

# Rhode Island (University of Rhode Island) Annual Report - FY2021

## Report Status: Approved as of 07/13/2022

### Contributing Organizations

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University of Rhode Island

### Executive Summary

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#### Overview

The URI College of the Environment and Life Sciences (CELS) is the home of Rhode Island's Agricultural Experiment Station (AES) and Cooperative Extension (Extension). URI's land grant programs address a wide range of national and international issues, with an emphasis on the needs of our state. The research conducted through the AES is broad based, spanning disciplines from the natural sciences to the social sciences, and basic to applied, capitalizing on the specialized knowledge of our faculty. Our Extension programs seek to improve Rhode Islander's quality of life, their livelihoods, and the health of our natural environment, with special attention to local issues, social justice, and equity. We emphasize close integration of research and Extension in our programs to create the greatest value from URI's land grant funding.

A recent CELS Strategic Plan for 2019 – 2023 identifies the following goals for research:

By 2023 CELS researchers will have increased their ability to do the following:

- Respond and adapt to local, regional, and global environmental changes;
- Sustainably grow, harvest, market, and consume food from terrestrial and aquatic species;
- Recognize and manage emergent human and environmental health challenges; and
- Understand (a) biodiversity at multiple scales from genomes to ecosystems and (b) how the evolution and ecology of organisms affects environmental and ecosystem health.

In addition, the following goals were identified for Cooperative Extension:

By 2023, URI Cooperative Extension will have strengthened the capacity of Rhode Islanders to do the following:

- Grow, process, and provide safe and nutritious food, and to better manage wild fisheries;
- Take actions that promote healthy lifestyles;
- Be strong stewards of the state's urban, suburban, rural, and coastal landscapes;
- Assess water resources and apply management practices to restore and protect those resources; and
- Address current and future energy challenges related to sustainable energy consumption and production.

#### Critical Issue: Agriculture and Food Systems

URI research and Extension activities address critical issues in agriculture and food systems in a wide range of ways through educational programming and basic and applied research. Our research and Extension programs, work toward economically, socially, and ecologically sustainable production, management, and consumption of land and water-based plant and animal species.

Research Goal: CELS researchers will increase our ability on local, regional, and global levels to sustainably grow, harvest, market and consume food from both terrestrial and aquatic species.

- Researchers created new knowledge in the characterization of how changes in the homeostasis of actin alter nuclear function, with progress toward a better understanding of the downstream consequences of these changes on cell metabolism and maintenance.
- We made progress toward the ability to predict antibiotic-resistance mutations occurring in pathogenic organisms, which will ultimately lead to the rational design of novel antibiotics that could potentially act against resistant organisms.

Cooperative Extension Goal: Strengthen Rhode Island's food and agricultural systems by increasing Rhode Islanders' capacity to grow, process and provide safe and nutritious food, and to better manage wild fisheries in Rhode Island and abroad.

- We provided education and technical assistance to fruit and vegetable producers on topics of insect control, variety trial results, and basic farm management.
- Extension supported Master Gardeners and home horticulturists in home gardening practices such as the importance of soil testing, vegetable growing and harvesting, and food preservation.
- We provided food safety education to food service workers and growers as well as consumers (safe food handling and food preservation practices).

**Critical Issue: Human and Environmental Health**

Rhode Island's AES and Extension programs work toward improved management of human and environmental health challenges by studying the molecular basis of infectious and noninfectious human, animal, and plant diseases; mechanisms of antibiotic resistance; and the design of new vaccines and probiotics. Our programs also address the distribution and impacts of health challenges across communities, including factors affecting nutrition and physical activity, and those associated with tick-borne illness.

Research Goal: Increase our ability to recognize and manage emergent human and environmental health challenges.

Clean water is a critical component to human and environmental health. URI Researchers are addressing water quality and water treatment system improvements through AES funded projects.

- Researchers, municipal officials, engineers, and Extension staff are working together to further understand the relationship between soil characteristics, system design, and climate change effects to onsite wastewater treatment systems. Results are being used to improve materials and design of systems and educate installation professionals.
- Policy research at URI is leading to a better understanding of why communities engage (or do not) in effective management of water resources. This work will lead toward more effective policies and incentives for communities to take appropriate action to protect ground and surface water.
- Wetland research is leading to a better understanding of the role depressional wetlands play in controlling greenhouse gas emissions.
- Multiple projects funded by URI AES funds are addressing questions about how climate change will affect New England's food system. Specifically, projects are looking at various species (and their genetics) that may increase local food production in a climate resilient manner.
- We used NHANES data to contribute to the justification for why multi-pronged approaches (diet and physical activity) are needed to improve the health trajectory of older adults. This research will help us determine what diet and physical activity choices for aging adults will lead to them maintaining independence for as long as possible.

Cooperative Extension Goal: Strengthen the ability of Rhode Islanders to take actions that promote healthy lifestyles and result in improved nutrition and physical activity, reduced risk of vector-borne diseases, and improved physical, social, and emotional health.

- 378/8,277 (5%) TickSpotters completed post-program use evaluations. Bi-annual assessment results of TickSpotters showed improvements in knowledge, confidence in performing TickSmart prevention practices, and plans to adopt additional TickSmart practices as a result of our "JIT" communications.
- TickSpotters indicated most would adopt important behaviors such as performing daily tick checks and be mindful of the trails they are on and where they walk.

**Critical Issue: Local to Global Environmental Change**

Rhode Island's AES and Extension programs enable communities to cope with changing hazards associated with sea-level rise; stronger coastal storms; increasing water temperature; impacts to water quality and availability; ocean acidification; changing disease patterns; invasive species; and biological invasions. We also seek to mitigate global environmental change by understanding the social and biological consequences of transitioning to renewable energy technologies.

Research Goal 1: Increase our ability to respond and adapt to local, regional, and global environmental changes.

- Solar and wind power are renewable energy sources important to RI; however, there are costs and benefits to these systems that can be controversial in a community. URI research and Extension programs are exploring how communities make decisions and providing science-based information to help them in their decision making process.
- Similarly, protecting watersheds throughout RI is important to our state's economy and tourism industry. Researchers and Extension staff work with state agencies and municipalities to monitor and protect our state's water resources.
  - We are studying the impacts of saltwater intrusion in coastal aquifers due to storm surges. We've completed a Dam Atlas as well that uses GIS modeling to assess ecological attributes, social metrics, and physical attributes.
  - We assisted the URI Coastal Institute and The Watch Hill Conservancy to evaluate geospatial technologies applied in new workflows for field verifying submerged aquatic vegetation areal coverage by leveraging geospatial technologies. In addition, our GIS team worked with the RI Department of Environmental Management and The Nature Conservancy to plan for a forest health inventory and assessment.

Cooperative Extension Goal 1: Provide leadership, information, and guidance on the stewardship of land including urban, suburban, rural, and coastal landscapes to achieve ecosystem resilience, water resource protection, forest management, and economic and agricultural viability.

- URI Cooperative Extension provides land stewardship education through workshops and the Master Gardener program. We stress the importance of native plantings and protection of pollinators. These programs are attended by homeowners and landscape professionals, and lead to more site assessments prior to making landscape decisions, and more sustainable land management.

Cooperative Extension Goal 2: Expand the capacity of Rhode Islanders to assess water resources and apply management practices to restore and protect water resources.

- The URI Cooperative Extension Watershed Watch program engages hundreds of trained volunteers to gather water quality data on more than 200 streams, lakes, estuary and marine sites. Data are shared with state and municipal officials and provide longitudinal information about the health of RI's watersheds.
- Extension trained (virtually) and provided technical assistance to communities around stormwater and nonpoint source pollution. This work has led to changes in policy in several towns that will lead to long-term protection of watersheds.

Cooperative Extension Goal 3: Strengthen the capacity of Rhode Islanders to face current and future energy challenges related to sustainable energy consumption and production.

- Cooperative Extension provides energy literacy training through a lecture series (held virtually in 2021). Participants included energy professionals, policy makers, homeowners, and college students. One important outcome was that almost 80% of the participants requested a home energy assessment after participating.

#### **Critical Issue: Youth, Family, and Community Development**

Rhode Island's AES and Extension programs use a variety of approaches to address these issues, including economics, social science, historical analysis, and information technology. Our faculty study issues such as the social context of teaching and learning as it pertains to at-risk and under-represented minority populations; barriers and motivators influencing family financial decision-making; the history of gender and development; tourism and development; and community disaster planning. We also advance positive youth development through 4-H with an emphasis on science and technology, leadership, life skills, and healthy living.

Cooperative Extension Goal: Improve the physical, social, and emotional well-being of Rhode Island's youth population by expanding activities, events, and educational experiences related to science and technology, leadership, life skills, and healthy living.

- 4-H staff and volunteers worked diligently to develop kits and virtual programming for youth to complete at home and/or in family settings during the pandemic. Virtual communications events and science cafes helped to keep 4-H youth engaged.
- Youth participating in 4-H gain skills that will help them to be successful adults (communication, decision making, responsibility, etc.).

## Merit and Scientific Peer Review Processes

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### Updates

AES-funded research projects undergo institutional peer review prior to submission to NIFA for review and approval. In this multi-step process, the Experiment Station Director assesses the project's fit and relevance to URI's critical issues, a member of the CELS faculty with relevant expertise evaluates the technical merit of the proposed work, and the Experiment Station Director evaluates how well the proposer subsequently responds to the peer reviewer's comments. Once those steps are completed satisfactorily, the proposal is finalized and submitted to NIFA. Proposed multi-state projects are evaluated by the Experiment Station Director for relevance to URI's critical issues, by the leader of the relevant multi-state project for relevance to the goals of the project, and for technical merit by a relevant member of the CELS faculty. We seek NIFA approval after these steps are completed.

Extension programs are evaluated for progress toward goals and sub-goals described in the 2018 – 2022 Cooperative Extension Strategic Plan by reporting to the Director on program-identified metrics. New programs are reviewed for relevance to the critical issues facing Rhode Islanders. Evaluation results will be used to guide resource allocation and future programming decisions.

### Stakeholder Input

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#### Actions to seek stakeholder input that encouraged their participation with a brief explanation

Stakeholder input is captured through a variety of mechanisms throughout the year. Stakeholder feedback is sought after most Extension workshops and meetings to ensure that our programs are meeting their needs. Covid restrictions required us to move almost all of our programming to a virtual environment, meaning we had less opportunity for informal discussions with participants. Research faculty routinely present the results of their work to interested government, industry, and community groups (as well as the academic community) and use feedback from those groups to inform their future research directions. However, travel restrictions due to the pandemic prevented many of our investigators from participating in face-to-face meetings.

Virtual and survey-based listening sessions have been held and we use social media data to track interest in various topics. Many programs use end of session evaluations for needs assessment as well, adding one or two questions about interests and future needs of participants.

Volunteers for 4-H and RI's Master Gardener programs were engaged through virtual meetings and regular check ins from staff to address particular needs and concerns brought about by Covid-19 restrictions. The past two years have been particularly challenging to keeping our volunteers engaged; so regular communication through video and phone has been essential.

#### Methods to identify individuals and groups and 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 a wide range of issues related to CELS, including its land-grant programs. The College also utilizes Rhode Island's CARET representatives for stakeholder input. Primary methods used by our faculty and staff to identify individuals and groups include surveys of groups or individuals, and virtual consultation with advisory committees. Programs relying heavily on technology to engage with their audiences assess demographics of website visitors to identify stakeholders, taking web and social media analytics into account.

URI Extension and Research faculty and staff work closely with several state agencies (Department of Environment Management, Department of Health, etc.) and non-profits on grant development and submission, and implementing programs across Rhode Island. Our partners often help us identify new or underserved audiences as well. For example, the URI Food Recovery program, working with food pantries and the state Food Policy Council, have identified a refugee (African) community in Providence with food security needs that our Master Gardener program is now working with to help them grow culturally familiar foods in RI.

