED lighting. Growers plan to make changes to their operations due to information learned at a previous workshop including improving tomato fertilizing, using degradable mulches, selecting carrot varieties, and considering producing saffron.

Key Items of Evaluation

The 650 active Master Gardener volunteers in Rhode Island play an important role in helping the people of our state improve their knowledge of sustainable gardening practices.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy, Climate Change and the Environment

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	2%		11%	
102	Soil, Plant, Water, Nutrient Relationships	0%		4%	
112	Watershed Protection and Management	16%		7%	
123	Management and Sustainability of Forest Resources	8%		10%	
131	Alternative Uses of Land	8%		2%	
132	Weather and Climate	10%		4%	
133	Pollution Prevention and Mitigation	20%		4%	
135	Aquatic and Terrestrial Wildlife	8%		10%	
136	Conservation of Biological Diversity	8%		6%	
605	Natural Resource and Environmental Economics	5%		17%	
608	Community Resource Planning and Development	5%		8%	
721	Insects and Other Pests Affecting Humans	3%		6%	
722	Zoonotic Diseases and Parasites Affecting Humans	2%		2%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		9%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	15.0	0.0
Actual Paid	2.6	0.0	4.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
297579	0	298682	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
276904	0	249963	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

Vector Borne Diseases

- Use surveillance data to develop new tools to pinpoint risk, both spatially and seasonally.
- Use computer models to view disease patterns in Rhode Island and to develop models for disease risk.
- Determine landscape patterns that present the greatest risk for encountering a tick bite.
- Formulate landscape plans to reduce the chances of encounters between ticks and people.
- Create a web-based decision support system. Using this system, people will be able to compile a customized risk index and then follow links that will help them devise short- and long-term disease prevention action plans.

Climate Change

Research investigations focus on watershed patterns and processes that affect the fate of nitrogen and environmental flows. Research methods include lab and field studies as well as geospatial analyses.

Extension programs create locally relevant programs focused on land and community management. In cooperation with stakeholders and partner agencies, we will identify needs and build upon successful local programs to create and disseminate new materials, tools and curricula in RI and New England. Our water quality programs will continue development, delivery, training and application of proven water quality management tools and techniques such as:

- Curricula and training on best management practices (BMPs) for conventional and alternative and innovative onsite waste water treatment
- Public outreach and training on storm water management
- Curricula and training regarding private wells
- Volunteer Water Quality Monitoring

Use geological evidence to evaluate risks from coastal hazards. Primary tools are the records of inundation that are preserved in salt marshes and coastal freshwater marshes that enable us to identify when land-level changed due to earthquakes, when tsunami and storm sediments inundated the coastline, and how sea level has risen in response to past climatic changes.

The Environment and Adaptive Agro-ecosystems

Sustaining wildlife through habitat management is a critical issue for RI. Migrating song birds require

suitable food sources to complete their migration, and coastal lands have undergone extreme changes in vegetation, potentially imperiling migration success and fecundity for many native species.

Although vernal ponds in forested watersheds provide essential habitat for a host of organisms, the fecundity of these organisms is highly linked to forest disturbance and management, requiring a careful understanding of the underlying ecology.

Invasive plants threaten the integrity of New England habitats and could affect biodiversity within the state. Research and extension programs are planned to assess invasives and develop strategies for mitigation.

Sustainable Energy

- Feasibility and implementation of energy efficiency and renewable energy technologies
- Municipal energy training for municipal officials and employees
- Climate Showcase Community conferences
- Residential Energy Education:

2. Brief description of the target audience

Vector Borne Diseases

The target audience will be diverse and will represent all Rhode Islanders, especially those at greatest risk of contracting vector borne diseases. This audience will include community members, grassroots agencies, municipal and state policy makers, home owners and educational institutions.

Climate Change

Public decision makers; policy makers; NRCS; local, state, and federal agencies; municipal planners; private sector firms engaged in watershed management, landscaping, onsite waste water treatment and private wells; NGOs (land trusts, environmental organizations, etc), agricultural producers, the public.

The Environment and Adaptive Agro-ecosystems

A mixture of public policy personnel (federal and state agencies as well as town conservation, planning and management officials), local nonprofit groups involved in land management, such as conservancies, interested and involved citizens, and private landowners and high school students (through training and participation in the Rhode Island Environthon).

Sustainable Energy

Municipal officials, building and utility managers, financial administrators, mayors/town managers, municipal employees, residential energy consumers, school systems.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	34190	40197127	3778	301200

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

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	19	19

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer reviewed publications

Year	Actual
2018	19

Output #2

Output Measure

- Number of books and monographs
 Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of abstracts
 Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of conference proceedings
Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Number of fact sheets, bulletins and newsletters
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of training manuals (includes instructional CDs)
Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of scientific/professional presentations

Year	Actual
2018	107

Output #8

Output Measure

- Number of workshops (including short courses)
Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Number of conferences hosted
Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of websites developed and/or refined
Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Number of public presentations
Not reporting on this Output for this Annual Report

Output #12

Output Measure

- Number of public service announcements
Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Number of students trained

Year	Actual
2018	112

Output #14

Output Measure

- Number of theses/dissertations completed
Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of postdoctoral scientists trained
Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Number of volunteers trained

Year	Actual
2018	404

Output #17

Output Measure

- Number of trainings or workshops (including professional, volunteer, industry, school-based, etc.) conducted.

Year	Actual
2018	163

Output #18

Output Measure

- Number of outreach resources (fact sheets, bulletins, newsletters, videos, public service announcements) written or produced.

Year	Actual
2018	65

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Improved understanding of risk for vector tick encounters and tick-borne disease. Indicator is number of tick adverse moisture events (TAME) each year.
2	Improved public understanding of how to prevent tick bites and reduce risk of tick-borne illness. Indicators include number of unique users of the TickEncounter website; number of email inquiries responded to; and number of views on TickEncounter's Youtube channel.
3	Increased capacity of practitioners to design, install, maintain and improve onsite wastewater treatment systems. Indicator is number of people receiving training.
4	Enhanced capacity to manage and protect local water quality. Indicators include number of data points added to the URI Water Watch database, data usage by regulatory agencies and citizen groups, and presentations to local organizations.
5	Private landowners adopt best practices in testing, treatment, and protection of private well water. Indicators include percentage of workshop participants that have their water tested; percentage of workshop participants who inspect their wellhead area for possible pollution problems.
6	Enhanced capacity in Rhode Island to effectively manage storm water. Indicators include number of people (public, professionals, municipal officials) attending workshops; number of municipalities using our content to educate residents; other actions taken to prevent storm water pollution.
7	Enhanced capacity to manage coastal lands and forested lands to improve habitat for song birds and other wildlife species. Indicator is number of people (wildlife biologists, land managers, the public) who attend presentations; number of people who view, download or cite reports produced by the project.
8	Natural resource managers use vernal pool soil maps for management and restoration. Indicators include number of publications, workshops, and presentations. Integrated; NE-1438
9	Geospatial information is used by government organizations, NGO's and the public for natural resource management and conservation. Indicator is number of contacts (hits) and the amount (Tb) of geospatial data downloaded from RREA-supported online data services.
10	Increased understanding of resistance and tolerance to hemlock wooly adelgid (HWA) in eastern hemlock. Indicator is number of publications, presentations, and procurement of external funding to continue/expand the work.
11	Increased adoption of energy conservation behaviors and implementation of efficiency practices by RI residents, small businesses, municipalities, school districts, water suppliers and state agencies. Indicators are number of energy audits scheduled with the local utility; number of implemented efficiency projects.
12	Upon completion of the Energy Fellows program, URI undergraduate and graduate students demonstrate increased capacity to address real-world energy issues. Indicator is number of students completing the programs.
13	Improved capacity for coastal managers to predict greenhouse gas emissions resulting from changes in nitrogen loading and coastal marsh restoration. Indicator is number of research discussions held with coastal managers and peer-reviewed publications.
14	Increased understanding of how wildlife populations may respond to ongoing climate change. Indicator is number of publications and presentations.

15	Increased understanding of how plant genome size influences competitive ability and susceptibility to herbivory. Indicators are number of publications and presentations.
16	Advance understanding of demand and supply of ecosystem services from watersheds in the rural-urban fringe at a policy-relevant scale. Indicator is number of publications and presentations.
17	Increased understanding of the economic valuation of air quality and greenhouse gas emissions. Indicator is number of publications and presentations.
18	Enhance capacity of land use managers to identify effective strategies for minimizing watershed nitrogen export. Indicator is number of publications and presentations.
19	Enhanced capacity of land trust organizations and agency personnel to manage and protect amphibian and reptile populations from the effects of forest loss and pollution. Indicators are number of peer-reviewed scientific publications and presentations to conservation organizations and at scientific meetings.
20	Enhanced capacity of land trust organizations, government agencies, and private landowners to manage and protect turtle populations from the effects of forest fragmentation. Indicators are number of peer-reviewed scientific publications and presentations to the public and conservation organizations and at scientific meetings.
21	Improve understanding of seismic hazards along the coastlines of North America to improve assessment of this hazard to coastal environments, including coastal communities and coastal agriculture.
22	Improved understanding of the factors that influence public acceptance of the Block Island Wind Farm. Indicators are number of publications and presentations.
23	Enhance understanding of the tradeoffs between alternative groundwater management regimes to improve decisions by irrigators and policymakers. Indicators are number of publications and presentations.
24	Improved understanding of the efficacy and accuracy of using small unmanned aerial systems (UAS) to map and monitor gypsy moth defoliation in hardwood forest ecosystem. Indicators are number of publications and presentations.
25	Improved understanding of tourism concerns related to installation of offshore wind farms in RI. Indicators are number of publications and presentations.
26	Improved understanding of biology, ecology, and control of emerging disease vectors. Indicators are number of publications and presentations.