## Methods for collecting stakeholder input and brief explanation

Stakeholder input is captured through 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 (mostly held virtually this past year). Input is also collected through the discussions and work of the Research Committee, the Cooperative Extension and Outreach Coordinating Committee, and the Dean's Agriculture Industry Advisory Group. Primary methods used by our faculty and staff to collect stakeholder input are meetings with traditional and non-traditional stakeholders, including those held specifically to learn about needs of non-traditional stakeholders; meetings with the public; and surveys of traditional stakeholders. Individual interviews with stakeholders are also conducted for some program areas. Researchers work with community partners, when appropriate, to seek out and test ideas. Our 4-H and Master Gardener programs work closely with their volunteer groups to collect feedback about existing programs and solicit ideas for new ones.

### A statement of how the input will be considered and brief explanation of what you learned from your stakeholders

Stakeholder input is used to inform a number of decisions throughout the year, including priority setting and action planning. Our researchers and Extension experts incorporate stakeholder input into their thinking, planning, program/project development and implementation over time. The Dean and Associate Deans use 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 possible.

For example, researchers use data about animal health and migratory bird data as indicators for determining research priorities and Extension professionals use evaluation feedback to make modifications to current programming.

## Highlighted Results by Project or Program

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Critical Issue

### Agriculture and Food Systems

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#### [Building regional food sovereignty through urban agriculture](#)

Project Director

John Taylor

Organization

University of Rhode Island

Accession Number

7001032



#### **Agricultural intensification and expansion can make Rhode Island self-sufficient in fruit and vegetable production**

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##### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

State governments in New England have established a regional goal of meeting 50 percent of food needs from local sources by 2060--the so-called "50 by 60" plan. However, Rhode Island and New England as a whole are highly dependent on imports from outside the region. The overall goal of this research project is to develop a model for sustainable intensive vegetable production in Rhode Island that can serve as a model for urban and urbanizing environments regionally and nationally. The project merges methods from land use planning, sociology, and the agricultural sciences and descriptive and experimental research.

##### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

**Overall goal:** To develop a model for sustainable production and intensification in Rhode Island that can serve as a model for urban and urbanizing environments regionally and nationally.

Accomplishments under each aim

**Aim 1: Develop a spatially explicit model of Rhode Island's urban and suburban food production capacity under different intensification scenarios.** Master's student Nina Oberg made substantial progress on this aim during the reporting period. She established a state-level GIS for the project after collecting data layers from municipalities and state agencies. She used Lidar data to construct a digital surface model (DSM) and a digital elevation model (DEM) for the entire state, and then, in ArcGIS pro, used the area solar radiation and other tools to identify land area in the state suitable for agricultural production (2.5 kW per day of sunlight, unsealed, unvegetated). She also developed a decision matrix for assigning agroecosystem type, e.g., home garden, urban garden, market garden, urban or rural farm, controlled environment agriculture, to each polygon of suitable land.

Preliminary results indicate that Rhode Island has 24,859 hectares of land suitable for or currently in agricultural production according to study criteria, including 494 hectares of current farmland, 521 hectares of potential rooftop production, and 23,843 hectares of potential ground-level production. If total land use is assumed, 2,071% of the state population's vegetable needs and 81% of its fruit needs can be met. These numbers are based on 62.5% of total area in vegetable production--with the exception of rooftop, high tunnel, and CEA agriculture which is considered in 100% vegetable production--and 37.5% of total area in fruit production. While fruit needs aren't quite met, vegetable needs are met 20 fold, and therefore with adjustments to the percentage of land in vegetable and fruit production, the fruit and vegetable needs for the state can be met fully using much less than the total available land.

Ms. Oberg conducted a quantitative scoping review of the literature on solid waste recycling in urban agriculture and prepared a draft manuscript for publication based on that review.

The PD began to conduct both observational and experimental research on urban food forests, a promising form of multifunctional perennial crop production potentially well-suited to the Northeast. Results from that research will be incorporated into future models of the state's food production capacity.

**Aim 2: Identify best management practices for annual polycultures suited to intensive urban production.** We attempted to replicate the 2020 bitter melon-sweet potato greens polyculture experiment; however, germination of the bitter melon seed was poor and we were unable to procure additional seed from the vendor, Kitazawa Seeds. We also attempted to replicate the 2020 Tarbais bean polyculture, but the arbors supporting the bean vines collapsed due to high winds during Hurricane Henry.

**Aim 3: Compare the longitudinal performance of different systems of intensive vegetable production adaptable to varying scales of urban and suburban production.** The small-scale systems trial was conducted for a fifth and final year

**Briefly describe how your target audience benefited from your project's activities.**

The project has raised awareness of the potential food production capacity of Rhode Island among stakeholder groups including state food policymakers.

**Briefly describe how the broader public benefited from your project's activities.**

Study results have not yet been widely publicized because work is ongoing.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

**Training and professional development.** Sustainable Agriculture and Food Systems (SAFS) master's student Nina Oberg continued to work on the project, gaining expertise in GIS during the reporting period. Two undergraduate students in SAFS received training in agricultural research and assisted the project director in the management of transplant production in the URI greenhouses and in the management of field experiments at the Gardner Crops Research Center.

**Dissemination.** Dr. Taylor presented results from his research on urban food forests at two conferences, the European Agroforestry Conference and the Midwest Agroforestry Conference. He also presented his research on annual polycultures and ethnic crops during a Rhode Island Master Gardeners training on biocultural diversity conservation through urban agriculture and during the Core Training for new Master Gardeners.

**Plans for the next reporting period.**



***Aim 1: Develop a spatially explicit model of Rhode Island's urban and suburban food production capacity under different intensification scenarios.*** We will: 1. Finalize the model and estimates reflecting different production scenarios and prepare and submit for publication a manuscript reporting results; 2. Prepare and submit for publication a manuscript based on observational research on urban food forests and create a production scenario incorporating food forests and other agroforestry systems for the RI food production capacity model; and 3. Finalize and submit for publication the manuscript based on the scoping review of the literature on the recovery of organic matter and nutrients from waste for use in urban agriculture.

***Aim 2: Develop a spatially explicit model of Rhode Island's urban and suburban food production capacity under different intensification scenarios.*** We will replicate the bitter melon-amaranth and bitter melon-sweet potato greens polyculture experiments conducted in 2017, using the smaller, sturdier trellis used in that experiment to prevent the structural failure that ruined the 2021 experiment.

***Aim 3: Compare the longitudinal performance of different systems of intensive vegetable production adaptable to varying scales of urban and suburban production.*** This part of the project has been completed.

## **Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation**

Project Director

Claudia Fallini

Organization

University of Rhode Island

Accession Number

1025262



## **Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation**

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**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

This project is focused on identifying the basic cellular and molecular mechanisms that regulate maintenance and function of post-mitotic cells. In particular, we are investigating how alteration to the actin cytoskeleton - the cellular structure regulating cell morphology, contractility, and division - affect the structure and functionality of the nucleus - where DNA is stored - via the LINC complex. This project is focused on elucidating how the cytoskeleton interaction with the LINC complex leads to changes in gene expression that can affect the metabolism and maintenance of postmitotic cells such as neurons and muscle cells.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

Through rigorous experimental research, we have made substantial progress in the characterization of how changes in the homeostasis of actin alter nuclear function. We found that increasing or decreasing the tension exerted on the nucleus by the actin cytoskeleton alter the expression of several genes, with the potential to affect cell metabolism. We are currently performing additional experiments to better understand the downstream consequences of these changes on cell metabolism and maintenance.

**Briefly describe how your target audience benefited from your project's activities.**

Our results highlight a novel and underappreciated connection between cytoskeletal structure and nuclear function that could expand our current knowledge on the role of actin in regulating fundamental cellular processes such as cellular metabolism via changes in gene expression. In addition, through its academic and educational mission, this research is contributing to the fostering and mentoring of a new generation of scientists.

**Briefly describe how the broader public benefited from your project's activities.**

While there is no direct and immediate benefit to the broader public from our research, there are important indirect benefits from our project's activities. These include (1) the generation of new knowledge of the basic molecular mechanisms of cellular function that may lead to new strategies to safely increase muscle growth without affecting the health of the overall organism; (2) the mentoring of undergraduate and graduate students in the classroom and laboratory settings to foster a new generation of scientists; (3) the identification of new druggable targets to improve animal health.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

The continuing COVID-19 pandemic has limited our ability to travel to conferences with the purpose of disseminating the results of our research. In the next reporting period, we plan to improve our efforts to disseminate our research to our target audience which includes scientists interested in general cell biology, cell biology of postmitotic cells, ageing, and cytoskeleton function. We will continue our efforts to provide opportunities for training and professional development of both undergraduate and graduate students, including hands-on laboratory-based research training, and participation to local and national conferences. Further, we will continue our research on the connection between nuclear function and actin cytoskeleton, expanding our understanding of the downstream consequences of actin upregulation on cell metabolism and gene expression.

### **Food Literacy Initiative: Food Recovery for Rhode Island**

Project Director

Lisa Townson

Organization

University of Rhode Island

Accession Number

7000232



### **FY21 Food Literacy and Recovery Accomplishments**

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**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

The Food Recovery for RI program addresses the twin challenges of food insecurity and excess food waste. According to the RI Food Bank statewide survey, one in six Rhode Island households were food insecure in 2021, while there was enough food produced to feed all individuals. Food insecurity can come in many forms and disproportionately affects individuals who are traditionally underserved. The second of the twin challenges, excess food waste, affects Rhode Island's central landfill, which is composed of ~30% food waste and is set to close in 2040. This is not only detrimental to the state's infrastructure, but the increased impact on the environment by this waste is of constant concern.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

**Outcome 1:** 120 Rhode Islanders enhance their food literacy knowledge to become "Food Recovery for Rhode Island" trainers who will educate 2,500 people to adopt conservation behaviors and participate in projects that benefit the food system.

40 Rhode Islanders have completed the URI Food Recovery course to become URI Food Recovery volunteer educators, with another 44 registered participants for the Winter 2022 course. Over 46,000 people have benefited from the URI Food Recovery volunteers and community partner organizations through education, adopting conservation behaviors, receiving fresh produce donations, and participating in stewardship projects to benefit the food system.

**Outcome 2:** 60,000 pounds of wasted food is reduced, recycled, or recovered through community projects and used to feed hungry people.

In 2021, 39,562 lbs of food was donated to feed those in need and 74,767 lbs of food was diverted from the landfill by our community partners with assistance from trained URI Food Recovery volunteers. This exceeds the stated outcome measure.



**Briefly describe how your target audience benefited from your project's activities.**

Course participants were surveyed to determine change in behavior, attitude, and knowledge after the course. Thirty-one participants (n=40) completed the survey for a 78% response rate, and the following results:

- Participants adopted (plan, began or increased) eight food recovery behavior changes:
  - 80% volunteer on a community-based service project that reduces food waste and increases access to food
  - 77% store food properly, keeping fruits and vegetables fresh
  - 74% conducted a food waste audit
  - 74% pickle food using the “refrigerator pickling” method
  - 61% can food using the water bath method
  - 61% use “eat what you buy” smart saving practices
  - 48% compost at home
  - 45% prepare food using a prep now, eat later, concept
- 100% of participants increased or significantly increased their knowledge of food recovery overall
- 100% agree that they can play a role in reducing food waste sent to the landfill at home
- 98% agree that they can play a role in reducing food waste sent to the landfill in the community
- 97% learned about wasted food solutions
- 97% learned about food preservation and nutrition
- 97% learned about composting (commercial and residential)
- 87% students learned about the challenges of food waste, food insecurity and the environment
- 84% learned about inclusive community engagement (diversity, equity, and inclusion).

Testimonials:

- o *(This experience...)“Provided the knowledge, experience, and confidence to put these lessons into practice as part of daily life. I’m more conscious and aware of my actions related to food waste and have the tools to reach out into the community to share the knowledge”*
- o *“I have always been interested in these efforts on a personal level, but this course has emboldened me to take it a step further in working with my local community to help implement grassroots efforts that will have a broader impact statewide.”*
- o *“This course has significantly impacted my life. I find myself having the answers to the questions that I've been asking for a long time and have been able to figure out how I can change things on a smaller level, and impact organizations that can make a larger difference. I find myself standing up for what I believe in more, whether it comes to speaking out about the need for fresh food donations at my company (who actively does volunteer work, food drives, etc.), or just the need to limit our waste in general. I've adopted a lot of the practices that we learned about at home and can't wait to do more in the future when I'm not spread so thin. All in all, I think everyone can benefit from taking this course or something like it.”*

**Briefly describe how the broader public benefited from your project's activities.**

The public benefited from this project through a strengthened food system. Individuals facing food insecurity had improved access to healthy, locally sourced produce and food donations equaling about 40,000 pounds. By recovering and rescuing food and diverting it from the waste stream, greenhouse gas emissions are reduced. These efforts were enhanced by partners, Hope’s Harvest RI and Rescuing Leftover Cuisine. Compost infrastructure improved through this program, with more capacity at small scale compost processing facilities due to volunteer efforts. This included partner agency, Groundwork RI’s Harvest Cycle, which diverted over 73,000 pounds of food waste from residents and businesses in Providence, Pawtucket, and Cranston, and processed the food waste into finished compost. Two food scrap drop off sites for community members were established in Providence and Cranston through efforts from two partner organizations aided by FRRI volunteers, Zero Waste Providence, and Groundwork RI.

Job training and partnerships arose from collaboration between partner organizations and FRRI participants. Efforts were made to engage various elements of the food sector in food rescue and recovery efforts including restaurants, schools, and community members. We Share Hope, a food bank, became a recipient agency for locally gleaned produce through Hope’s Harvest RI In an effort to increase food recovery at local schools. Zero Waste Providence created educational tools and began assisting student-led food recovery efforts at local schools. A refugee serving agency (Beautiful Day) scheduled a service-learning trip with refugees to pick and donate apples at the URI orchard. Zero Waste Providence partnered with the Center for Ecotechnology and Clean Ocean Access to plan a series of statewide events to encourage restaurants to participate in food recovery efforts through peer modeling of best practices. Mint was grown for Afghani refugees by our sister program volunteers, URI Master Gardeners, through a partnership with We Share Hope.

In addition, the FRRI program is resonating with a national audience, with interest in replication. We have already received inquiries from three other organizations, including three Cooperative Extension units from other states and a national food recovery organization requesting information on curriculum so they may replicate the program and/or requesting that they be able to take the course. Stacey Viera, MPH a Strategic Communications for Public Health and Master Food Recovery Volunteer out of Washington DC contacted our program looking for a version to scale nationally. She was particularly interested in the rigor of the course and the possibility of including evidence-based findings and science across the program. We plan to continue conversations as we learn more about our program outcomes and reach.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

We were able to overcome pandemic related restrictions by hosting events online and hosting outdoor activities that allowed for adequate spacing. This led to innovative program delivery methods, including a hybrid course with self-paced online portions and field sessions for hands-on skill building in the areas of canning, pickling, composting, inclusive community engagement and more.

Groundwork Rhode Island, a community partner of FRRI completed the following job training:

- o Building Futures adult job training - Approximately 14 young adult participants; workshop participants were given a verbal compost lesson and then participated in turning two compost bins and sifting finished compost.
- o Training was conducted for Garden Time, a nonprofit for formerly incarcerated. Harvest Cycle staff delivered a 30-minute lesson on compost and then there was 30 minutes of open question time.
- o Beautiful Day Interns - In the beginning of December, Harvest Cycle began working with three youth interns through a partnership with Beautiful Day Granola, a refugee serving job training nonprofit. These youth staff work 5 hours/week on compost processing. They also learn about the process of composting from Groundwork staff and do general job readiness training.

We use a variety of print and online dissemination tools, including press releases which are picked up in print and online media, social media, and email blasts through the URI system. A press release from Senator Reed's office was distributed through the U.S. News and World Report, The Washington Times, San Francisco Chronicle, Seattle PI, San Antonio Express-News, WJAR -TV, and more with over 40 media pickups of the AP News report. We have 575 followers on our newly formed FRRRI Instagram page. In addition, URI faculty and Extension staff and partner organization staff presented at a URI Food Summit follow up session.

The program will continue to provide educational services in a manner that is mindful of the safety of volunteers and community members. We'll continue to host two additional Food Recovery courses for 80 additional people to train as URI Food Recovery volunteers. A future direction for this program will be to ensure that food insecure individuals are served by this program, through partnerships with food pantries and other food focused organizations. The project team is partnering with the URI SNAP-ED faculty director and Brown University faculty to pursue funding for a scientific evaluation of the program in meeting these aims. We also hope to develop a non-volunteer online track of the program open to a national audience either next year or in the future.

Closing Out (end date 09/07/2023)

### [Enhancing Microbial Food Safety by Risk Analysis](#)

Project Director

Nicole Richard

Organization

University of Rhode Island

Accession Number

1017756



### **Food Safety Education Program**

**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

One in six Americans is impacted by foodborne illness each year, causing illness, hospitalizations, chronic illness, death and lost productivity; resulting in a cost of billions of dollars. URI Food Safety's Education Program addresses preventing outbreaks that can occur anywhere along the food chain from field or garden to processing, transportation, handling, and preparation. The integrated research/outreach education program aims to increase knowledge of food safety practices in compliance with appropriate regulatory requirements and provide research-based intervention strategies important to prevention.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

The long-term goal of this project is to perform comprehensive and integrative risk-based research and outreach to improve food safety and advance public health.

The URI Food Safety Education Program improved awareness of safe food handling practices among commercial growers of fruits and vegetables, food industry producers/processors, food safety regulators, and foodservice personnel by providing educational workshops specific to the target audience. Overall, 16 workshops were offered and 278 people were trained. In addition, the 26th annual RI Food Safety Task Force conference provided RI Dept. of Health, Center for Food Protection regulatory updates to 60 participants. Specific programs offered included:

- Preventive Controls for Human Food (2 workshops; N= 31 people trained)
  
- Food safety for food entrepreneurs (5 workshops; N=109 people trained)
  
- Seafood HACCP (7 classes; N=118 People trained)
  
- Produce Safety Rule/RI GAP (2 workshops, N=20 People trained)
  
- The 26th annual RI Food Safety Task Force conference was also held virtually for the first time. This conference focused on RI Dept. of Health Center for Food Protection updates. (N=60)

The URI Food Safety Education Program improved awareness of safe food handling practices by consumers. Overall, 167 consumers were trained, and an additional 1000 people viewed pre-recorded programming regarding food safety when preserving food at home, gardening and composting.

- Food Recovery for Rhode Island (N=40)
  
- URI Master Gardener Core Training (N=127)
  
- URI CoopExt Learn at Home Webinar Series
  - Practical Backyard Composting with Food Safety in Mind (417 views as of 1.12.22)
  
  - Preserving the Bounty (300 views as of 1.12.22)
  
  - Vegetable Gardening Best Practices for Food Safety (330 views as of 1.12.22)

Laboratory-based research has investigated the impact of lauric arginate on the growth of *Listeria innocua* in lean fish species. Non-pathogenic *Listeria innocua* was used as a surrogate to evaluate the impact of lauric arginate on bacterial growth in a poached white fish stored at refrigerated temperatures (41F). The poached fish that received the addition of lauric arginate showed a reduction in the growth of *Listeria innocua* over 21 days of storage in the refrigerator. The reduction in microbial growth is promising, but the application needs optimization to determine if a larger reduction in microbial growth can be seen.

**Briefly describe how your target audience benefited from your project's activities.**

- The Preventive Controls for Human Food workshop was rated  $4.8 \pm 0.3$  (on a 5-point scale) by nineteen participants for their understanding of key concepts taught.
  
- The food safety for food entrepreneurs and beginning stage food businesses was rated  $4.3 \pm 0.7$  (on a 5-point scale) for usefulness of the content presented and  $4.5 \pm 0.5$  (on a 5-point scale) for understanding of key concepts taught by

ninety participants.

- One hundred and eighteen participants at the Seafood HACCP workshops improved their confidence in conducting a hazard analysis (2.5 - 4.3 points on a 10-point scale) and in developing a HACCP Plan (2.2 - 4.9 points on a 10-point scale).
- Twenty participants at the PSR/RI GAP training agreed or strongly agreed that the curriculum taught increased their knowledge of the produce safety requirements in the FSMA Produce Safety Rule. Participants (N=20) also agreed or strongly agreed that they are committed to implementing produce safety practices on their farm.
- The RI Food Safety Task Force was rated  $4.4 \pm 0.6$  (on a 5-point scale) for the usefulness of the content presented by thirty-four participants.

**Briefly describe how the broader public benefited from your project's activities.**

The URI Food Safety Education Program is helping to keep food safe and reduce the burden of foodborne illness by providing educational opportunities for food businesses and the general public to improve their knowledge in food safety.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

Most workshops and classes have been virtually delivered, due to the ongoing COVID pandemic. As a result, the very popular hands-on food preservation workshop was not offered to the public. Additionally, the hands-on Retail HACCP class was not offered.

The Food Safety Education Program received a Specialty Crop Block Grant to enhance the home food preservation program by developing a series of videos demonstrating proper handling and preservation of specialty crops grown by RI farmers.

Critical Issue

## Human and Environmental Health

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### [Onsite Wastewater Treatment Systems: Assessing the Impact of Soil Variability and Climate Change](#)

Project Director

Alissa Cox

Organization

University of Rhode Island

Accession Number

1025466



### **Annual report: Impacts of soil variability and climate change on onsite wastewater treatment systems**

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**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

Onsite wastewater treatment systems (OWTS; also called septic systems) are used in unsewered areas to treat human wastewater and recycle water via groundwater recharge, serving to protect riparian, wetland, and aquatic ecosystems. In most cases conventional OWTS, consisting of a septic tank and gravity drain field, work well for protecting public and environmental health, but they do not remove nitrogen (N) from wastewater, which is problematic in coastal communities as excess N contributes to eutrophication of marine systems, contaminates groundwater and creates health risks to human

populations. Advanced N reducing OWTS have been developed to specifically target N removal from wastewater and to assure sustainable development in N sensitive areas, but these technologically complex systems require training for wastewater professionals engaged in siting, design, permitting, installation, and operation and maintenance of these and other OWTS. The New England Onsite Wastewater Training Program provides this training to professionals, while conducting research on their performance and serving as technical advisors and resources for private citizens, municipalities and regulatory programs in the northeastern US.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

From October 1, 2020 to September 30, 2021 our program held 28 credit-bearing training workshops for wastewater professionals' licensing requirements from RI, NH, VT, MA and NY, reaching a combined 296 professionals. Our workshops are continuously updated with the latest scientific and technical information, and are structured to improve these attendees' design skills. We encourage wastewater professionals to design systems with greater separation distances from drainfield bases to groundwater tables, which results in better treatment of wastewater and also reduces the potential impacts of climate change, ultimately and helping to protect ground and surface receiving water quality.

Program staff presented five virtual one- to two-hour talks aimed at homeowner audiences in RI and MA to help individuals better understand how OWTS function, and how best to maintain and care for them for optimal long-term performance. We also redesigned our program's website ([uri.edu/owt/](http://uri.edu/owt/)) to be more user-friendly, with explicit sections for wastewater professionals and homeowners. In September 2021, over a dozen program stakeholder volunteers contributed a combined 53 hours of time to make improvements to the wastewater demonstration facility on URI's Kingston campus, paving the way for future homeowner and lay audience educational events to occur at the training center.

Our program collaborated with the Town of Charlestown (RI) to gain regulatory approval to pilot a novel, non-proprietary advanced N-reducing OWTS drainfield option in RI, which presents an inexpensive alternative to currently approved proprietary technologies for N reduction. Four year-round occupied private residences in coastal Charlestown, RI with substandard or failing conventional OWTS were selected as sites to pilot this new technology, which will be installed in spring of 2022. Our program successfully collaborated with several municipal and public entities and was awarded competitive federal grants (combined >\$1M in USEPA funding) to fund the installation and study of additional systems, with the ultimate goal of gaining general regulatory approval for this technology in RI, NY and potentially MA.

**Briefly describe how your target audience benefited from your project's activities.**

296 professionals earned continuing education credits to maintain their professional licenses, and learning new skills to keep them competitive in the industry. We conducted required classes that enabled 20 new RI and MA wastewater practitioners to receive regulatory jurisdiction approval to design and install bottomless sand filters. Five new practitioners passed the examination and were added to the conventional septic system inspector registry and two participants were added to the nationally accredited alternative and innovative technology service provider program list based on successful completion of their exams. Gaining these skills and passing their exams enabled these professionals to expand the services they offer and provide new income potential for their companies, while ensuring that wastewater infrastructure in RI is designed, installed and managed by knowledgeable professionals.