Outcome #1

1. Outcome Measures

Improved understanding of risk for vector tick encounters and tick-borne disease. Indicator is number of tick adverse moisture events (TAME) each year.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved public understanding of how to prevent tick bites and reduce risk of tick-borne illness. Indicators include number of unique users of the TickEncounter website; number of email inquiries responded to; and number of views on TickEncounter's Youtube channel.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The high incidence of Lyme disease, now infecting >300,000 people each year in the United States, along with increasing rates of other dangerous tick-transmitted infections, is a critical and growing public health problem for communities--especially across Rhode Island, the rest of the Northeast, and mid-Atlantic states. In the United States, estimated costs for the impact of Lyme disease alone exceeds \$1.3 billion annually. Moreover, the tick problem in the U.S. is continuing to grow in geographic scope, scale, and costs.

What has been done

To help raise tick bite protection awareness, we managed the TickEncounter website and its Facebook, Twitter, Instagram, and YouTube social media channels. Several features of our outreach program make it unique and one of the most widely used tick and tickborne disease prevention resources in America. Perhaps the most unique aspect of TickEncounter is our focus on seasonal and geographical relevance and how that relates to tick encounter risk. We offered a Continuing Education (CE) program with certification and CE credits, currently targeting only veterinary clinics, but are making plans to expand this program to other stakeholder groups. Additionally, we conducted a high volume of more traditional outreach, including 25 TickSmart lectures and workshops to a wide variety of stakeholder groups in MA, NH, RI, MI, NY and PA with an estimated direct reach of 2,500 individuals.

Results

Our outreach work has two principal goals: to increase our reach and influence, and to change people's tick prevention behaviors leading to a healthier lifestyle. Based on more than 1200 internet survey results from multiple outreach sources, we learned that when compared to the

CDC, personal PHP, Lyme-literate physician, academic website, and family/friends, TickEncounter serves as a leading source of tick prevention information with a high level of trust.

4. Associated Knowledge Areas

KA Code	Knowledge Area
721	Insects and Other Pests Affecting Humans
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #3

1. Outcome Measures

Increased capacity of practitioners to design, install, maintain and improve onsite wastewater treatment systems. Indicator is number of people receiving training.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Onsite wastewater treatment systems (OWTS; also called septic systems) are used to treat 30% of residential wastewater in RI and they are known to contaminate ground and surface waters and contribute to eutrophication in coastal waters and shellfish closures.

What has been done

We monitored performance of 50 advanced nitrogen removal OWTS to see if they were meeting State performance standards. We evaluated groundwater levels in near-shore environments to assess if sea level rise due to climate change has impacted the OWTS in these at-risk coastal areas. We delivered 28 workshops for OWTS practitioners to get the results of our research and other related topics out to professionals. Our workshops enabled these practitioners to get continuing education credits so they can renew their professional licenses. These classes were attended by OWTS practitioners - engineers, land surveyors, system designers, public health agents, regulators, system inspectors, and soil evaluators - from RI, MA, CT and NY. Twenty-two of the workshops took place in RI and six occurred in Suffolk County, NY.

Results

Research results show variability in six tested OWTS technologies to produce effluent total nitrogen levels less than 19 mg/L as required by RI regulations, with AX20 systems being most effective and Norweco systems least effective. Testing of the nitrogen removal potential of layered soil treatment areas (STA) against control areas showed the layered STA removed 65-98% of total nitrogen, compared to 11-88% in the control. Studies of the influence of climate change on OWTS in the coastal zone indicate that current coastal community resilience plans are not adequately addressing the threats of storms or groundwater table rise with respect to OWTS, which could result in significant environmental degradation and public health risks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
112	Watershed Protection and Management
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation

Outcome #4

1. Outcome Measures

Enhanced capacity to manage and protect local water quality. Indicators include number of data points added to the URI Water Watch database, data usage by regulatory agencies and citizen groups, and presentations to local organizations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Seasonal droughts, periodic deluges, rising nutrient levels, longer periods of warm water, nuisance and harmful algae blooms (HABs) and the spread of invasive aquatic plants have increased awareness that water quantity and quality is a concern for the public, local, state and

national decision makers. Agency resources, both staff and financial, to monitor water resources in RI (and New England) are insufficient, while the need increases yearly. Monitoring is long-term, with status and trends typically not clear until at least 10 years of data have been collected, making the collection of information for effective decision-making a long-term commitment. Detecting trends and threats to local waters is increasingly becoming the responsibility of local communities and watershed organizations.

What has been done

URI Watershed Watch is the largest and premier long term (more than 3 decades) volunteer water quality monitoring and citizen science program in RI and is a model for other states and organizations. We have held multiple trainings for new and returning volunteers. This year approximately 350 citizen scientists conducted targeted ecological monitoring on ~260 locations primarily in RI, sponsored by more than 45 local organizations, measuring water clarity, temperature, oxygen content, pH and alkalinity, processing samples for chlorophyll and collecting samples for lab analyses of nutrients and bacteria during the six-month core monitoring season. Surf beaches are monitored for bacteria year-round in order to fill data gaps during the primary surf season which coincides with the off-season for beaches. Nine classroom and field trainings were provided across the state, with several additional one-on-one trainings to accommodate volunteer needs. Monitoring was conducted on sites of concern to the sponsoring organizations, exemplifying the responsiveness of the programs. Sites were 1/3 lakes or ponds, 1/3 rivers and streams, 1/3 estuaries, bays, salt ponds. We participated in the annual Save The Lakes meeting to answer questions and concerns from residents and watershed organization members about monitoring, lake and watershed ecology. In FY 2018 we made 2 large audience public presentations and held or participated in 11 workshops or short courses. We are using our relational database, which houses decades of data to quickly and easily provide program volunteers, their program coordinators, environmental and agency professionals data in a variety of forms. We use it internally for data assessments and have provided data free of charge and upon request to eleven organizations in FY 2018. In addition, in consultation with the USEPA EPA's Atlantic Ecology Division Laboratory we have converted the data into .CSV files and posted those on our website to provide immediate online access to researchers and agencies. We are active at the local to national scale in aquatic resource and volunteer-related efforts. We are on the RI DEM-DOH Cyanobacteria Task Force, providing a linkage to our volunteers and serve as a point of contact for the distribution of health advisories for posted waterbodies. We send out notifications via our list serve and post HABs advisories on our website, where we also maintain a record of each seasons' advisories so that users can better assess their own potential risk.

Results

New England boasts a number of very long-term volunteer monitoring or citizen science programs, with programs in NH, VT and ME boasting more than 35 years of existence. URI WW reached 31 years in FY 2018. With each passing year the value of the long-term data and results of water clarity, temperature, oxygen content, nutrients and bacteria levels increases. In FY 2018 almost 21,000 data points were added to our database and also aggregated and posted on the URIWW website and then distributed to sponsoring organizations as well as RI DEM & US EPA. We downloaded and sent large data sets in response to 11 specific requests, ranging from URI students to watershed groups, to municipalities to RI DEM and EPA Offices of Tribal Coordination, Atlantic Ecology Division Laboratory and Long Island Sounds Program. Regulatory agencies used the data to create and/or support regulations to protect excellent water quality as well as to document poor water quality, and to help best direct their resources. WW results are used for 303d listing of impaired waters. Extension has used monitoring results to target programs to specific geographic areas. Local groups have used the data to take action to enact local

ordinances, to promote farm and home owner awareness, and to address local runoff and erosion issues. These data are also now being used to document surface water temperature changes and to track cyanobacteria blooms, as well as deep water hypoxia and anoxia, which often results from algal blooms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #5

1. Outcome Measures

Private landowners adopt best practices in testing, treatment, and protection of private well water. Indicators include percentage of workshop participants that have their water tested; percentage of workshop participants who inspect their wellhead area for possible pollution problems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Protection of municipal drinking water receives increased attention as water suppliers are now required to test, report and treat for numerous water quality contaminants. Surprisingly, private wells, which serve 15% of the state's population, are not protected under the Safe Drinking Water Act or other federal programs. Private well owners are largely responsible to ensure that their well water is safe for them and their families to drink. These residents need to be aware of contaminant risks to their drinking water sources and how to protect against such risks. Changing property laws and regulations in the state have increased demand for well water testing and educational materials. Education and technical assistance about protecting private sources of drinking water is critical to the health and safety of families relying on private wells. Audiences include private well owners, scientists and researchers, educators, federal, state, and local policymakers, and non-profit organizations. Given the large number of Rhode Islanders (approximately 150,000) who rely on private wells, this Extension program has used a variety of methods to educate and provide technical assistance to the state's private well owners.

What has been done

The University of Rhode Island Cooperative Extension Home*A*Syst Program provides education and technical assistance to Rhode Island private well owners to help them make informed decisions to protect drinking water and human health. We partner with the Rhode Island Department of Health, the Rhode Island Department of Environmental Management, Rhode Island Association of Conservation Districts, local community boards and commissions; for example Conservation Commissions, Planning Boards, libraries, Farm Fresh RI, and other groups to provide these services. Below is a summary of our efforts for this reporting period.

Education and Technical Assistance to RI Private Well Owners

Four community workshops across the state attended by 350 private well owners. In January 2014, we began facilitated well water testing in conjunction with our workshops. Workshop participants can sign out well water test kits for the RI State Health Laboratories. One or two days after the workshop, we return to the community to pick up test kits and take them to the State Health Lab. We have continued to provide this facilitated testing as part of our educational programming. Our annual program evaluation indicates a 25% increase in the number of workshop attendees who report having their well water tested as a result of attending our workshops.

We continued the Community Intercept Campaign at RI Farmers Markets, RI Home Show and other community events in a continuing effort to meet private well owners in their own community. We provided technical assistance and educational materials to 321 people at 2 events throughout this reporting period.

Continued to update program website at web.uri.edu/safewater. Our community event calendar is posted on the website and people can sign up for workshops via our website. The Program's quarterly email newsletter was sent to 1200 private well owners quarterly during this reporting period.

Maintained an active and robust social media outreach on Facebook to build and sustain interest in program events.

Mentored Students: Including 1 graduate assistant and 2 undergraduate Coastal Fellows during this reporting period.

Provide Education and Technical Assistance to Professional Audiences

Developed and held professional training workshop for the RI Realtor's Association for professional continuing education development. Training was held on April 2, 2018 for twenty-five realtors.

Continue to work with the RI Association of Building Officials to develop and offer training to their professional membership.