Our talks (and their recordings) aimed at lay audiences have garnered more than a combined 300 views as of October 1, 2021, helping lay audiences learn to care for their OWTS in ways that protect public and environmental health.

We provided direct OWTS technical assistance to Suffolk County Health Dept. (NY) and RI Department of Environmental Management. Our program coordinated with seven technology vendors for recently approved OWTS technologies to present required technical training to regulatory staff and OWTS professionals, ensuring that the industry is up to date on the latest best practices and technologies available.

**Briefly describe how the broader public benefited from your project's activities.**

Wastewater professionals leave our training workshops armed with actionable information and best practices for how to site, design, install, maintain and inspect OWTS to perform well in the long-term, protecting public and environmental health and homeowner investment in their wastewater treatment system. This benefits individual property owners who have new systems installed, but also indirectly benefits neighbors and the broader community, because well-designed and installed and properly functioning OWTS mitigate pathogen and nutrient pollution of ground, surface and coastal water resources. Ultimately, this helps protect public and environmental health, assures sustainable development, and promotes a clean and desirable economic landscape. Our website and virtual talks help end users better understand OWTS technology, and how to

maintain and enhance the performance of this critical infrastructure. Strong collaborations with municipal and regulatory agencies help advance scientific understanding and can serve as a model for other communities and regulatory jurisdictions to learn from, emulate or adapt. Our work with other colleagues at other universities (e.g. through the HATCH NE2045 Multistate Project, which our program coordinates) enhances scientific understanding, collaboration and communication, which can inform future research and extension efforts.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

- Major changes or problems encountered in our approach.
  - The continuing COVID-19 pandemic has required us to adapt and offer the majority of our trainings and workshops virtually, with a select few occurring face-to-face workshops for outdoor hands-on learning. Some of our target audiences do not have the requisite technological skills or confidence to successfully participate in our program's virtual offerings. However, we have developed support materials and have helped nervous class enrollees practice before joining the virtual class to set them up for success reduce virtual class jitters. The vast majority of our participants are pleasantly surprised at their success, despite pre-workshop concerns, and many report preferring online version of the class to typical in-person offerings in past years.
  
- Opportunities for training and professional development
  - One undergraduate student was trained in effective science communication with lay audiences using onsite wastewater treatment systems as an example. One Master's student began a two-year grant-funded project to study the novel N-reducing drainfield technology being piloted in collaboration with our partners and is assisting with training workshop presentations.
  
- Dissemination of results to communities of interest
  - In addition to our technical trainings for wastewater professionals, our program (and its collaborators at URI) delivered a total of 11 talks (9 of which were invited) to academic, professional and homeowner audiences relative to OWTS and climate change at conferences and webinars in RI, CT, MA, NY, and nationally. Our audiences included scientists, wastewater practitioners, board of health officials, regulatory decision makers and coastal resource managers, in addition to homeowners and students. Over 180 URI students were exposed to onsite wastewater treatment principles in 1-hour lessons during fall and spring semesters. In addition, we published five peer-reviewed journal papers.
  
- What our program plans to do during the next reporting period to accomplish the goals.
  - We plan to run workshops for realtors, homeowners and URI students to help end users and lay audiences recognize the importance of OWTS as water infrastructure and provide them with knowledge and best practices to protect their investments and the health of their communities and the environment. In addition, we plan to continue to hold high-quality science-based and relevant training workshops for wastewater professionals, both virtually and in-person, and plan to develop and pilot online self-paced offerings to better meet professionals' needs. We will continue to collaborate with our municipal, regulatory and academic colleagues to study the novel non-proprietary N-reducing drainfield technologies with the ultimate goal of gaining widespread regulatory approval for their use in northeastern US communities.
  
- Peer-reviewed publications (full-text citation).
  - Cox, A.H. & G. W. Loomis. (2021). "Silver linings of the COVID era: structured rotating small-group approach improved engagement in outdoor technical education." Manuscript in review at *Journal of Extension*.
  
  - Ergas, S., J. Amador, T. Boyer, and E. Friedler. 2021. Special Collection Announcement: Onsite and Decentralized Wastewater Management Systems. *Journal of Sustainable Water in the Built Environment* 7 (3) 02021001.



- Görres, J. H., and J. A. Amador. 2021. Fauna. In Principles and Applications of Soil Microbiology, 3rd ed. (T. J. Gentry et al., Eds.), p. 181-212. Pearson, Upper Saddle River, NJ.
- Ross, B. N., K. P. Hoyt, G. W. Loomis, and J. A. Amador. 2020. Effectiveness of advanced nitrogen-removal onsite wastewater treatment systems in a New England coastal community. *Water, Air and Soil Pollution* 231(11): 1-10.
- Wigginton, S., J. Amador, B. Baumgaertel, G. Loomis, and G. Heufelder. 2021. Mesocosm- and field-scale evaluation of lignocellulose-amended soil treatment areas for removal of nitrogen from wastewater. *Water* 13 (15), 2137 <https://doi.org/10.3390/w13152137>

## **TickEncounter**

Project Director

Lisa Townson

Organization

University of Rhode Island

Accession Number

7000233



## **FY21 "TickEncounter" Accomplishments**

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### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

Tickborne diseases increasingly threaten the health of people in the United States. Between 2004 and 2016, tickborne disease cases doubled. Lyme disease is the most common tickborne disease, with approximately 476,000 Americans diagnosed and treated for Lyme disease each year. In addition to the rise in tickborne disease cases, geographic regions where Lyme disease is common are expanding. According to the CDC, “New tools for preventing tickborne diseases are urgently needed, and everyone should take steps to help protect themselves from tick bites.”\*

With ticks in more places and the incidence of tickborne diseases increasing, it is critical for the public to increase their tick literacy, better understand tick prevention strategies, and take action to prevent tick bites. Over the past 50 years, there’s been a significant decline in the public’s access to tick experts across the United States. Extension entomologists are becoming increasingly rarer and extension public health entomologists almost non-existent. To reduce the incidence of tickborne illnesses and keep people healthy, critical innovation in tick bite prevention outreach and education is needed to engage the public in relevant, actionable prevention strategies at the moment they are needed.

\*<https://www.cdc.gov/ncezid/dvbd/media/lyme-tickborne-diseases-increasing.html>

### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

RI’s TickEncounter program works to increase tick literacy among members of the public and promote actionable, best-practices for tickborne disease prevention through its on-line and virtual (2021 pandemic forced) education and outreach programs.

- 162,615 individual users visited and engaged with our TickEncounter.org website. During FY 2021, we renovated and restructured our web-based content with easy-to-implement actions for preventing tick bites, and guidance on what to do if a bite occurred. Innovative tools such as our regionally- and seasonally-based TickFinder forecast map and field guide resources, our TickSpotters crowdsourced tick survey and response, and our TickSmart Google calendar, all reflecting our focus on providing a relevant, Just in Time tick-bite prevention presence, helped us reach our goal of improving tick literacy across America. Other content, including tick-related news stories, educational blog posts, and an active social media presence combine to help fill vast gaps in the public’s knowledge of ticks and tickborne disease prevention.
  - 89 original Facebook posts were viewed by 275,700 people

- 40 Twitter posts were viewed by at least 68,424 people
- Our SM posts often share real “lived experiences” derived from our nationally prominent TickSpotters surveillance network, to provide seasonally- and geographically relevant tick literacy and tick bite prevention “nudges” or reminders on the types of ticks active in different geographic regions across the seasons and best-practices for tick bite prevention. We responded to 8,277 TickSpotters submissions from every state and Canadian province.
- TickSpotters assists tick bite victims with accurate, timely (<24 hr) tick identification confirmation and science-based risk assessments tailored to the ticks encountered on pets (~30%) and people (~70%). This engagement with a tick expert empowered people to take best, next actions following their tick encounters to lessen their risk of future tickborne disease and tick bites.
- Our webinar program reached thousands of veterinary and public health practitioners through 1 and 2 hr industry or stakeholder-sponsored sessions (CE credit applicable). Dr. Mather appeared on The Today Show (NBC) in May and was quoted by >100 national, regional, local and industry news media sources (NY Times, Washington Post, Wall Street Journal, Forbes, etc).

#### RESULTS:

- 378/8,277 (5%) TickSpotters completed post-program use evaluations. Bi-annual assessment results of TickSpotters showed improvements in knowledge, confidence in performing TickSmart prevention practices, and plans to adopt additional TickSmart practices as a result of our “JIT” communications.
  - 93.4% of respondents reported their knowledge of tick species identification improved by a moderate to excellent amount.
  - 94.7% of respondents reported an increase in confidence in their ability to accurately identify ticks.
  - 94.7% of respondents reported feeling better prepared for future tick encounters
  - 82.3% of respondents reported their knowledge of protecting pets from tick bites improved by a moderate to excellent amount
- Top 3 tick bite prevention practices respondents plan to adopt:
  - 72.5% of respondents plan to perform daily tick checks
  - 65.5% of respondents plan to walk in the middle of trails
  - 50% of respondents plan to purchase pointy tweezers for tick removal and have ziplock bag for collection

#### **Briefly describe how your target audience benefited from your project's activities.**

Every year, we receive hundreds of email testimonials expressing gratitude and often evidence of change or intent to change tick-bite prevention behaviors and practices. Examples from this past reporting period:

“I received some fast help in identifying a tick from the TickEncounter Resource Center at URI and very much appreciated the thorough response. Helped to alleviate some of my concerns and decide what I should do next. Thank you so much Tickspotters team!” M.I., Big Sur CA

“Thank you so much for your fast reply. I plan on reaching out to my vet tomorrow to discuss a tick knockdown product. I’ll also purchase a pair of sharp tweezers; this was my first time removing a tick and I had a lot of difficulty! I really appreciate this organization. Thank you for replying on a Sunday night!” K.F., Monterey MA

“So informative. You rock. Thank you so much. I tell everyone about tickencounter.org!” T.S., Warwick RI

**Briefly describe how the broader public benefited from your project's activities.**

Helping people accurately identify the ticks they encountered and helping them better understand and appreciate the degree of disease risk associated with their tick while guiding them to best next actions is expected to lower the burden on the public health system. Furthermore, motivating people to adopt tick bite prevention strategies helps prevent ticks from biting. If they do happen to bite, improved tick literacy reduces the likelihood of prolonged tick attachment and transmission of germs. These actions also help lower the burden on the public health system because people no longer need to use primary care doctors, urgent care clinics or ER visits for each and every tick they encounter. Knowing the type of tick, its duration of attachment provides important data directing decision-making about prophylaxis, treatment, and symptom recognition. TickSmart information shared by our project participants with medical and veterinary professionals helps educate them and future patients they may see.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

In addition to continuing the activities described above, we plan to continue adding to our portfolio of Just in Time (JIT) learning tools. If the Covid 19 pandemic had any positive impact, it promoted use of QR-codes linking to vital JIT information (like take-out food menus) and highlighted the role of smartphones as portals to anytime learning. Building on the new-found familiarity of QR codes, we are developing QR-coded “smart” WARNING: TICK HABITAT signs prompting anytime access to practical and prioritized tick prevention educational resources, tailored to the most likely tick encounter risk before someone enters tick habitat. We will launch a promotional campaign around the signs and other QR code-driven products (water bottle stickers, dog ID tags) beginning in March 2022. The QR code will link users to web-based landing pages with relevant content for in-the-moment actions to help prevent tick bites and will be integrated with novel interactive instructional quizzes serving as a robust assessment of our Just in Time learning approach. We plan to target managers of public access lands including state-level, municipalities, Land Trusts, and other entities.

Peer-reviewed publications resulting from this project:

Laga, A.C., T.N. Mather, R.C. Duhaime, S.R. Granter. 2022. Identification of hard ticks in the United States: a practical guide for clinicians and pathologists. *Am J Dermatopathology*. DOI: 10.1097/DAD.0000000000002005

Laga, A.C., S.R. Granter, T.N. Mather. 2022. Proficiency at tick identification by pathologists and clinicians is poor. *Am J Dermatopathology*. 44:111-114. DOI: 10.1097/DAD.0000000000001977

Kopsco, H.L., R.J. Duhaime, T.N. Mather. 2021. An analysis of companion animal tick encounters as revealed by photograph-based crowdsourced data. *Vet Med & Sci*. 7:2198-2208.

Kopsco, H.L., R.J. Duhaime, T.N. Mather. 2021. Crowdsourced tick image-informed updates to U.S. county records of three medically important tick species. *J Med Entomol*. 58:2412-2424.

Kopsco, H.L., T.N. Mather. 2021. Tick-borne disease prevention behaviors among participants in a community science photograph-based passive tick surveillance system compared to a nationwide sample of Master Gardeners. *J Community Health*. (in press)

Kopsco, H.L., R.J. Duhaime, T.N. Mather. 2021. Assessing public tick identification ability and tick bite riskiness using passive photograph-based crowdsourced tick surveillance. *J Med Entomol*. 58:837-846. <https://doi.org/10.1093/jme/tjaa196>

**[Improving the health span of aging adults through diet and physical activity.](#)**

Project Director

Ingrid Lofgren

Organization



## Improving the health span of aging adults through diet and physical activity

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### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

As the population ages, changes in diet, physical activity, and body composition can impact chronic disease prevalence. We completed secondary data analysis to identify some of these relationships and associations to target specific areas for community-based interventions. We also examined how to engage persons with Parkinson's disease (a specific condition that is mostly seen in older adults) via digital health options to increase their access to health care and diet information and resources.

### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

Our major achievements for the 2021 year were two manuscripts and two conference abstracts. We used NHANES data to contribute to the justification for why multi pronged approaches (diet and physical activity) are needed to improve the health trajectory of older adults. The manuscripts and abstracts also provide a chance to disseminate our findings with other researchers who focus on aging adults.

### **Briefly describe how your target audience benefited from your project's activities.**

The target audience benefited from our project's activities in indirect ways. Because of COVID-19, we were not able to do direct participant research, so we put our energies into identifying more evidence for why the research is needed and to further show how our research group continues to work on this issue. We also submitted a proposal as a collaborator with Iowa State University and South Dakota State University (both members of this multi state group) to the Department of Health and Human Services, Administration for Community Living, "*LifeSPAN – A Community-Based Online Sarcopenia Prevention Program*". It was scored but not funded. We are currently looking at how we can rework this proposal for another mechanism.

### **Briefly describe how the broader public benefited from your project's activities.**

The broader public benefit to this research is to determine what diet and physical activity choices for aging adults will lead to them maintaining independence for as long as possible.

### **Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

The 2021 year was a particularly challenging year. First we had the COVID-19 epidemic that severely curtailed the type of research we do as we normally conduct clinical trials here at URI or research in the community, normally through senior centers. This was not possible to do. Additionally, one of the three faculty (Ingrid Lofgren) was on sabbatical for the 2021 year (both semesters).

Closing Out (end date 09/07/2023)

### **[From \(Epi\)Genomes to Farms: Novel Tools for Managing the Impact of Climate Change on Food Production.](#)**

Project Director

Marta Gomez-Chiarri

Organization

University of Rhode Island

Accession Number

1017848



**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

Rhode Island and New England's food system will continue to be impacted by climate change. In addition to challenges to plant production for food; fisheries and livestock production will also be impacted. Not only will our management systems need to change; but the species (and their genetics) we are able to produce here may change as well.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

**Aim 1 – Evaluating the potential for adaptation/acclimation to environmental stress (at the genomic, genetic, epigenetic, physiological, and population levels)**

To understand how animals may respond to climate change and look for acclimation/adaption potential, we must first look at how the coastal marine environment will be influenced by global processes. The Southern Ocean plays a fundamental role in global climate, contributing climate signals throughout the global oceans (including the Atlantic).

The Suckling lab has contributed to international collaborative effort to report current state of understanding on the current and projected changes within the Southern Ocean and how these feed into ecosystems, fisheries and beyond. This work has also assessed the responses of ecologically and economically important Rhode Island fish species to near future climate change by making stronger links with physiology to explain any alterations in responses commonly incorporated in modeling efforts (e.g. food consumption, growth, survival). This work has shown that classic modeling approaches of clustering species responses together within functional groups overgeneralizes response variables which could weaken predictive modelling capabilities.

Suckling and Davies have teamed up with global leading experts in the field of microplastics to draw together evidence highlighting how long-term issues such as climate change is intrinsically linked with plastic pollution, two anthropogenic issues often handled separately by researchers and policy makers. The take home message is an appeal for these communities to consider these two anthropogenic factors together since both pose issues long term threats to marine ecosystems. Plastics could exacerbate the influence that plastics have on the marine organisms, meaning that our existing predictions of how animals respond to climate change could be severely underestimated. In addition, plastic materials are made from fossil fuels, and their breakdown through waste management processes (e.g. incineration, land fill) as well as for mismanaged waste (litter) contribute to emissions contributing towards climate change.

Suckling's work has also shown that benthic invertebrates (sea urchins) show good capacities to cope with episodic benthic resuspension events which resuspend microplastics during storm events. The organisms are able to detect and actively remove the microplastic particles using a combination of pedicellariae and surface cilia. The natural dietary habit of benthic grazing sea urchins could be used as a potential indicator for sensitivity towards the ingestion of microplastics. More specifically, those which are strong omnivores (*P. miliaris*) ingesting diet items which include hard components such as shells, bone fragments and tubes of tubeworms will have experience with ingesting and passing along hard abrasive food items. This subsequently increases their resilience to ingesting microplastics. In contrast, those with strong herbivorous feeding habits (*P. lividus*) consume softer dietary items (e.g. biofilms, algae, animal soft tissue) and are therefore more sensitive to the ingestion of microplastics. This study also highlights that responses to environmentally relevant microplastics are species-specific and dependent on the type of exposure (e.g. external or ingested), meaning that clustering species responses together (i.e. into functional groups) overgeneralizes response variables which in turn might hamper any attempts for effective management.

Corals worldwide have suffered repeated coral bleaching when ocean temperatures warm to a few degrees above normal, and there is a need to understand how these organisms will cope with warmer oceans as reefs provide food for millions of people. Research by Prada using genome-wide genotyping shows a vast amount of genetic variation associated with heat tolerance exists across different cryptic species of corals. Some of these cryptic species are in peril given their susceptibility, while others seem to thrive under warmer waters. This research also shows that these cryptic lineages are adapted to different reef zones. This is key for coral restoration as this work suggests that matching donor and transplanted sites reduces transplant mortality, promoting transplanted fragments' long-term survival during restoration (critical for managers investing in coral restoration).

**Aim 2 – Developing tools and strategies to manage the impact of environmental stress on agricultural systems**

***Aim 2a. (Epi)Genetic mechanisms of resilience to climate change in aquaculture species.***

Schwartz began to examine the potential origins and impacts of copy number variation in oysters by comparing copies in two immune system gene families. We found that one gene family appears to have a pattern of duplication like genes across the genome, while the other appears to have excess duplications. The former observation may suggest selection is acting to retain additional copies and support a more diverse immune system, while the latter suggests that duplication processes differ across the genome.

***Aim 2b. The role of maternal programming on the performance of ruminants and cattle.***

Peterson (previously Hoffman) is addressing the issues that maternal and fetal programming possess to livestock production and health. Specifically, her work tries to determine how different environmental factors (such as stress, disease and/or nutrition) can impact the mother as well as the offspring both immediately and long term. She also continues to evaluate the effects of maternal cranberry vine (CVP) supplementation in ewes during pregnancy and postnatally. Originally, they had planned to evaluate gene expression in lambs supplemented with CVP using a microarray, but had issues with sample integrity. Regardless, the serum of these animals as well as pregnant ewes supplemented with CVP over the past two years were used to evaluate changes in key circulating factors that are involved in metabolism and lipid homeostasis. This is based on the data collected during the reporting period that suggests that the milk composition of the ewes is affected by CVP supplementation. Our goal is to determine how and why this is occurring. We are also interested in determining if CVP can be used as a dietary intervention for animals stressed or predisposed to metabolic issues.

Peterson also received pancreas tissue samples from collaborators at UCONN and new collaborators from NDSU, from a) lambs who were born to ewes fed diet that was a control, restricted or over-fed; and b) fetuses and dams fed a diet rich in methyl donors. These samples will be analyzed for patterns of gene expression using microarrays, as well as for epigenetic signature using methylation arrays and RRBS.

***Aim 2c. Developing microbial-based strategies to increasing resilience in agricultural species***

Ramsey has now published a study between the host associated commensal bacteria *Haemophilus parainfluenzae* and *Streptococcus mitis* revealing interactions beneficial to both organisms. Recent efforts have focused on how these and other native commensal organisms may collaboratively degrade and utilize host-produced mucins as a source of carbon and energy. Recent efforts and a review of the literature in this direction have revealed the lack of a suitable model that mimics in vivo growth on mucus in aerobic environments. The team has secured preliminary data of an in vivo mimic model of growth of an oral supragingival plaque biofilm community on hydroxyapatite (tooth enamel) that preserves most of the original microbiome over a >1 week period. They have also determined they can integrate laboratory strains into this natural community, allowing to test numerous loss of function mutants in much more complex settings in vitro, expanding the utility of findings in initial reductionist experiments.

**Aim 3 – Developing tools to analyze and predict the impact of agriculture on ecosystems**

Understanding population structure in wild populations is essential for maintaining natural genetic variation and sufficient standing variation for adaptation. The Schwartz lab has been developing alternate strategies to examine population structure from genome sequencing. Using human population data and populations as a ground-truth reference, they have shown population structure can be identified using k-mer frequencies across the genome. k-mers are short overlapping substrings of the longer genome sequence. When principal component analysis (PCA) was applied to k-mer frequencies, the methods accurately identified known human populations and could infer admixture like prior work in the 1000 Genomes Project. Using k-mer frequency data rather than SNPs to examine population structure identification has the potential to avoid some of the effects due to sequencing and genotyping errors. Preliminary analysis of oyster resequencing data suggests clustering by several superpopulations.

The Puritz lab has been working to improve EecSeq, a cost- and time-efficient method of exome capture with no need for existing genomic resources, that has the potential to revolutionize ecological, evolutionary, and conservation genomics. Work has been working to improve cost and time efficiency by focusing on laboratory protocol optimization and improvement and validation. Lastly, they are working on the development of an open source, reproducible bioinformatics pipeline.

**Briefly describe how your target audience benefited from your project's activities.**

URI is working towards identifying suitable sites and locations of oyster broodstock off the cooler waters of RI and is working with regional stakeholders to determine how this species could be cultured as seed and field growth to supply local demand. This presents exciting opportunities for the diversifying a market in RI where major shellfish production focusses on oysters which are threatened by near future climate change.

While livestock production in Rhode Island is mainly small scale; understanding environmental and genetic influences on production practices is critical for small and larger scale systems. Research on maternal and fetal programming may influence how producers feed pregnant and lactating ewes in the future.

**Briefly describe how the broader public benefited from your project's activities.**

There is currently no production effort in RI for sea urchins, despite the high international demand which is unmet, and sea urchins have shown to be resilient to environmental stressors such as climate change and plastic pollution making them a good contender for future sustainable food production which must be met through aquaculture due to limited fisheries. A historically abundant, but now sparse species with high market value is the Green Sea Urchin (*Strongylocentrotus droebachiensis*). At present it has a fishery and aquaculture effort in Maine, but there is opportunity to expand aquaculture of this species into RI.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

Peer-review publications:

Barney, A., Lally, J., Gatley, R., Hoffman M. 2021. The effects of maternal programming on postnatal growth and inflammation in neonatal dairy bull calves. *J. Anim. Sci.* Pending DOI and Issue Number.

Chomicki, G., R. Beinart, C. Prada, K. B. Ritchie, and M. G. Weber. 2022. Editorial: Symbiotic Relationships as Shapers of Biodiversity. *Frontiers in Ecology and Evolution* 10. USDA ACKNOWLEDGED: YES

Eaton, L., Barney, A., Lally, J., Gatley, R., Hoffman M. 2021. The effects of maternal programming on dairy bull calf response to an intravenous glucose tolerance test. *J. Anim. Sci.* Pending DOI and Issue Number.