Results

Each year, we mail surveys to private well water workshop attendees to determine actions they took as a result of attending the program. This is an IRB approved approach. Post workshop evaluations conducted annually show that workshop participants are taking action to protect their private well. Most notably, 78% of workshop participants had their water tested. This is an increase in the percentage of workshop participants who had their water tested as a result of

attending a workshop since we began facilitating testing at the RI State Health Lab. In addition, 77% of workshop attendees inspected their wellhead area for possible pollution problems and 68% shared workshop information with others.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #6

1. Outcome Measures

Enhanced capacity in Rhode Island to effectively manage storm water. Indicators include number of people (public, professionals, municipal officials) attending workshops; number of municipalities using our content to educate residents; other actions taken to prevent storm water pollution.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This program supports municipal officials to take effective measures to reduce polluted runoff and comply with MS4 Stormwater Management permit requirements for education and outreach and public involvement.

What has been done

We worked with state agency partners, municipalities, and the RI Green Infrastructure Coalition to organize and conduct workshops for municipal officials, storm water managers and maintenance staff and others:

10/10/17 Practical Maintenance of Green Infrastructure, Roger Williams Park, Providence RI. Included introduction to design and function of green infrastructure (GI), field tour of several bmps, field identification of weedy and invasive plants, and hands-on maintenance. Attendance totalled 49, including park maintenance staff, municipal stormwater managers and DPW staff, and designers.

9/27 Stormwater Conversations, Roger Williams Park, Providence, RI. Brief presentations on designing for maintenance by municipal stormwater managers, followed by break out sessions to discuss challenges and lessons learned in implementing GI and identify solutions. Attendance totalled 60, including municipal stormwater managers and DPW staff, and designers.

2/28/18 Managing Tiverton's Water Resources. Workshop with Tiverton municipal officials and staff focusing on local water resources and protection measures.

3/19/18 Work session with Pawtucket Parks staff to introduce planned rain gardens and wetland buffers for their input on maintenance issues. Their feedback was used to develop new inspection and maintenance guides for their use and as models for other communities, prepared by the Nonpoint Education for Municipal Officials program (NEMO) for new rain gardens and restored wetland buffer.

11/2/18 NRS 361 Watershed Hydrology - conducted field lab on design and function of bioretention systems at CBLS and Chemistry buildings, with rain garden.

Completed three parts of a four-level online training program in Soil Erosion and Sediment Control customized for RIDEM stormwater management regulations and the recently updated RI Soil Erosion and Sediment Control Handbook in partnership with StormwaterOne LLC.

Created and updated educational materials for the municipal officials and staff, agency staff, non-profit organizations, and the public on managing stormwater runoff statewide. We made these available through our project website, Stormwatersolutions.org which is the state's stormwater website for the general public, municipalities, and others. We provided methods for municipal officials to use, customize, and distribute these materials using their own communication channels to residents, applicants seeking development permits, and board and commission members. We publicized these resources via our e-news and partner's communication networks.

We responded to requests for information on water quality related to stormwater, primarily from municipal officials, and we regularly maintained the RINEMO and RISTormwaterSolutions.org websites.

Results

At least 95% of RI municipalities continued to use or customized URI educational materials to educate residents about stormwater pollution using flyers, town hall notices, adding content to their own websites or linking to ours, posting stormwater cartoons and other notices in newspaper, and sponsoring educational events and cleanups, enabling them to develop effective stormwater management programs. RI DOT has continued to demonstrate a high level of EPA compliance with public education and involvement requirements based on URI outreach. RIDOT has proceeded with online training in Soil Erosion Training for their staff, ranging from Introductory training for all staff involved in land development activities or permitting, to training for field staff, inspectors and plan preparers. Participants in workshops on GI inspection and maintenance gained practical knowledge of GI maintenance based on field tours, hands-on maintenance, and sharing lessons learned in designing for maintenance from engineering and landscape design professionals and public works maintenance staff. At least 3 nonprofit organizations involved in installing GI bmps are using inspection and maintenance templates created by NEMO.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #7

1. Outcome Measures

Enhanced capacity to manage coastal lands and forested lands to improve habitat for song birds and other wildlife species. Indicator is number of people (wildlife biologists, land managers, the public) who attend presentations; number of people who view, download or cite reports produced by the project.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Migrating song birds require suitable food sources to complete their migration, and coastal lands have undergone extreme changes in vegetation, potentially imperiling migration success and fecundity for many native species. Many forest owners, including private forest owners, land trusts, or NGOs, state and federal agencies, are interested in managing their forests to improve habitat for songbirds and other wildlife species. However, there are still many outstanding questions about the most effective methods for achieving this.

The North American woodcock population has been decreasing by about 1% per year for the past 40 years, and it is believed that this long-term trend is related to the loss and degradation of the young forest habitat it requires for its life cycle. Given that habitat management will play a critical role in the conservation of woodcock and other young forest populations, research investigating habitat selection and better estimations of population sizes on regional levels will aid in understanding the response of the species to management efforts. However, little is known about the population status and habitat selection of woodcock in Rhode Island. Thus, additional data on these aforementioned factors will help with future habitat management plans specifically in Rhode Island. Project Timberdoodle is designed to directly address these issues.

What has been done

We conducted studies on the habitat and dietary requirements of migratory birds in Rhode Island. We refined our model of habitat suitability for American woodcock that utilizes new GIS layers in conjunction with additional telemetry data, which allows us to identify properties in Rhode Island with strong potential for creation of habitat for this species. We continued our outreach program to engage land trusts and private landowners in the conservation of migratory birds and other wildlife species. Our outreach program included workshops, management of the Rhode Island Woods website, and field visits to private landowners to advise them on how to best manage their properties.

Project Timberdoodle is a Public Participation in Scientific Research (PPSR) project based in Rhode Island. The project is a collaborative effort between scientists at URI, RI DEM, and Rhode Island residents interested in science. The main goal of Project Timberdoodle is to conduct a multi-year, state-wide census of the resident woodcock population in RI to better inform forest management practices. To conduct this census, Team Timberdoodle training was held in April 2018. The first season of data was collected by URI scientists and RI volunteers from April 20-May 10th of 2018, and the second season will be conducted again in 2019 on the same days. These data will be used to inform new forest management plans.

Results

The overall outcome was increased understanding by wildlife biologists, land managers, and the general public through presentations and publications about how habitat quality and management practices affect populations of migrating song birds. Graduate and undergraduate students and research technicians conducted field experiments that determined (a) how variation in refueling rates of migratory birds at different coastal New England sites is related to fruit resource abundance, (b) the fruit preference of birds during migration, and (c) how body condition of migratory birds affected their movements at stopover sites that differed in the abundance of fruits. We further refined a model to predict habitat suitability for American woodcocks in any location of the state. We will use this model to (a) prioritize landowners for future URI outreach efforts and (b) advise state and private conservation agencies on site selection for habitat creation.

The specific research objectives of Project Timberdoodle are to (1) test whether PPSR projects help non-scientists achieve learning outcomes more effectively than standard science communication and (2) measure achievement levels of the Project Timberdoodle learning outcomes and determine whether those values vary by degree of participation.

Learning Outcomes for Team Timberdoodle: compared to their baseline values before starting Project Timberdoodle, participants will?

1. Be more likely to participate in Project Timberdoodle and other PPSR projects in future years. (Behavior & Stewardship)
2. Demonstrate confidence in their ability to understand scientific concepts and teach these skills to others (Self-efficacy)
3. Accurately explain scientific concepts important to the project such as: early successional forest, abundance, and distribution (Knowledge of the nature of science)
4. Conduct SGS with accuracy that is similar to that of scientists (Skills of science inquiry)
5. Interpret our distribution and abundance data, and develop research questions related to our woodcock study. (Knowledge of the nature of science)

This winter, we will analyze survey data to determine whether outcomes were met, to what degree those outcomes were met, and whether that varies over time and between group types.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #8

1. Outcome Measures

Natural resource managers use vernal pool soil maps for management and restoration. Indicators include number of publications, workshops, and presentations. Integrated; NE-1438

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our work is focused on vernal pool wetlands specifically understanding the hydrology, redox conditions, carbon fluxes, and hydric soil indicators. Knowing the hydrology is necessary to understand the use of the vernal pool by a range of plants and animals, several that are considered threatened or endangered. Understanding redox conditions is important in understanding several of the important wetland functions that vernal pools provide such as points of denitrification and sinks for carbon. Understanding carbon fluxes is important in understanding how vernal pool soils serve as a sink for organic carbon and the magnitude of that sink. Hydric soil indicators are used in wetland determinations as part of the three-parameter approach to identify a wetland.

What has been done

We tested current hydric soil indicators and developed new ones in cases where the current ones were ineffective. We measured hydrology and redox conditions at points along a transect from the wettest part of the vernal pool (basin) to the upland. We used both Fe and Mn IRIS sensors to examine differences in redox potential. We studied the amount of carbon stored at each transect point and measured rates of decomposition of coarse woody debris and roots. We presented our findings at regional and national scientific meetings. We submitted our proposed hydric soil

indicators to national and regional hydric soil technical committees. We met with regional hydric soil technical committees to explain our findings and make recommendations.

Results

Our proposed hydric soil indicator (Mesic Spodic) was approved by the National Technical Committee for Hydric Soils (NTCHS) and is now part of the national indicators (A-17). We are currently testing other indicators. Our research is part of the region-wide multistate project from Virginia to Massachusetts. We are currently analyzing the relationships between soil temperature, saturation, inundation, redox potential, and carbon fluxes and storage. Our almost 5 year study is providing a longer term assessment of climatic and hydrologic variations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
135	Aquatic and Terrestrial Wildlife

Outcome #9

1. Outcome Measures

Geospatial information is used by government organizations, NGO's and the public for natural resource management and conservation. Indicator is number of contacts (hits) and the amount (Tb) of geospatial data downloaded from RREA-supported online data services.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The University of Rhode Island (URI) Renewable Resources Extension Act (RREA) program addresses the need for geospatial data and technology for more informed decision making by natural resource managers, and the need for forest management educational opportunities for private and non-governmental landowners. The primary objectives of the URI RREA Program are: 1) increasing the amount and reliability of geospatial data and technology resources that are available to Rhode Island's conservation community; 2) increasing the awareness of natural

resource managers of the availability of these geospatial resources; 3) increasing the number of natural resource managers skilled in the effective application of these geospatial resources; 4) providing training and guidance in forest management to private and NGO landowners.