Medina, M., D. M. Baker, D. A. Baltrus, G. M. Bennett, U. Cardini, A. M. S. Correa, S. M. Degnan, G. Christa, E. Kim, J. Li, D. R. Nash, E. Marzinelli, M. Nishiguchi, C. Prada, M. S. Roth, M. Saha, C. I. Smith, K. R. Theis, and J. Zaneveld. 2022. Grand Challenges in Coevolution. *Frontiers in Ecology and Evolution* 9. USDA ACKNOWLEDGED: YES

Modak, T., R. Literman, J. Puritz, K. Johnson, E. Roberts, D. Proestou, X. Guo, M. Gomez-Chiarri, and R.S. Schwartz. 2021. Exceptional genome wide copy number variation in the eastern oyster (*Crassostrea virginica*). *Proceedings of the Royal Society B*. 376: 20200164. <https://doi.org/10.1098/rstb.2020.0164>. USDA ACKNOWLEDGED: YES

Northrup, J. M., Vander Wal, E., Bonar, M., Fieberg, J., Laforge, M. P., Leclerc, M., ... & Gerber, B. D. (2022). Conceptual and methodological advances in habitat-selection modeling: guidelines for ecology and evolution. *Ecological Applications*, 32(1), e02470.

Pelosi, J. A., M. A. Bernal, T. J. Krabbenhoft, S. Galbo, C. Prada, M. A. Coffroth, and H. Lasker. 2021. Fine-scale morphological, genomic, reproductive, and symbiont differences delimit the Caribbean octocorals *Plexaura homomalla* and *P. kükenthali*. *Coral Reefs*. USDA ACKNOWLEDGED: NO

Perera, D., McLean, A., Morillo-López, V. et al. Mechanisms underlying interactions between two abundant oral commensal bacteria. *ISME J* (2021). <https://doi.org/10.1038/s41396-021-01141-3> USDA. ACKNOWLEDGED: YES

Ramsey KM\*, Ledvina HE\*, Tresko TM, Wandzilak JM, Tower CA, Tallo T, Schramm CE, Peterson SB, Skerrett SJ, Mougous JD, Dove SL. 2020. Tn-Seq reveals hidden complexity in the utilization of host-derived glutathione in *Francisella tularensis*. *PLoS Pathog* 16:e1008566 <https://doi.org/10.1371/journal.ppat.1008566>. USDA ACKNOWLEDGED: NO \*Authors contributed equally to this work

Ricks, E., Barney, A., Lally, J., Gatley, R., Hoffman M. 2021. Determining the Effect of Dam Milk Production and Mastitis Infection During Pregnancy on Blood Biochemistry in Dairy Bull Calves. *J. Anim. Sci.* Pending DOI and Issue Number.

Sánchez, J. A., F. L. González-Zapata, C. Prada, and L. F. Dueñas. 2021. Mesophotic Gorgonian Corals Evolved Multiple Times and Faster Than Deep and Shallow Lineages. *Diversity* 13:650. USDA ACKNOWLEDGED: YES



Smith, D., Petersson, K., Hoffman, M. 2021. The Effects of Feeding a 50% Cranberry Vine Pellet on Milk Components During Lactation in Sheep. *J. Anim. Sci.* Pending DOI and Issue Number.

Travis BA, Ramsey KM, Prezioso SM, Tallo T, Wandzilak JM, Hsu A, Borgnia M, Bartesaghi A, Dove SL, Brennan RG, Schumacher MA. 2021. Structural Basis for Virulence Activation of *Francisella tularensis*. *Mol Cell.* 81(1):139-152.e10.

<https://doi.org/10.1016/j.molcel.2020.10.035>. USDA ACKNOWLEDGED: NO

Trigg, S.A., Venkataraman, Y.R., Gavery, M.R., Roberts, S.B., Bhattacharya, D., Downey-Wall, A., Eirin-Lopez, J.M., Johnson, K.M., Lotterhos, K.E., Puritz, J.B. and Putnam, H.M., 2021. Invertebrate methylomes provide insight into mechanisms of environmental tolerance and reveal methodological biases. *Molecular ecology resources*.

Wampole, E, Farris, Z, and Gerber, BD. A synthesis of life-history, functional traits, and consequences of anthropogenic pressures on Madagascar's threatened carnivorans, Eupleridae. *Mammal Review.* 51: 402-419.

<https://doi.org/10.1111/mam.12234>.

#### Presentations:

National Shellfishery Association Meeting in 2021 (Virtual): 2021 Unlocking the Exome: exploring de novo assembly for capture sequencing Green\*, J. M., and Puritz J. B.

National Shellfishery Association Meeting. 2021 From Sequence to Consequence: genomic selection to expand and improve selective breeding for the eastern oyster Guo, X., Allen Jr., S., Proestou, D., Allam, B., Gomez-Chiarri, M., Hare, M., Liu, M., Lotterhos, K.E., Kube, P., Plough, L., Puritz, J.B., et al.

National Shellfishery Association Meeting. Virtual. 2021 Investigating the effects of coastal stressors on the genomic variation of oyster populations in Narragansett Bay Zyck\*, A., Stevick, R., Gallagher, A., Padro, N., Gomez-Chiarri, M., Puritz J. B.

National Shellfishery Association Meeting. Virtual. 2021 An assembled genome reference for the eastern oyster: a resource for discovery and innovation Puritz, J.B., Zhao, H., Weedop, B., Modak, T., Roberts, E., Allen Jr., S., Hare, M., Lotterhos, K.E., Rawson, P., Schwartz, R., Proestou, D., Guo, X., Warren, W., Gomez-Chiarri, M.

National Shellfishery Association Meeting. Virtual. 2021 Assessing the evolutionary response of eastern oyster larvae to exposure to coastal acidification and sewage effluent: a CASE study Puritz, J. B., Harvey, J. A., and Lotterhos K. E. National Shellfishery Association Meeting.

Invited: Suckling, CC. Determining whether microplastics impact marine organisms. RI-INBRE Virtual North East Regional IDEA Conference (Session organizers JP Walsh (URI) & Cody Sharpe (RWU)). Aug. 2021.

Invited: Suckling, CC. Working towards sustainability, Rhode Island School of Design (Host Anastasiia Taina). Mar. 2021.

Invited: Suckling, CC. Sustainable aquaculture and anthropogenic pressure: A story of fish sea urchins and integration, Brown University (Host Gary Wessel). Mar. 2021.

Suckling, C. Expanding green sea urchin production by removing key aquaculture challenges. National Shellfish Association Virtual Conference. Oral. Mar./Apr. 2021.

Suckling, C. The impacts of microplastics on a largely overlooked marine invertebrate – the sea urchin. National Shellfish Association Virtual Conference. Oral. Mar./Apr. 2021.

Suckling, C. A slow growing perspective on multi-generational responses to future change. National Shellfish Association Virtual Conference. Oral. Mar./Apr. 2021.

Workshop: Expanding green sea urchin production – removing key aquaculture challenges (Host Umaine; Feb 2020).

Center For Antimicrobial Resistance & Therapeutic Discovery Research Symposium, 2021; Virtual North East Regional IDEA Conference (v-NERIC) 2021; Invited Seminar, Molecular Medicine Seminar, Cornell University, Ithaca, NY 2020; RI-INBRE Summer Retreat, Kingston, RI

American Society of Animal Scientists Annual Meeting in Louisville, KY. 4 abstracts presented and 1 symposium presentation

Presented results to the PR Department of Natural Resources (March 4, 2021)

## Local to Global Environmental Change

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### Advanced Understanding and Prediction of Pollutants in Critical Landscapes in Watersheds

Project Director

Soni Pradhanang

Organization

University of Rhode Island

Accession Number

1025722



### Advanced Understanding and Prediction of Pollutants in Critical Landscapes in Watersheds

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#### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

The principal focus of this project is to evaluate the effectiveness of best management practices (BMPs) at the watershed scale. This includes the water quality and environmental benefits of mitigation practices as well as their cost effectiveness. This will be achieved through monitoring at sub-watershed scales, modeling at larger spatial scales, and analysis of uncertainty in both monitoring and modeling efforts.

#### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

Effective mitigation of nonpoint source (NPS) pollution is difficult because of the spatial and temporal variability of sources and pollutant fate and transport pathways. The cost associated with preventing and/or mitigating NPS pollution is ever increasing. Multiple barrier approaches are now in use by large water authorities to reduce and remove contaminants in upstream watersheds, reservoirs and groundwater systems. Large reductions in watershed-level nutrient loads could be achieved through coordinated placement of BMPs on high-contributing areas.

The placement and optimization of BMPs for controlling NPS requires a suite of individual and coupled mechanistic models that effectively capture a range of factors and watershed processes. The goal of this research project project is to explore effective solutions to predict performance (individually and cumulatively) of management practices at the various spatial and temporal scales.

A research project on the impacts of saltwater intrusion in coastal aquifers due to storm surges was completed in 2021 and report submitted in late 2021. Observation and model-based nutrient transport research supported by EPA was completed in early 2022. The SNEP report was submitted to EPA. The sUAS-thermal infra-, red-based imaging study to track shallow groundwater plumes and contaminants is still underway. The statewide water uses, and availability database project started in 2020 and will end in 2022. Gold and team have been working on New England Dams and stormwater quality studies using high frequency sensors. At URI's Senior Design / Capstone course within Ocean Engineering, Resource Economics and Landscape Architecture used our Baily Brook and Maidford River data that we collected. The students used the flow data and conductivity data for 3 years. In addition, 20 students in the Hydrology participated in a lab with water quality sensors. We participated real-time monitoring with s::can and YSI sonde sensors in Roger Williams Park in Providence, RI. These lakes have harmful algal blooms each summer and fall. URI provided the data for sensor calibration. The report led by UNH will be available next year. We completed a draft of the Dam Atlas of the watersheds that drain to the Narragansett Bay and coastal waters south of RI. We used GIS modelling to assess ecological attributes, social metrics, and physical attributes. The Dam Atlas with a website will be available soon to help local dam decisions. Dam removals are on the increase across the US. When these areas are dewatered, we are using soil assays to determine if increase nitrification and decrease denitrification in the riparian zone. Supported by USDA-AFRI, the Pradhanang Lab is advancing research to evaluate riparian zone functions in glaciated settings for decision-support purposes with respect to N and P fluxes. Supported by the RI DOT, a study to evaluate the effectiveness of improved roadside best management practices in maintaining stormwater quality was completed in early 2021. The project developed a stormwater runoff model for sub-urban areas in Southern Rhode Island, as well as assessed model uncertainty and calibration through the application of Bayesian statistics.

#### **Briefly describe how your target audience benefited from your project's activities.**

The results are communicated to stakeholders and decision makers in a form usable to these varied audiences, including workshops, webinars and factsheets. Team members shared with state and local stakeholders research findings, especially targeted studies for the regions where each member carried out studies.

**Briefly describe how the broader public benefited from your project's activities.**

At URI's Senior Design / Capstone course within Ocean Engineering, Resource Economics and Landscape Architecture used our Baily Brook and Maidford River data that we collected. The students used the flow data and conductivity data for 3 years. In addition, 20 students in the Hydrology participated in a lab with water quality sensors.

The results were communicated to stakeholders and decision makers in a form usable to these varied audiences, including workshops, webinars and factsheets.

**Geospatial Extension Program**

Project Director

Lisa Townson

Organization

University of Rhode Island

Accession Number

7000230



**FY21 Geospatial Extension Accomplishments**

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**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

The University of Rhode Island (URI) Geospatial Extension Program works to increase the capacity of the Rhode Island community to access and utilize geospatial data in decision-making and promote a higher level of citizen and community engagement. Combining and interpreting geospatial data (e.g., field observations collected with a GPS-enabled device, tabular data, publicly available Geographic Information System (GIS) data) can be quite challenging. The URI Geospatial Extension Program helps our target audience meet these challenges, building upon their knowledge base to further encourage our partners to take advantage of the rich geospatial databases and technology available through our State. The URI Geospatial Extension Program serves as the outreach component of the URI Environmental Data Center, recognized in RI state statute as the technical center of Geographic Information System (GIS) expertise for the State of Rhode Island.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

The URI Geospatial Extension works with internal (Extension) audiences to expand and improve the uses of geospatial data to improve programs as well as supporting state agencies and nonprofits.