What has been done

The URI RREA program continued supporting and maintaining the Rhode Island Geographic Information System (RIGIS) data clearinghouse and the URI GPS Base Station. Both resources provide geospatial data extensively used by natural resource managers throughout Rhode Island. URI RREA staff represented Rhode Island in the planning phase of regional NRCS initiative to acquire new orthophotographs, and continued collaborating with RIDOT and the University of Connecticut on modernizing the URI GPS Base Station. One workshop was organized and conducted for forest managers in partnership with the RI Resource Conservation and Development Council, USDA NRCS, and RIDEM (May 5, 2018; Exeter, RI). URI RREA staff also significantly contributed to a USDA NRCS forest management workshop (May 16, 2018; Wyoming, RI). Five classroom-based instructor-led geospatial technology training classes were conducted at the URI Kingston campus (January 8-9, 2018; January 15, 2018, May 23, 2018) and ten additional presentations were given throughout the reporting period in partnership with the RI Executive Climate Change Coordinating Council, Watch Hill Conservancy, U.S. Coast Guard, RIDEM, and the URI Coastal Institute.

Results

More landowners are adapting forest management plans as awareness increases of the benefits of these plans. Rhode Island continues to have reliable access to current geospatial data that are used to inform natural resource management decisions. In particular demand are aerial photographs that are used in the development of forest and wildlife management plans. Our audiences are changing how they access these readily available geospatial data resources as we are now seeing a migration to the use of Esri ArcGIS Online (cloud-based GIS software) and Esri ArcGIS Pro (desktop-based GIS software), moving away from Esri ArcGIS Desktop and even hand-drawn maps.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #10

1. Outcome Measures

Increased understanding of resistance and tolerance to hemlock wooly adelgid (HWA) in eastern hemlock. Indicator is number of publications, presentations, and procurement of external funding to continue/expand the work.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The decline and near-extirpation of eastern hemlock (*Tsuga canadensis*) and Carolina hemlock (*T. caroliniana*) in the eastern United States has had major economic and ecological consequences. From an economic perspective, the loss of hemlock (the only native shade-tolerant conifer in the eastern US) has nearly destroyed the tree nursery industry in southern New England and decreased property values for homes located in forested settings. From an ecological perspective, hemlock decline removes important habitat for several migratory bird species, changes hydrologic regimes, and negatively affects trout and other aquatic species that rely on cool headwater streams for breeding.

Our work addressing hemlock resistance and tolerance to the adelgid is aimed at facilitating reforestation efforts. Because forests replanted with adelgid-vulnerable phenotypes will themselves be destroyed by this pest, only plants that have some degree of adelgid resistance/tolerance should be included; our research seeks to understand and ameliorate the adelgid's impact on its host.

What has been done

We conducted research into adelgid resistance and tolerance. Most recently, we conducted two common garden experiments in which we challenged chronically adelgid-infested hemlocks with gypsy moth (Experiment 1) and the jasmonic acid (JA) pathway-elicitor methyl jasmonate (MeJA; Experiment 2) and quantified phytohormone, secondary metabolite, and defensive/antioxidant enzyme responses. In addition to this work (the results of which are described below), we are midway through the creation of chemical and metabolomic profiles of adelgid-resistant and susceptible eastern hemlock individuals.

Results

In the two common garden experiments described above, we detected substantial bioactive gibberellin and salicylic acid accumulation in adelgid-infested foliage. When hemlock was simultaneously challenged with gypsy moth, we found an ameliorating effect of adelgid on certain components of the JA pathway. Gypsy moth folivory alone substantially increased expression of multiple components of the JA pathway. Few significant effects of adelgid, gypsy moth, and

adelgid and gypsy moth combined were detected on the accumulation of phenolic and terpene metabolites, except for the accumulation of cell wall-bound phenolics and lignin. We detected a local effect of MeJA application on lignin accumulation and lipoxygenase activity, but MeJA had no detectable impact on any measured response on foliage on which it was not directly applied, with or without adelgid present. These results showed that neither folivory nor external application of chemical pathway inducers affected the impact of adelgid on hemlock.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity

Outcome #11

1. Outcome Measures

Increased adoption of energy conservation behaviors and implementation of efficiency practices by RI residents, small businesses, municipalities, school districts, water suppliers and state agencies. Indicators are number of energy audits scheduled with the local utility; number of implemented efficiency projects.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Energy use and energy production are major sources of emissions that need to be reduced. In accordance with the Resilient Rhode Island Act of 2014, URI helps Rhode Island meet statutory goals for reduction of greenhouse gas emissions through stakeholder engagement. Increasing Rhode Islanders' awareness of contemporary energy challenges and bringing about behavior change by promoting best practices that increase sustainable energy consumption and production have a positive impact on this effort.

What has been done

Staff and students participated in select public outreach events throughout Rhode Island (e.g. RI Home Show, Pascoag Green Festival) to lead hands-on, educational activities for families and to

sign them up to receive our e-blast newsletters. We designed and delivered energy education lessons to K-5 youth through a school field trip program we host each spring, using undergraduate students as energy educators. We disseminated science-based energy-related information on our Facebook and Instagram profiles, including "Calls to Action" regarding energy conservation behaviors and upcoming local energy events, and we designed and delivered the 3rd annual "Plugged into URI Energy Research" lecture, an educational workshop open to all on campus in November of 2017.

Results

Direct contacts at public outreach events were encouraged to schedule home energy audits and implement energy saving measures suggested through the audit process to reduce their at-home energy consumption. Half of the direct contacts signed up for audits on the spot (~50 individuals). We increased awareness around energy production and consumption in K-5 youth through kinetic energy-related activities. We encouraged adoption of energy conservation measures through social media related to in-home consumption, smart purchases, and landscape management decisions, and through our lecture, we increased knowledge of current and future local and state level policy initiatives relevant to energy consumers. Lecture attendees were encouraged to participate in the local and state level policy making process to ensure that these policies had a positive effect on their interests (money, the environment, etc.).

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #12

1. Outcome Measures

Upon completion of the Energy Fellows program, URI undergraduate and graduate students demonstrate increased capacity to address real-world energy issues. Indicator is number of students completing the programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2018

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many students enrolled at URI have indicated interest in sustainability, and more specifically, opportunities to engage with renewable energy production and distribution, energy efficiency and energy conservation practices outside the classroom.

Rhode Island also has a growing need for a well-trained energy workforce, and energy companies and organizations seek talent with experience and training in the energy field.

The energy system is extremely complex and there is a need for Rhode Islanders to receive clear fact-based information about energy production, consumption, conservation, efficiency and policy. Students completing the Energy Fellows program understand the complexity of the energy system and are trained to disseminate information to the public.

What has been done

The Energy Fellows Program placed eight fellows with industry and policymaker mentors for the 2018 program year. We solicited applications from high performing, motivated students interested in supplementing their classroom studies with an experiential learning experience, professional development training and immersion in a summer learning institute.

We refined our professional development training based on feedback from our 2017 student cohort and their mentors. We implemented and improved upon the summer learning institute developed in 2017, which incorporates industry-led training sessions with field trips to energy projects and offices around southern New England.

Each student completed a minimum of 600 hours of experiential learning at a Rhode Island or Massachusetts energy-related company or organization. Additionally, students participated in 60 hours of industry led training, a minimum of four hours of industry networking and one outreach event. Outreach events included the Energy Expo at the Rhode Island Home Show, the Pascoag Utility District Green Festival and the Rocky Hill School Energy Hackathon.

Results

Eight students engaged in experiential learning through project-based work, and subsequently graduated from the Energy Fellows Program in 2018. Four fellows worked alongside energy professionals at National Grid; Green Development, LLC. and the Rhode Island Office of Energy each hosted a fellow to work on renewable energy projects; the Rhode Island Energy Efficiency Resource Management Council funded one fellow to work alongside their consultancy, Optimal Energy; and one fellow worked alongside engineers at RISE Engineering to implement energy efficiency improvements in buildings.

These students, from a variety of majors, were afforded the experience of working on real-world, current energy projects in interdisciplinary teams with their mentors. Fellows received training in general energy topics through presentations from energy professionals, field trips, and conference attendance as well as specialized training in leadership and communications. Fellows actively participated in outreach events and presented their work to the University community and general public at an academic oral presentation session at the end of the year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation

Outcome #13

1. Outcome Measures

Improved capacity for coastal managers to predict greenhouse gas emissions resulting from changes in nitrogen loading and coastal marsh restoration. Indicator is number of research discussions held with coastal managers and peer-reviewed publications.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

My research in wetland ecology aims to improve restoration policies and guide priorities for land use management (nutrient mitigation, climate change, invasive species).

What has been done

Activities during this reporting period were limited. Research is in stages of publication and was conducted based on input from stakeholders and scientific collaborators.

Results

My research has shown that coastal wetlands can receive high levels of nutrients without emitting significant greenhouse gases. This means that coastal wetlands can still be managed for carbon sequestration benefits even if they are in areas with poor water quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
135	Aquatic and Terrestrial Wildlife

605 Natural Resource and Environmental Economics
608 Community Resource Planning and Development

Outcome #14

1. Outcome Measures

Increased understanding of how wildlife populations may respond to ongoing climate change. Indicator is number of publications and presentations.

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

Increased understanding of how plant genome size influences competitive ability and susceptibility to herbivory. Indicators are number of publications and presentations.

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

Advance understanding of demand and supply of ecosystem services from watersheds in the rural-urban fringe at a policy-relevant scale. Indicator is number of publications and presentations.

Not Reporting on this Outcome Measure

Outcome #17

1. Outcome Measures

Increased understanding of the economic valuation of air quality and greenhouse gas emissions. Indicator is number of publications and presentations.

Not Reporting on this Outcome Measure

Outcome #18

1. Outcome Measures

Enhance capacity of land use managers to identify effective strategies for minimizing watershed nitrogen export. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The goal of the Extension work from the Watershed Hydrology Lab (WHL) is to provide data and decision support tools to local, state and federal land managers to foster watershed protection, restoration and management. We also communicate Extension materials (i.e., watershed assessments, factsheets, websites) to educate citizen groups, the public, and private sector groups on the connections between activities in the watershed with water quality to engage them in local efforts of watershed protection. We share these resources with other Extension groups.

Much of the work of the WHL focuses on the export of nitrogen (N) and phosphorus (P) from watersheds which can exert profound negative effects on the function and value of coastal estuaries and drinking water reservoirs. Elevated nitrate concentrations in drinking water can also be a human health concern. Phosphorus inputs to freshwater is linked to harmful algal blooms and increases in organic matter. We characterize the extent of N and P transport within watersheds and identify climatic, land use and aquatic attributes that relate to export and removal rates.

What has been done

In Fall 2017-Winter 2018, the WHL developed a factsheet "Woodchip Bioreactors: A Science-based Option to Reduce Nitrate Loss" based on our peer-reviewed paper "Denitrifying bioreactors for nitrate removal: a meta-analysis" (Addy et al. 2016). In Spring 2018, this factsheet was distributed in hard copy and via websites throughout the US and New Zealand to NRCS local offices, agricultural advisors, system installers, Extension agents, and farmers.

During Winter-Spring 2018, the WHL worked with URI Watershed Watch (WW) to create a template GIS-based watershed assessment and report on one pond that is part of the program. This template will be used to assess watershed characteristics in many lakes/ponds that are part of WW. These assessments will be shared with WW volunteers, local watershed groups, and local decision makers.

The WHL has been in constant communication with RI DEM (at least meetings every 2 months, in-person or via conference call) to aid in their development of TMDL's on Aquidneck Island, RI. RI DEM used our weekly grab sample and storm sample N and P data as well as our stream flow data from over the course of three years from the Maidford River and Bailey's Brook to generate

models for the P TMDL which was given to US EPA in Summer 2018. The WHL has aided RI DEM in determining which models to use. In Fall 2018, we provided guidance for the newly requested N TMDLs from US EPA. NRCS is also very active with establishing projects on Aquidneck Island and consulted with us on agricultural best management practices for the Maidford River watershed.

The WHL has been in contact with Providence Water through our sensor project in Cork Brook, on the protected land of Providence Water since 2013. We generated a poster and peer-reviewed journal article on the impacts of the gypsy moth infestation in 2015 on stream nutrients and carbon. Providence water is taking our report into consideration for the management of gypsy moths in drought years. We suggested that human effort and investments to minimize gypsy moth infestations focused on the stream corridor is warranted to protect against potential impact to stream ecology.

WHL and collaborators have generated a decision support model named RZ-TRADEOFF (based in Excel) to inform NRCS and town/state managers on the ecosystem services provided by riparian zones with N and P removal and greenhouse gas (GHG) attenuation. The goal of this model is to choose the best riparian areas for restoration or protection to maximize N and P removal and mitigate GHGs. Peer-review journal articles are in review. The WHL is generating data to validate the model. Fact sheets and presentations in development for Spring 2019.

The WHL has provided guidance to the Town of Charlestown, RI as they develop a groundwater protection strategy. Several meetings were held between the WHL and Art Gold since the fall 2017. A graduate student in the WHL assisted in assessing the water quality records and GIS assessment.

The WHL also is collaborating on a study of dam removals in New England. In Spring 2016, we began development of a comprehensive New England Dams Database with geospatial attributes, state dam database attributes, hydrologic data from USGS National Hydrography Dataset (NHDPlusV2), land use and land cover data from National Land Cover Database, and attributes from the Northeast Aquatic Connectivity dataset. This dam database resides at the UNH Data Discover Center http://ddc-dams.sr.unh.edu/about/project_description/. We continued to augment this dataset through 2018. This database is used by many researchers and agencies throughout New England in multiple disciplines to assist in developing dam removal decision tools.

Results

With the WHL outreach work:

Wood Chip Bioreactors are being designed to site-specific recommendations to minimize transport of N to tile drains and fluvial systems.

RI DEM was able to model P and develop P TMDLs for multiple watersheds on Aquidneck Island with WHL data.

WHL data highlighted a N problem and US EPA responded by asking for N TMDL development. Once approved by US EPA, implemented watershed management strategies will improve water quality of the lakes, ponds, rivers and the bay as well as improve the source water quality for a major drinking water provider.

Recommendations on forest and water management for gypsy moths.

The town of Charlestown has presented a draft ordinance for groundwater protection. Nitrate retention in reservoirs behind dams is now a tradeoff considered in several tools to assess choices in dam decisions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #19

1. Outcome Measures

Enhanced capacity of land trust organizations and agency personnel to manage and protect amphibian and reptile populations from the effects of forest loss and pollution. Indicators are number of peer-reviewed scientific publications and presentations to conservation organizations and at scientific meetings.

Not Reporting on this Outcome Measure

Outcome #20

1. Outcome Measures

Enhanced capacity of land trust organizations, government agencies, and private landowners to manage and protect turtle populations from the effects of forest fragmentation. Indicators are number of peer-reviewed scientific publications and presentations to the public and conservation organizations and at scientific meetings.

Not Reporting on this Outcome Measure

Outcome #21

1. Outcome Measures

Improve understanding of seismic hazards along the coastlines of North America to improve assessment of this hazard to coastal environments, including coastal communities and coastal agriculture.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2018

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Earthquakes pose a risk to the maintenance of agriculture through the subsidence experienced during megathrust earthquakes (up to 1m along the Oregon and California coastline and perhaps 1.5-2.0m in Washington) and the threat from tsunami inundation including trans-Pacific tsunami generated from Alaska that can impact the west coast and Hawaii. Depending on the magnitude, sudden subsidence combined with tsunami inundation will likely destroy levees used in many parts of Oregon, California, and Washington to protect coastal agricultural land that has been reclaimed from coastal marshes. Tsunami inundation will transport significant salinity and contaminants into the low-lying agricultural land that may compromise its use without significant remediation. A prime example is the Tillamook Estuary (\$117 million dollars of agricultural products sold in 2012), where almost all the agricultural land lies within inundation zones based on worst-case scenario modeling. Further understanding of recurrence intervals and magnitudes will enable more accurate forecasting of likely inundation and the threat to agriculture. Total coastal agriculture production is estimated at \$213 million dollars for coastal Oregon alone.

What has been done

We have continued to analyze samples collected from previous field seasons in southern Washington, Oregon, northern California, and Alaska. Further, we have undertaken additional fieldwork in Washington, Oregon and Alaska during the summer of 2018 to fill gaps identified as part of our analyses. The work at URI has involved myself, two graduate students working directly on the projects, as well as an additional graduate student who was exposed to the project through participation in fieldwork. As part of this project, we continued our collaboration with the Earthwatch Institute and the Durfee Foundation. Eight high school students from Los Angeles came and participated in a two-week residential field trip to Rhode Island coastal marshes. Because of logistical challenges, we run these in Rhode Island as they provide similar coastal environments to demonstrate the concepts that we apply on the west coast and in Alaska.

Results

We collated data on foraminiferal assemblages from across the entire Cascadia subduction zone and used them to develop a new statistical method for estimating the amount of subsidence during past earthquakes. This method supported some of the previously published results but also called into question previously lower estimates in northern Oregon and southern Washington that likely require a modification of the slip model and would have implications for our understanding of future earthquakes in these regions. This was published in the Bulletin of the Seismological Society of America and acknowledges the support for this program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate

Outcome #22

1. Outcome Measures

Improved understanding of the factors that influence public acceptance of the Block Island Wind Farm. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The national transition to less carbon-intense sources of electricity requires the construction of new facilities. The Federal government has already leased large areas of the Outer Continental Shelf for offshore wind energy development. It is critical to understand the factors that contribute to social acceptance of this technology.

What has been done

In this reporting period, this funding supported a summer graduate assistant to work on analysis of data collected during earlier funding periods.

Results

This work contributed to a journal article, in progress.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #23

1. Outcome Measures

Enhance understanding of the tradeoffs between alternative groundwater management regimes to improve decisions by irrigators and policymakers. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

My work looks at estimating and understanding the benefits to groundwater management, specifically which policies will be of greater overall benefit to society.

What has been done

I developed an economic/hydrologic model of groundwater management to connect groundwater flows to dynamic economic efficiency.

Results

The main outcomes of my work are academic publications in top agricultural economic journals. In the past year, I published a paper that evaluated cognitive elements of common pool resource depletion. This relates to the myopic depletion of shared groundwater resources which can be affected by the mental scarcity presented in users. This work established experimentally the connection between cognitive thought processes and cooperative behavior in common pool resources, which is the first paper to do so. This may have large policy implications, because it means that incentives and institutions not only lead to depletion of groundwater resources, but mental scarcity also plays a significant role in the sustainability of natural resources. Further work can establish if interventions can overcome this additional hurdle.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #24

1. Outcome Measures

Improved understanding of the efficacy and accuracy of using small unmanned aerial systems (UAS) to map and monitor gypsy moth defoliation in hardwood forest ecosystem. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Gypsy moth defoliation is diminishing the health of forest ecosystems in RI. We are conducting this research to determine the efficacy and accuracy of using small Unmanned Aerial Systems (UAS) carrying true-color and multispectral sensor packages to map and monitor gypsy moth defoliation in hardwood forest ecosystems. The results of our research will be of significant importance to forest managers who must monitor the extent and magnitude of defoliation.

What has been done

In early July of 2018 we deployed a small UAS to collect 1.2-inch pixel resolution true-color aerial imagery and 3.2-inch pixel resolution multispectral imagery over the Cork Brook watershed within the larger Scituate Reservoir watershed. We engaged Providence Water Supply Board Natural Resource Management personnel.