*Outcome : URI Cooperative Extension professionals are successful using, and improve their understanding and application of, geospatial technologies, applications, and databases in their programs to reach wider and more diverse audiences.*

In 2021, the URI Geospatial Extension Team worked with 3 URI Cooperative Extension programs and 2 other university outreach organizations to leverage geospatial data, applications, and technologies.

- o Assisted the URI Cooperative Extension Watershed Watch Program with their program goal of communicating results of their volunteer water quality monitoring program by leveraging geospatial applications:
  - o automated field surveys
  
  
  - o interactive web maps
  
  
  - o interactive data dashboard

- interactive storytelling
- 2 geospatial databases – Rhode Island Geographic Information System (RIGIS), Watershed Watch relational database
- Assisted the URI Cooperative Extension Water Quality Group to develop public web resources supporting the Dam Atlas Project by leveraging 2 geospatial applications – interactive web map, interactive web application tool; 2 geospatial databases – RI Dam Atlas Database, USDA Hydrologic Unit Code Watersheds; 2 geospatial technologies – desktop and cloud GIS platforms.
- Assisted the URI Cooperative Extension Master Gardener Program to update their interactive web map by leveraging 1 geospatial application – interactive web map; 1 geospatial database – Master Gardener School locations; 1 geospatial technology – cloud GIS platform.
- Assisted the URI Coastal Institute with updating the RI Coastal Resource Management Council with a public shoreline rights-of-way database and map by leveraging 2 geospatial applications – interactive web map, interactive web application; 1 geospatial database – RI Coastal Resources Management Council public shoreline rights-of-way access locations; 2 geospatial technologies – desktop, cloud GIS platforms.
- Assisted the URI College of Pharmacy’s Community First Responder Program (CFRP) to update their interactive web map by leveraging 3 geospatial applications – field survey app, interactive web map, interactive data dashboard; 2 geospatial databases; CFRP Survey Database, RIGIS; 3 geospatial technologies – desktop, enterprise, and cloud GIS platforms.

*Outcome 2: Government agencies, non-governmental organizations, and private industry improve their understanding and application of the latest advances in geospatial technology.*

In 2021, The URI Geospatial Extension Team worked with 1 state government agency, 2 non-governmental agencies, and 1 other university outreach organization to leverage geospatial data, applications, and technologies.

- Assisted the RI Department of Environmental Management (RI DEM) to carry out environmental data collection, monitoring, and assessment activities resulting in 1 organization (RI DEM) receiving a geospatial technology demonstration regarding mapping grade GPS receivers and the internet-accessible GPS correction services from the URI GPS reference station; 2 geospatial technologies adopted and incorporated.
- Worked with RI DEM and The Nature Conservancy to plan for the execution of a forest health inventory and assessment resulting in 2 organizations on schedule to receive GIS technology demonstrations in FY22 – mobile mapping app, small unmanned aerial drone system, survey-grade GPS; 1 geospatial planning database developed/mapped; 3 geospatial technologies anticipated to be adopted/incorporated.
- Assisted the URI Coastal Institute and The Watch Hill Conservancy to evaluate geospatial technologies applied in new workflows for field verifying submerged aquatic vegetation areal coverage by leveraging 3 geospatial technologies; 2 organizations received GIS technology demonstrations – mobile mapping app, mapping and survey grade GPS, remotely operated underwater camera system; 2 geospatial data layers were developed – point locations for seagrass bed sampling points, underwater video; 2 out of 3 technologies adopted, upcoming field season and equipment availability will determine if underwater camera technology will be incorporated.

**Briefly describe how your target audience benefited from your project's activities.**

*Outcome 1: URI Cooperative Extension professionals are successful using, and improve their understanding and application of, geospatial technologies, applications, and databases in their programs to reach wider and more diverse audiences*

The URI Geospatial Extension Program worked closely with URI Watershed Watch Program staff to develop workflows and integrate annual volunteer-collected water quality data into the URI cloud GIS platform led by the URI EDC. A series of public-facing geospatial web map and dashboard applications were designed, configured, and published, resulting in freeing up Watershed Watch staff time as they no longer need to spend as much time responding to data requests from their audiences of volunteers, state/federal agencies, and the general public. Watershed Watch has realized an improved turnaround time for data entry and verification, allowing higher quality results to be published and more quickly accessed by program participants and stakeholders.

The URI Water Quality group benefits from the technical assistance and expertise provided by the URI Geospatial Extension program for their involvement in the RI Dam Atlas Project. Following our technical lead in geospatial data engineering and integration, they are better equipped to handle, maintain, and update changes to the underlying geospatial databases and web mapping applications that support their Dam Atlas online application.

Success of Dam Atlas Project:

New users were brought onto project.

Best workflows for data publishing, editing, and sharing were adopted.

The final web application will be accessed via a public-facing website supporting decision making.

Through the ongoing technical assistance provided by the URI Geospatial Extension Program, URI Master Gardener Program staff become more aware of how to apply geospatial technologies and data to improve program efficiency, and they continue to ask questions about how best to incorporate GIS technologies, maps, and apps to better share their data with stakeholders.

The URI Coastal Institute has engaged the expertise of the URI Geospatial Extension Program to provide geospatial technical assistance in updating the state's shoreline access rights-of-way database managed by the RI Coastal Resource Management Council and enhance its interactive web mapping application interface. Public coastline access is becoming increasingly limited and controversial, especially in many areas adjacent to privately owned property.

The College of Pharmacy Community First Responder Program benefited from the URI Geospatial Extension Program involvement in their Naloxone Training and Distribution Mapping application and digital dashboard. The Survey123 app we configured for them allowed their staff to capture locational information on where their mobile unit distributed Naloxone and was used to collect additional data that will help them with documentation and reporting.

*Government agencies, non-governmental organizations, and private industry improve their understanding and application of the latest advances in geospatial technology*

RI DEM requested the assistance of the URI Geospatial Extension Program to deploy aerial drone imaging technology to assess forest health at a pitch pine barren adjacent to the Pawcatuck River, located within The Nature Conservancy's Francis Carter Preserve. The RI DEM Division of Forest Environment and The Nature Conservancy (TNC) RI have no in-house expertise with using small Unmanned Aerial Systems (sUAS) equipped with specialized sensors for scientific data collection. In FY21 we requested TNC's digital boundary layer for the Preserve to generate detailed flight plans using specialized mission planning software to share the results with our stakeholders. Along with our stakeholders, the flight plan allows us to evaluate mission control location, takeoff/landing site, areal coverage, and potential safety concerns. At the end of the FY21 reporting period we were in the process of working to gain landowner (TNC) approval and permits from both TNC and URI to carry out the mission. The goal of our activities is to assist our stakeholders in developing new techniques to synoptically assess the current health and condition of this ecosystem and to determine what kind of action to take depending upon the outcomes.

The URI Geospatial Extension Program continues to provide RI DEM with ongoing technical assistance in acquiring, configuring, and deploying mapping grade GPS receivers for environmental management, monitoring, and enforcement applications. During FY21 we provided the connection parameters and walked them through the device configuration for accessing the URI GPS reference station real-time correction data service. We configured and published a real-time data service that is compatible with the RI DEM receivers and will be accessible to them 24/7. RI DEM can expect improvements from standard GPS accuracy of 5m down to 1 to 1.5 meters while connected to our correction data service.

The URI Geospatial Extension Program deployed an Unmanned Underwater Vehicle (UUAV) tracked at the surface with a mobile mapping app connected to both mapping and survey-grade GPS receivers in coastal waters of the Napatree Point Conservation Area in Watch Hill, RI. The purpose was improving existing workflows and developing standard operating procedures for the repeatable, consistent, and regular monitoring of seagrass. These organizations were encouraged by this new option to map the deep-water edges of seagrass habitat boundaries in real-time, eliminating the time, expense, and safety concerns of sending a diver down.

**Briefly describe how the broader public benefited from your project's activities.**

URI Watershed Watch Program: Volunteers have benefitted from immediate access to current observations for all Watershed Watch sampling sites. The interactive dashboards developed and maintained by the URI Geospatial Extension Program are used to visualize bacteria data along with the provisional and verified information. The dashboards have been well received by volunteers and other stakeholders. These data have always been made public, however, the turnaround time from when data are collected, analyzed, and published is now greatly reduced. Data previously would need to be entered manually from hand-written volunteer monitoring cards into Microsoft Excel spreadsheet files, verified, and then at the end of the season the raw data and accompanying charts would eventually be available. Previously, it would take almost 6 months for these data to be published after the monitoring season typically ending in November. Through improved workflows, these data are now available within just a couple of months. All data and visualizations are available to the public at "URI Watershed Watch: Data," a data hub site created in the Esri ArcGIS Online cloud GIS environment - <https://uriwatershedwatch-uri.hub.arcgis.com>.

URI Water Quality Group: The Dam Atlas app raises awareness to local, regional, and state agencies as well as citizens regarding the location and characteristics of dams. Consolidating the information in this way and providing an intuitive mapping interface allows communities to access centralized, common, consistent, and reputable data that is easy to visualize and understand.

URI Master Gardener Program: The audience of the URI Master Gardener Program are presented with more visual and interactive geospatial content which improves their overall understanding of the materials and resources available through their program.

The more accurate and up-to-date rights-of-way database and interactive web-mapping application allows the URI Coastal Institute to provide citizens with access to the latest, official locations for which to access the RI shoreline along with important attributes related to the site.

Through using the Opioid Mapping application and digital dashboards, Community First Responder Program staff are better able to focus their activities to identify areas in need resulting in more effective delivery of their important services to the public.

RI DEM and TNC will have better information to make decisions on managing and protecting the ecosystem, as well as helping ensure that the public may continue to safely enjoy the Francis Carter Preserve.

RI DEM use of mapping-grade GPS, configured to ingest premium correction services through the URI GPS reference system in real-time, achieves higher accuracy, helps to promote more consistent and repeatable data collection which translates into more reliable information going into improved decision-making, resulting in better management and protection of the state's natural resources for public benefit.

The URI Coastal Institute and The Watch Hill Conservancy can leverage geospatial technology to improve decisions around management, protection, and public use of sensitive seagrass habitat.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

We've encountered a lengthy landowner permission and permitting process to reach final approvals for the URI Geospatial Extension program to conduct aerial overflights at the TNC Carter Preserve site. RI DEM has advised us that best practices for detecting evidence of forest pest infestation in the pitch pine barren ecosystem is late fall which also pushed our flight window into FY22.

We provided RI DEM GIS technical staff with over-the-phone tutoring and instructions on how to pair GPS receivers via Bluetooth and configure mobile applications to connect to the URI internet-based GPS correction data service.

We trained URI Coastal Institute staff in the configuration and operation of the mobile-based apps used to receive premium GPS correction signals for enhancing real-time precision GPS data collection. URI Coastal Institute staff were also trained in the operation of unmanned underwater systems for validation of seagrass mapping.

The URI Geospatial Extension Program will continue providing support to the URI Watershed Watch Program, URI College of Pharmacy's Community First Responder Program, and URI Master Gardener Program as our budgeted staff time permits.

## URI Master Gardener Program

Project Director

Lisa Townson

Organization

University of Rhode Island

Accession Number

7000194



## FY21 Master Gardener Accomplishments

### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

By teaching Rhode Islanders to grow a portion of their own food, facilitating information sharing among community members, and encouraging consumers to buy locally grown food, URI Master Gardeners are contributing to the state's 50 by 60 goal (50% of New England's food produced regionally by 2060) and increasing the region's food sovereignty. In the past year, food insecurity continued to be an issue with 1 in 6 residents experiencing food insecurity, and more people gardened for the first time or more frequently for its myriad benefits (mental, emotional, physical). These gardeners sought out reliable sources of information to improve their yields of food crops and select ecologically-sound practices.

### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

777 people who had participated in URIMGP activities or had interacted with a URI Master Gardener volunteer responded to our year end impact survey. Survey results indicate that we achieved and exceeded our outcomes from the work plan.

*Outcome 1: More than 80% of individuals who interact with URI Master Gardeners learn something new each year.*

91%, or 676 individuals learned something new from URI Master Gardener volunteers or staff.