Results

Although gypsy moth infestation was much reduced from the last two years, the results of our second stage research demonstrated the effectiveness of UAS-collected, multispectral imagery for identifying dieback from defoliation in prior years. This information will be of value to forest managers in evaluating the long-term effects of defoliation. We anticipate more feedback on changes in learning due to outreach during the upcoming 2019 field season with RI-based extension projects involving sUAS image data collection to evaluate forest health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #25

1. Outcome Measures

Improved understanding of tourism concerns related to installation of offshore wind farms in RI. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Wind power in the US has grown at a rate of more than 10% per year, on average, in the last ten years. Until 2016, all wind power in the country had been produced onshore, with the first commercial offshore wind farm being constructed 3.8 miles off the coast of Block Island, Rhode Island in the Atlantic Ocean. The five-turbine, 30 MW project started operating in December 2016, and is responsible for providing most of Block Island's power, which had historically depended on diesel generators. Block Island poses a unique case since most of its revenues come from tourism. If the wind farm located off its coast is perceived as a disamenity and users substitute visits to the neighboring islands of Nantucket and Martha's Vineyard, the island's revenues could be severely impacted. There is also the possibility of recreational users switching from one activity to another if they find their experience less (or more) satisfying because of the turbines' presence. Despite wind being a clean and renewable form of energy, projects related to wind power generations are often riddled with controversy and met with protests by the local community. For instance, developer Cape Wind's plan to erect over 100 offshore wind turbines in Nantucket Sound, Massachusetts, was toppled in part due to the opposition by property owners concerned about their view of the ocean. Correspondingly, there are several studies suggesting that wind turbines are a disamenity to people enjoying recreational activities. Thus, the Block Island offshore wind farm presents an interesting opportunity to gauge public perception of the wind farm, especially given that it is the first of its kind to be established within the United States. Offshore wind power generation is extremely capital intensive and better understanding of its impact on income-generating activities leads to a more efficient allocation of resources.

What has been done

We designed and disseminated an economic survey in August 2018 through the Qualtrics platform to residents 18 years of age and above who reside in the states of California, Connecticut, Florida, New Jersey, New York, Maine, Maryland, Massachusetts, Michigan, Pennsylvania or Rhode Island. We excluded from our survey Block Island residents and people who own a second home on Block Island since we believe that this demographic will have preferences that are inherently different from tourists.

Our survey consisted of three parts. In the first part, we asked respondents some questions about their trip to Block Island. Respondents were asked about the average cost of their trip, who they took the trip with, the average number of days spent per trip, and the recreational activities they engaged in during their visit. The second part of our survey included questions about the wind farm at Block Island. Respondents were asked if they had any knowledge of the wind farm prior to taking the survey and whether they had seen the wind turbines in person during their visit. The survey takers were also asked about their reactions on seeing the turbines, and what recreational activities they were engaged in while seeing them. For respondents who had not seen the turbines, these questions were modified to elicit hypothetical reactions. The second part also included questions where we elicit respondents' WTP for fishing, boating, sightseeing, beach, and bird and whale watching sites either with a view of the turbines or without them. The respondents were given an option to remain neutral if they had no preference.

Results

A total of 263 respondents completed the survey. We are analyzing the data and intend to collect additional response via different techniques (i.e. intercept survey)

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #26

1. Outcome Measures

Improved understanding of biology, ecology, and control of emerging disease vectors. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Vector-borne disease is a major public health burden in the United States. Tick-borne disease, and specifically Lyme disease afflicts approximately 300,000 individuals per year. This work addresses the prevention of tick-borne disease by furthering our understanding of the underlying ecology of the tick vector *Ixodes scapularis* and its association with the disease agent, *Borrelia burgdorferi*. In mosquito-borne disease, the major public health issue facing the US is the invasion and spread of exotic mosquito vectors, increasing the risk of mosquito-borne outbreaks. Another major issue is that the control of both ticks and mosquitoes heavily relies on chemical pesticides that are detrimental to non-target and beneficial insects. This work focuses on tracking invasive vector threats and developing novel biological control methods for vectors.

What has been done

I conducted laboratory experiments to test the hypothesis that the parasite *B. burgdorferi* manipulates the tick vector behavior to increase transmission. Through this grant, I have conducted surveillance to track the invasion of invasive vector *Aedes albopictus* in Rhode Island. In addition, I am developing a novel bio-control method using carnivorous aquatic plants.

Results

For the tick vector *Ixodes scapularis*, early results indicate that parasite manipulation may be occurring. This phenomenon will dramatically alter our understanding of the ecology of tick-borne disease. This means if we want to successfully model and predict tick-borne disease we will need to account for parasites manipulating vector behavior in order to increase their own transmission. For the mosquito work, early experiments indicate aquatic carnivorous plants are a promising avenue for biocontrol.

4. Associated Knowledge Areas

KA Code	Knowledge Area
721	Insects and Other Pests Affecting Humans

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Outcome #4

Outcomes were generally as expected. Our staffing was reduced by the retirement of founding director Linda Green, and ongoing challenges in securing external grants in an era of limited grant opportunities and increased competition has meant that in the near term we are unlikely to be able to hire a full-time staff person to support Elizabeth Herron who has taken over as program director. This presents a potential obstacle to future expansion to meet local needs. New volunteer recruitment continues to be challenging as the more targeted nature of social media makes it less likely for "new" people to discover the program.

Outcome #10

The postdoc on the project, Dr. Chad Rigsby, left in spring 2018 to take a full-time research position with Bartlett Tree Experts, Inc.; his departure has slowed our completion of the chemical and metabolomic profiling we are conducting for adelgid-resistant versus -susceptible hemlocks.

Outcome #24

Low incidence of gypsy moths defoliation for the 2018 growing season did not present conditions that were ideal for our analysis. We are also working to refine our data processing approaches to reduce the high number of images that are being excluded by the routine we use to carry out image mosaicing due to lack of well-defined geometric features used in that process. This pertains to the true-color imagery we have collected.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome #4: Although we did not conduct a formal evaluation, we do so informally. We track how many people attend our training sessions and as a result become bona fide volunteer water quality monitors. Annually it is 75-80%. We also track the retention of our volunteers and know how many, and who, have been monitoring for X number of years. We have an average 66% retention rate for volunteers between their first and second years. It is 88% by their fifth year, 92% for their tenth year, 92% for their fifteenth year. We have 25 twenty-plus year volunteers. After the first year, most of our retiring volunteers report

moving or physical inability to participate as the primary reason for their decision, suggesting satisfaction in the program.

Outcome #5: Participation in facilitated well testing events and workshop participants' self-reporting indicate that workshop participants are taking action to protect their private well. During this reporting period we used Google Forms to follow up with our workshop participants to determine actions they took to protect their private well. To date, we've received 22 responses. This response rate is notably lower than we have received in the past when conducting a mail survey. We are investigating how to best improve our participant response rate.

In 2014, we began to facilitate private well water testing at our educational workshops by arranging to pick up participant water samples a day or 2 after the workshop. We transport the samples to the RI Department of Health State Laboratories for the homeowner, thereby eliminating one of the identified barriers to testing. As a result, we have found an increase in testing among our workshop participants. During this reporting period 86 workshop participants had their well water tested via our facilitated testing process. In addition, we modified this approach during this reporting period and applied it to our Community Intercept Campaign. During this pilot effort, 58 people had their water tested. We intend to build upon this effort in the current fiscal year.

Outcome #6: Workshop attendees typically report satisfaction with workshops in the range of 4-4.5 on a scale of 1-5. The open and click through rate for E-news to municipal officials ranges from 20-26% for general informational notices such as webinars on municipal storm water topics, but is much higher for RI-specific information such as local workshop notices at 44- 50%.

Outcome #7: The participant evaluations of our workshops were very positive - landowners appreciated the mix of classroom and field sessions that we offer, and especially appreciate the field visits to private landowners who have already implemented related activities. The results of our one-on-one technical assistance was also positive - 16 of the 33 landowner who received this support from URI have already followed up by applying for NRCS support for forestry activities on their properties. Many of them mentioned how much they appreciated being visited by a URI outreach staff member.

Survey results for Project Timberdoodle have not yet been analyzed.

Key Items of Evaluation

URI's Extension programs related to water quality are long-standing and highly valued by private citizens, municipal officials, wastewater treatment practitioners, RI conservation districts, and RI's Department of Environmental Management.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Youth, Family and Communities

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
608	Community Resource Planning and Development	8%		20%	
801	Individual and Family Resource Management	0%		26%	
806	Youth Development	92%		0%	
807	Disaster Preparedness, Mitigation, Response, and Recovery	0%		27%	
903	Communication, Education, and Information Delivery	0%		27%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	0.0	0.0
Actual Paid	1.6	0.0	2.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
120562	0	140933	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
75275	0	109754	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

4-H

- Forge academic connections to strengthen 4-H curricula, provide undergraduate experiential learning opportunities, increase program research base and utilize evaluation expertise to measure impacts and improve programs.
- Connect target audience to 4-H educational programs through workshops, web-based training and newsletters, 4-H volunteer training and curriculum guides (train the trainer).
- Develop resources and information to connect youth and families to community and land-grant resources (4-H to serve as portal).
- Expansion of the 4-H club system into currently underrepresented, urbanized areas of the state and creation of a state-wide network of 4-H science enrichment after school programs that serve as a catalyst for improving the science based knowledge, skills and academic motivation among urban elementary and middle school students.

Sustainable Communities

- Investigate factors that influence financial decision-making in families and households.
- Work with municipalities and community members to manage natural and economic resources wisely.
- Teach and promote sustainable development techniques and management to communities.
- Develop and implement innovative approaches for effective STEM educational experiences to support the success of all students.

2. Brief description of the target audience

4-H

Youth 5-18 years of age, parents of targeted youth, community-based family-serving agencies and organizations, volunteers

Sustainable Communities

Farmers/ farm organizations, RI Department of Environmental Management (RI DEM) Division of Agriculture, RI Center for Agricultural Promotion and Education, Rhode Island Agricultural Partnership, other agricultural service providers, tourism councils and tourism businesses, land trusts, policy makers and municipal leaders, grassroots and community organizations, RI households and families, RI Emergency Management Agency, URI faculty and students

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1974	376763	3013	1775

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

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	7	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops (including short courses)
 Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of volunteers trained

Year	Actual
2018	105

Output #3

Output Measure

- Number of 4-H record books

Year	Actual
2018	121

Output #4

Output Measure

- Number of youth reached through programs

Year	Actual
2018	106

Output #5

Output Measure

- Number of community/family serving groups reached
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of community service projects
Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of activities and programs
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of students trained

Year	Actual
2018	39

Output #9

Output Measure

- Number of websites developed and/or refined
Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of curricula developed and delivered
Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Number of professional training sessions completed
Not reporting on this Output for this Annual Report

Output #12

Output Measure

- Number of public presentations

Year	Actual
2018	0

Output #13

Output Measure

- Number of trainings or workshops (including professional, volunteer, industry, school-based, etc.) conducted

Year	Actual
2018	109

Output #14

Output Measure

- Number of outreach resources (e.g. fact sheets, bulletins, newsletters, videos, public service announcements, etc.) written or produced.

Year	Actual
2018	24

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	RI 4-H club members demonstrate increased knowledge and skills related to science and health. Indicator is percentage of 4-H club members participating in science and health projects who demonstrated increases in knowledge and skills.
2	RI 4-H club members demonstrate increased commitment to, and understanding of, their communities. Indicators are number of 4-H club members participating in community service projects and number of community service hours completed by 4-H club members.
3	RI 4-H Club members apply leadership skills (e.g. public speaking, project leadership) to make a positive difference in their schools and communities. Indicator is percentage of 4-H club members who exhibited increased leadership skills.
4	Viability of agriculture in the state of Rhode Island and in southern New England is strengthened. Indicators are number of training sessions conducted that address issues related to sustainable agriculture, value-added products and/or agri-tourism and percentage of participants that report intent to implement new ideas, behaviors or practices.
5	Improved understanding of how American households make financial decisions. Indicator is number of publications and presentations.
6	Improved understanding of best practices for university engagement in local decision making. Indicator is number of publications and presentations.
7	Improved understanding of how social relationships, identity and perceptions affect success of at-risk students. Indicator is number of publications and presentations.

Outcome #1

1. Outcome Measures

RI 4-H club members demonstrate increased knowledge and skills related to science and health. Indicator is percentage of 4-H club members participating in science and health projects who demonstrated increases in knowledge and skills.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Out-of-school educational programs provide youth with a safe, supportive environment for developing academic and life skills. Research shows that structured learning, encouragement and adult mentoring that young people receive through their participation in 4-H plays a vital role in helping them achieve success in life. Research also shows that children of underrepresented audiences do not excel in math and science classes. Science and Healthy Lifestyles programming is a major focus of the RI 4-H club system, after school programming through SPIN (special interest) groups and military 4-H Clubs.

What has been done

A significant number of 4-H programs, workshops, activities and events focus on science and health enrichment programs including animal science, sustainability, horticulture, science nutrition and healthy lifestyles. Volunteer trainings and youth-adult workshops in 4-H science projects and healthy lifestyles provide youth with opportunities to increase their knowledge and skills and apply them in informal, adult-mentored settings where they receive positive feedback and reinforcement. In FY18, we continued to increase the use of 4-H Kits with 4-H club and youth-serving organizations and expanded our outreach to underrepresented areas of the state not being reached by the traditional 4-H club model through our 4-H SPIN (special interest) programs and clubs. Kits are very popular with libraries, youth-serving agencies, 4-H clubs, teachers and after-school providers. Currently we have more than 30 4-H kits that include curricula, lesson plans and activity supplies. Two new 4-Wheel Physic Kits were added in FY18 and other kits were duplicated to handle the demand.

Results

45% of RI's 810 4-H Club members participated in science and health projects/programs, competitions, and workshops and demonstrated an increase in knowledge (this does not include those participating on the club level). Spin Clubs continued to be a major delivery method in FY18. An additional 963 youth (Kindergarten - Grade 12) were reached through non-traditional club programming. This was accomplished by training volunteers, teachers and agency personnel to use the Science and Healthy Lifestyles Kits in underserved communities. 4-H Club Leaders and Assistant Leaders from 11 of 26 active 4-H clubs responded to an FY18 end of year club leader survey. Over half of the clubs responding reported that "Due to 4-H activities", 50% to 100% of their members showed an increase in science skills.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

RI 4-H club members demonstrate increased commitment to, and understanding of, their communities. Indicators are number of 4-H club members participating in community service projects and number of community service hours completed by 4-H club members.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many of today's youth lack opportunities to engage in positive out-of-school educational programs under the mentoring of caring adults who guide them in developing valuable life skills while aiding them in creating positive connections to the larger community and assisting them in successfully making the transition to productive, contributing young adults. Today's youth are tomorrow's decision makers and will determine our future.

What has been done

Members of RI 4-H Clubs, 4-H SPIN Clubs and after-school programs are expected to plan and conduct at least one community service project during the 4-H year as part of the Civic

Engagement mission mandate. 4-H volunteers are provided with community service opportunities through the 4-H listserv and connected to requests from citizens and community groups requiring assistance. 4-H clubs have the opportunity to apply for financial support through the RI 4-H Foundation Club Grant program for their projects. Beyond serving their communities, 4-Hers document their individual community service hours through their 4-H Record Books.

Results

41% of 4-H Club Leaders from approximately 11 of 27 registered, active 4-H clubs (average 30 members per club - membership ranged from 15-50 members per club) reported their club completed between 1-8 community service projects in FY18 with an average of 3.75 projects per club resulting in an average of 330 documented 4-H youth participating in approximately four community service projects. This 41% only includes clubs who reported their end-of-year results. 121 4-Hers who submitted record books (15% of 4-H club enrollments) in FY18 reported 3344 community service hours or an average of 27.6 hours per 4-H member. No results are available on 4-Hers who did not submit record books to the State 4-H Office.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

RI 4-H Club members apply leadership skills (e.g. public speaking, project leadership) to make a positive difference in their schools and communities. Indicator is percentage of 4-H club members who exhibited increased leadership skills.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many youth are lacking in school and family-center opportunities and support to increase their communications and leadership skills. Youth need a safe and nurturing environment to test their abilities and receive constructive and supportive feedback. Encouragement by caring adults and

positive peer support enables youth to develop confidence and incorporate these life skills into their school and community.

What has been done

4-H members are strongly encouraged to participate in the RI 4-H Public Presentations program at the club, district and state level. 4-H volunteers and staff provide training, as well as competitive and noncompetitive speaking opportunities for 4-H youth of all ages. Besides District and State competitions, 4-H members participate in local events to educate the public including 4-H Foundation Events, District 4-H Fairs, Washington County Fair Farm School and local festivals. 4-H youth practice and improve their leadership skills in their 4-H clubs and at 4-H events and programs on the State level and at Eastern States Exposition. In FY18 the 4-H Youth Leadership Conference was held at URI featuring skill development in public speaking and communication, cooperation, team-building, inclusion, conflict resolution, officer training and parliamentary procedure. Guest presenters included Providence Improv Guild, URI Center for Leadership Development, and 4-H staff and volunteers. A new program, the Teen Science Cafe, brings together 4-H teens from across the state to interact with the guest scientists speaking about their careers. Teens plan the program, host the guest scientist, and run all components of the program, which meets every two months.

Results

58% of active 4-H club members participated in district and state public presentation programs, 4-H Farm School, Eastern States Exposition and other state level public events promoting 4-H. 4-H teens demonstrated their leadership ability by assuming major roles at 4-H Fairs, Teen Science Cafe, State 4-H events and at State and New England animal science programs. 4-Hers also actively participated in communication and leadership training. The majority of 4-H club volunteers from 41% of active clubs reported that in FY18 more than 50% of their youth exhibited increased leadership skills as a result of their 4-H experience, and 94% of club leaders reporting had active club youth officers. 121 4-H members who submitted recorded books reported a total of 2,962 4-H leadership hours or an average of 24.5 hours per member.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Viability of agriculture in the state of Rhode Island and in southern New England is strengthened. Indicators are number of training sessions conducted that address issues related to sustainable agriculture, value-added products and/or agri-tourism and percentage of participants that report intent to implement new ideas, behaviors or practices.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Improved understanding of how American households make financial decisions. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

American households face increasingly complex financial decisions. This Hatch project uses a platform of behavioral economics to understand barriers those households encounter to make the best financial choices

What has been done

Currently working on a project regarding anchoring effects on student loan decisions. I am the lead author on a manuscript with co-authors Michael Gutter from University of Florida and Soo Hyun Cho from California State University-Long Beach. Our results show that the advice to attend college and when to take out student loans is driven by anchoring effects. This finding may help explain some of the hurdles that first generation students encounter to obtain a degree. The manuscript is close to completion for submission to a peer-reviewed journal in economic psychology.

Results

Preliminary results show that people with previous student loan experience are most likely to recommend student loans to first time college students. This finding helps explain some of the difficulties that potential first-generation face when planning to attend college.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #6

1. Outcome Measures

Improved understanding of best practices for university engagement in local decision making. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Coastal communities are facing increasing but uncertain risks from storms and sea level rise (Woodruff, Irish, & Camargo, 2013). In the context of Rhode Island, this includes significant port infrastructure, the disruption of which would have profound impacts on the regional economy, including disruption of important resources like home heating oil (Becker & Caldwell, 2015). Understanding and communicating these risks to the broadest base of stakeholders is an essential step to starting broader conversations regarding adaptation to uncertain future conditions (Becker, 2016).

What has been done

Work undertaken to date has focused on developing strategic partnerships and infrastructure to create, disseminate and test visualizations. These partnerships include:

1. University of Rhode Island, Information Technology Services (ITS). A team of undergraduate students from the departments of computer science and ocean engineering is being trained in relevant visualization methods. This team will assist in creating 3d representations of communities engaged as part of the project and will form an ongoing resource for future work.
2. The Beach Special Area Management Plan (Beach SAMP): the Beach SAMP is providing ongoing ocean modeling that underpins the visualizations, and is providing the primary means of engagement and outreach through community meetings conducted around the visualizations. Current work focuses on the communities of Bristol, Warren, and Barrington.
3. The University of Rhode Island Graduate School of Oceanography (GSO) to develop ocean modeling and visualizations for vulnerable port facilities and other infrastructure.
4. Rhode Island Emergency Management Agency (RIEMA): RIEMA has used visualizations provided by the project in Statewide exercises and trainings, and provides important input data regarding critical facilities.