Testimonial: "As far as I know, you are the only reliable source of gardening info in the state! It has given me a foundation and credential to get out and help my community with gardening. It also connected me to a network of knowledgeable gardeners who enjoy sharing what they know. I now have the opportunity to work together with gardeners on projects that I would not have had access to prior. I also learned more about native plants, pollinators and water and resource conservation, and refreshed my knowledge in many other areas of horticulture as well."

*Outcome 2: School garden contacts are more successful in gardening in a school setting after learning from Master Gardeners.*

62 people were more successful in gardening in a school setting after learning from URI Master Gardener volunteers.

Teacher testimonial: "I'm a teacher, not a gardener! I don't know much about maintaining a garden or keeping plants alive! The master gardeners were a huge help to our team this spring as we tried to decipher which plants were weeds, we wanted plucked and which ones would grow into something we intended to have there.... which plants we could leave if we wanted, and which were invasive and harmful. They also tested our soil and gave suggestions moving forward. SO HELPFUL!!"



292 people grew more of their food in 2021 because of something they learned from (a) URI Master Gardener volunteer(s) or the URI Master Gardener Program.

**Briefly describe how your target audience benefited from your project's activities.**

Intentional efforts were made to ensure that gardening knowledge is shared among communities that have historically been underinvested in by the program, including BIPOC individuals and those from “underserved communities”. This includes efforts from our Social Justice, Equity, Diversity, and Inclusion task force consisting of over 50 volunteers with four additional working groups designed to create a more inclusive and accessible program. Specifically, the goal was to increase the diversity (racial, socioeconomic, disability, etc.) of Master Gardener volunteers and Core Training participants. This was accomplished through targeted recruitment to the Providence community, expansion of resources available for financial awards, and relationship building with community-based organizations.

The core training course participants racial demographics went from 85% white and 15% non-white in 2021 to 81% white and 19% non-white in 2022. There was a 21% increase in the number of Core Training applications to become a URI Master Gardener this year, for a total of 227 applicants, with 37 applicants from our target area of Providence. 100% more people (30 individuals) attended the Core Training Program through a financial award (scholarship) program that enables BIPOC and people with low incomes to participate. This was expanded through a Health Resources in Action grant which funded 11 awards, and a programmatic investment for the additional awards. Additionally, partnerships with local indigenous community groups, including the Narragansett Indian Tribe, the Pettaquamscutt Community Garden and the Tomaquag Museum led to many members of the local indigenous community registering to train as URI Master Gardener volunteer educators. Efforts were made to deepen reciprocal relationships within the community and deliver programming based upon stated community needs.

A needs assessment resulted in an 8-part workshop series from 2021-2022 that combines research-based gardening information with food justice advocates. The initial workshops held in 2021 have been viewed by 1,600 people thus far. A peer educator model was implemented to ensure our volunteer service projects are community driven. This means that as an organization requested assistance from the MGP we encouraged them to send a member of the organization through the URIMGP Core Training to return to the community as a trusted, peer educator and potential service project leader. Finally, multiple workshops were held for URIMGP volunteers to increase their cultural sensitivity. These workshops focused on food sovereignty from the perspective of indigenous communities, and immigrant and refugees from Africa, as well as a program on “creating space for native voice” about co-curating educational content with indigenous communities.

**Briefly describe how the broader public benefited from your project's activities.**

Rhode Island’s food system is strengthened by the activities of URIMGP volunteers, with an increase in access to locally grown food and plant starts available for those in need. In a time when 1 in 6 Rhode Islanders was experiencing food insecurity, the program’s efforts resulted in 57,392 pounds of locally grown produce being donated to hunger relief agencies such as food pantries, kitchens, and school-based donation programs. This nutrient dense food was grown by volunteers in community donation/teaching gardens, plant-a-row plots in home gardens, and gleaned from local farms in partnership with Hope’s Harvest. 70 families of refugees from Afghanistan were welcomed to the state with URI Master Gardener grown mint plants this October, a culturally appropriate culinary herb. This was enabled through a unique partnership with We Share Hope, a nonprofit that partnered with Dorcas International Institute of Rhode Island to help families settle into the community.

Additionally, 18,283 vegetable and native plant seedlings were donated to school gardens, community gardens, BIPOC community members, and national wildlife refuges to assist with habitat restoration projects. These resources, coupled with access to Master Gardener educational services to teach food growing techniques in garden settings and online, answer questions and test soil, support people in their efforts to grow their own food.

School gardens were supported this year by partnering with specially trained URIMGP volunteer School Garden Mentors who provide technical guidance as well as garden maintenance support, an important added service this year as schools struggled with pandemic-related challenges. Thousands of school children have access to outdoor learning environments to learn about where their food comes from, STEM concepts in an authentic setting, and more. About 6,600 people benefited from the program’s activities by having access to the educational services of the URIMGP, including public workshops, the gardening and environmental hotline, soil testing, web-based “radio hour” events, and outdoor plant clinic events in the community. This includes a 17% increase in calls to our gardening and environmental hotline this year. The program staff curated a virtual series of workshops in partnership with Providence Community Library and Providence Seed Library (Seed Saving Basics and Winter Sowing). An additional 1,065 people attended the Gardening with the Master’s Tour, where 93% (97 individuals) of

garden respondents learned something new from attending the tour. Over 40 demonstration gardens located throughout the state served as educational sites to teach people best gardening practices, from ways to create wildlife and pollinator habitat at home, to edible crops, to habitat restoration gardens.

Finally, many people cited mental health benefits from their involvement in the program. Volunteers mentioned that despite the challenges this year, they looked forward to connecting outdoors safely with their gardening peers and volunteering in the community, as well as learning with us safely from home in an online format. Some testimonials in this regard are: “This program introduced me to like-minded people with a passion for gardening and saving the environment. More importantly, getting outside, gleaning at local farms to feed hungry people has been gratifying and has helped me through these times of instability. Thank you!” “Kept me going during the Covid shutdown”, “It made me appreciate nature outdoors which carried me thru recovering from an illness and during covid which made me feel more resilient and optimistic.”

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

We were able to overcome pandemic related restrictions by hosting events online and focusing on outdoor activities that allowed for adequate social distancing. This did present a challenge in re-considering how all our programs and services functioned, with fewer garden-based educational events than pre-pandemic.

We use a variety of print and online dissemination tools, including press releases which are picked up in print and online media, social media, email blasts through the URI system. We have 630 followers on our newly formed URIMGP Instagram page in addition to the URI Cooperative Extension social media presence.

The program will continue to provide educational services in a manner that is mindful of the safety of volunteers and community members. Next year, we look forward to providing more in-garden education which was de-emphasized the past two years. We'll carry forward the online Core Training, public presentations and workshops which enable great access to more Rhode Islanders, with recordings available for people to watch as their schedules allow from the safety of their homes. We'll continue to work on the goals of the Social Justice, Equity, Diversity, and Inclusion taskforce by meeting bimonthly with the larger group, supporting our volunteer working groups who are continuing to ensure education is accessible to all, creating action plans based on the result of the community needs assessment, improving accessibility to our volunteer garden projects, and creating systemic change to policies and educational models.

## **Watershed Watch**

Project Director

Lisa Townson

Organization

University of Rhode Island

Accession Number

7000227



## **FY 21 Watershed Watch Accomplishments**

**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

Timely, reliable data is critical for implementing effective watershed protection and restoration efforts. URI Watershed Watch (URIWW) fosters use of locally relevant data focused on community needs via its long-term ecological monitoring and assessment program. Collaborations with volunteers, students, and numerous partners enhance our effectiveness, reach, and impact. Citizen scientist generated data, combined with geospatial information, communicates information in an accessible manner. Knowing the current conditions, how they have changed, and whether efforts to protect or restore local waterways have been effective are critical for successful water resources management.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

Despite the challenges of COVID-19 in 2021, hundreds (+350) of trained volunteers helped URIWW gather water quality data on more than 215 stream, lake, estuary and marine sites throughout RI and adjacent areas. URIWW has a comprehensive dataset up to 34 years for some sites, with a decade of data for most; enabling trends to be detected.

*Outcome 1 – Volunteers and local sponsors learn and apply water monitoring techniques.*

Over 55 new volunteers received monitoring manuals and/or participated in online training sessions, increasing their understanding of water quality issues, and monitoring procedures, likely beginning multi-year commitments for many.

*Outcome 2 – Volunteers and local sponsors use water monitoring data to promote stewardship of local water bodies.*

In Warren, RI, URIWW data collected before a dam removal, spurred the town and local residents to monitor additional downstream sites to better characterize potential impacts from dam removal. Based on URIWW results, several organizations added monitoring sites to better understand the system or to identify possible pollution sources. Several communities and organizations used URIWW-generated data as justification for restoration funds in grant applications.

**Briefly describe how your target audience benefited from your project's activities.**

Two community groups worked with URIWW to conduct in-depth assessments of fecal bacteria to identify and correct sources. A newly formed watershed group and researchers asked for URIWW help to conduct a watershed assessment and evaluate a potential treatment for reducing cyanobacteria in an impacted waterbody. Several local groups added monitoring sites to either investigate local questions or to monitor impacts from restoration projects. For example, RI Surfriders collected samples from pond and creek site upstream of beaches that recorded high bacteria levels. Those data supported additional investigation by RIDEM and DoH.

Volunteer monitoring is a great hands-on way of educating youth and building stewardship. In 2021 two schools participated in monitoring: 1) at the Narrow River, middle school students learn about ecosystems and 2) a high school sustainability club, took on two stream sites near a recently developed solar farm to understand development impacts. Supervising teachers report that the students not only enjoyed the outdoor experiences, but the activity put lessons into context, improving student interest and understanding. Expanded online data entry (<https://uriwatershedwatch-uri.hub.arcgis.com/>) improved access to the data, allowing timely use and fostering volunteer interest.

**Briefly describe how the broader public benefited from your project's activities.**

URIWW data is widely used by agencies (including RI Department of Environmental Management's (RIDEM) and the Department of Health (DoH)) and local organizations. URIWW data was part of the biennial Integrated Water Quality Monitoring and Assessment Report. As a result, several sites were listed and others de-listed partially based on URIWW data, which was also used in Total Daily Maximum Load studies. Resources to help communities manage dams were expanded through the development of a RI Dam Atlas.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

COVID continues to be a challenge as it limits face-to-face training opportunities. Those have been temporarily replaced by online training sessions. We expect to keep online sessions to supplement in-person training in the future. In addition, having to deliver samples to a cooler outdoors means that we aren't able to allow volunteers into the lab to conduct quality control tests. This limits our ability to document QA/QC values, but we hope this is temporary. New volunteer training and refresher training for returning volunteers was conducted online with recorded and live sessions (<https://web.uri.edu/watershedwatch/resources/training-videos/>).

Water quality data are sent to the RI Department of Environmental Management for inclusion in their water quality database. Several partner organizations also receive database formatted results for inclusions in their databases (<https://wpwa.org/water-quality/>, <http://www.saltpondscoalition.org/OurPonds.html>). Others receive written reports summarizing their data. All data are available via the programs website as CSV files for downloading, or in data dashboards (<https://web.uri.edu/watershedwatch/data/>). Program staff also participate in municipal or organizational meetings to share results.

Sponsoring partners have already committed to monitoring in the 2022 season, and development of schedules has been completed. Staff have begun creation of templates to support watershed assessment tools to be completed by students and partners. Expansion of cyanobacteria monitoring conducted via the Cyanobacteria Monitoring Collaborative with support from the Audubon Society is planned. And Watershed Watch will be working on a RI Water Resources Center funded project to facilitate research on microplastic monitoring in several ponds in RI.

Peer-reviewed publications resulting from this project:

Hollister, J. W., D. Q. Kellogg, B. J. Kreakie, S. D. Shivers, W. B. Milstead, E. M. Herron, L. T. Green, and A. J. Gold. 2021. Analyzing long-term water quality of lakes in Rhode Island and the northeastern United States with an anomaly approach. *Ecosphere* 12(6):e03555. 10.1002/ecs2.3555

Type

**Projects / Programs without a Critical Issue**

Not Provided

Projects / Programs

**0**