Results

To date, visualizations have been created for nine Rhode Island Communities, this is being expanded by three more communities this spring. These visualizations have been employed in publications, outreach meetings conducted by the Beach SAMP, and in trainings conducted by the RIEMA. These visualizations have played an important role in uncovering and communicating specific vulnerabilities. These visualizations have served as important touchstones to facilitate stakeholder discussions regarding adaptation (Becker, 2016).

In addition to direct impacts of using these materials, a large scale survey (n=735) has been conducted, including both experts (e.g., coastal managers) and the lay public. The results of the survey are being used, among other things, to develop improved guidance for communication. We have also completed a pilot study collecting "stakeholder concern thresholds." These are qualitative data points that can be integrated with storm model outputs. Results were shared with emergency management community and are being further developed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
806	Youth Development

Outcome #7

1. Outcome Measures

Improved understanding of how social relationships, identity and perceptions affect success of at-risk students. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This work supports our understanding of best practices associated with the education of STEM students. Results of projects associated with this work help to create a more scientifically literate society.

What has been done

I engaged the students to determine ways in which I could design a STEM education experience that was specific to their social contexts. I have given several faculty development workshops and two podcast interviews on inclusive teaching design.

Results

The failure rates of students in my inclusively designed biology curriculum went from a historic high of 25% to under 10% in most semesters implemented. This means that STEM curriculum design that is student centered is best positioned to ensure the advancement of all students into higher level STEM courses, and into STEM careers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome #1: The increase of knowledge (and skills) was documented through observation and parent/leader/teacher surveys and feedback. No formal evaluations were conducted in science and healthy life styles areas in FY18.

Outcome #2: No formal evaluations were conducted. Significant participation in community service projects was documented in 4-H member record books.

Outcome #3: No formal evaluations were conducted. Significant participation in the leadership and communication projects was documented in 4-H member recordbooks and through staff observation at state and regional programs and events. 4-Hers may have participated in multiple programs and events, thus duplications are may be included in the percentage of 4-H youth participating in leadership and communications programs.

Outcome #6: A large scale public survey (n=735) was conducted to evaluate the

visualizations, and the affect they had on perceptions. These included specific outreach to experts such as coastal managers and scientists, persons in the maritime industry, planners, and the lay public. Preliminary survey results suggest that 3d visualizations developed as part of this project have strong influence on perception based on place attachment. Although there is some evidence of biased assimilation in the preliminary results, evidence suggests that well-designed visualizations can enhance communication. Other results suggest that enhanced background information and some specific visual cues may further enhance the perceived credibility and utility of the visualizations.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

International Programs

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
606	International Trade and Development	50%		50%	
611	Foreign Policy and Programs	50%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		50%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	0.5	0.0
Actual Paid	0.4	0.0	1.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
4565	0	67560	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	74828	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

- Develop and promulgate sustainable fisheries programs in Africa.
- Provide leadership training for African fisheries staff to support sustainable fisheries.
- Collect ethnographic data to understand and assist small island nations with change.
- Conduct archival research to understand transnational social movements related to globalization and modern society.

2. Brief description of the target audience

Foreign universities; governments; government officials; policy makers; international collaborators; international students; URI students

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	75	100	0	25

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

Patent Applications Submitted

Year: 2018

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	1	4	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of technical documents, fact sheets, bulletins and newsletters
Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of training manuals (includes instructional CDs)
Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of scientific/professional presentations

Year	Actual
2018	7

Output #4

Output Measure

- Number of workshops (including short courses)

Year	Actual
2018	2

Output #5

Output Measure

- Number of conferences hosted
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of websites developed and/or refined
Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of public presentations
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of students trained

Year	Actual
2018	7

Output #9

Output Measure

- Number of theses/dissertations completed
Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of postdoctoral scientists trained
Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Number of volunteers trained

Year	Actual
2018	102

Output #12

Output Measure

- Number of intervention studies
Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Number of social marketing actions/activities
Not reporting on this Output for this Annual Report

Output #14

Output Measure

- Number of video productions
Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of outreach resources (fact sheets, bulletins, newsletters, videos, public service announcements) written or produced.

Year	Actual
2018	6

Output #16

Output Measure

- Number of youth reached through 4-H programs

Year	Actual
2018	1773

Output #17

Output Measure

- Number of trainings or workshops (including professional, volunteer, industry, school-based, etc.) conducted.

Year	Actual
2018	106

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Chinese farmers apply new knowledge and technology to improve local food production. Indicator is number of new salt-tolerant vegetables and grasses grown by local farmers.
2	Artisanal fisheries ecosystems in the Gambia and selected stocks shared with Senegal are managed more sustainably. Indicator is number of new sustainable fishery management plans.
3	Improved understanding of best practices and challenges for small island sustainable development. Indicators are number of publications and presentations.
4	Improved understanding of how gender inequality and unsustainable development affect local, national and international communities. Indicator is number of publications and presentations.
5	Artisanal fisheries ecosystems in Africa are managed more sustainably. Indicator is number of new sustainable fishery management plans.

Outcome #1

1. Outcome Measures

Chinese farmers apply new knowledge and technology to improve local food production. Indicator is number of new salt-tolerant vegetables and grasses grown by local farmers.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Artisanal fisheries ecosystems in the Gambia and selected stocks shared with Senegal are managed more sustainably. Indicator is number of new sustainable fishery management plans.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Improved understanding of best practices and challenges for small island sustainable development. Indicators are number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

My work examines the way people adapt or don't to a changing planet, including to changing perceptions about change itself. This is vital social science that aids our understanding of problems and solutions in the Anthropocene.

What has been done

My work spans a number of sites from coastal Rhode Island where the public is grappling with renewable energy transitions, to small island Indonesia where small scale communities are

dealing with coral restoration interventions to The Bahamas archipelago where islanders and tourists are encountering new designs for the tourism industry. In all locales my research team conducts ethnographic qualitative data collection as well as semi structured surveys to understand local priorities and concerns.

Results

In Rhode Island, my team learned that energy infrastructures are deeply social and cultural materializations and that changing infrastructures can effect the local sense of place, sometimes for the better. In Indonesia, we are learning that restoration interventions are always political in post colonial contexts, and that restoration practitioners must be aware of the historical and social conditions of their restoration sites or else they risk exacerbating existing unequal power structures, even in the name of positive change. In The Bahamas, we have learned that collaborations between science and tourism may more often lead to the greenwashing of tourist ventures than to greater public engagement with environmental research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
606	International Trade and Development

Outcome #4

1. Outcome Measures

Improved understanding of how gender inequality and unsustainable development affect local, national and international communities. Indicator is number of publications and presentations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This project assesses the history and successes of transnational social movements in addressing issues pertaining to globalization and modern society. It reviews, synthesizes, and analyzes the work of scholar-activists from the 1970s-1990s in order to provide lessons learned as well as to question mindsets and effectiveness of past projects and proposals.

What has been done

I conducted archival research at three different archives in the United States searching for materials related to the activities and ideas of transnational social movement activists and NGO coordinators in the 1970s-1990s.

Results

So far, I have discovered obstacles faced by some activists in terms of gaining audiences with international organizations, but I have also discovered the ability of others to manage and make use of "social network resources." For example, activists living in New York City had access to and contact with diplomats at the UN and could put forward requests and ideas on behalf of NGOs based outside of the US.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #5

1. Outcome Measures

Artisanal fisheries ecosystems in Africa are managed more sustainably. Indicator is number of new sustainable fishery management plans.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Malawi is receiving 90% food aid from other countries. Food security is a major concern to the country. This work directly affects the use of the fishery resources through co-management for severely over fished species in Lake Malawi.

What has been done

There are three parts to the work: 1) Work directly with the stakeholders to develop effective management plans; 2) train fisheries staff to conduct studies and assessments; and 3) be involved in data gathering needed for assessment.

For 2018, the focus was on chambo, the lake tilapia which is considered to be a collapsed fishery. Leadership training of stakeholders occurred in 2017, and each year the stakeholders meet to discuss challenges and to improve skills. This workshop follows a training session with the Dept. of Fisheries on stock assessment that they are then able to discuss with the stakeholders. It also produces a stock assessment report. Management strategy is developed and a strategy document is produced and forwarded to the Fisheries Ministry for comment and implementation.

Results

In 2017, the strategy document was produced for usipa and was finalized in 2018. In 2018, the chambo strategy document is in draft form and ready for Ministry review. The critical part of this work is the empowerment of the stakeholders to drive this process. When asked what they applied from the training, they are very clear about shifts in learning and attitudes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
606	International Trade and Development
611	Foreign Policy and Programs

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

None

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

CELS-CARES

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
902	Administration of Projects and Programs	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	8.0	0.0
Actual Paid	2.0	0.0	2.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
379225	0	594115	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
368920	0	617344	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

Infrastructure needs are addressed by this program including administrative support personnel, facilities, and farms.

2. Brief description of the target audience

Academic faculty, university staff, graduate students, undergraduate students, university administrators, Experiment Station scientists, Extension faculty and staff.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2018
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of proposals submitted

Year	Actual
2018	170

Output #2

Output Measure

- Number of proposals funded

Year	Actual
2018	122

Output #3

Output Measure

- Total funding awarded(in millions of dollars)

Year	Actual
2018	17

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	University of Rhode Island scientists, faculty and staff supported by CELS CARES will leverage the investment of land-grant funds to attract extramural grant support.

Outcome #1

1. Outcome Measures

University of Rhode Island scientists, faculty and staff supported by CELS CARES will leverage the investment of land-grant funds to attract extramural grant support.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

CELS CARES was developed as an administrative program for the allocation of land-grant funds within the University of Rhode Island. The expected outcome was to build human capital and research infrastructure to boost competitiveness for external funding and expand the scope of integrated activities.

What has been done

Faculty, university scientists and staff were allocated land-grant funds that supported the Rhode Island Plan of Work. Land-grant funds were also dedicated to administrative staff who support and oversee our planned programs. These investments were used to ensure quality and impact of funded activities and to leverage external, competitively-awarded grants.

Results

In the past year, CELS scientists, faculty and staff submitted 170 grant applications and had 122 grant proposals funded from state, federal, and private sources. These proposals were valued at \$16.7 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
902	Administration of Projects and Programs

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We have reported evaluation results under each of our planned programs.

Key Items of Evaluation

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

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