

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Energy, Climate Change and the Environment

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	3%		3%	
112	Watershed Protection and Management	11%		11%	
123	Management and Sustainability of Forest Resources	11%		11%	
131	Alternative Uses of Land	9%		9%	
132	Weather and Climate	9%		9%	
133	Pollution Prevention and Mitigation	11%		11%	
135	Aquatic and Terrestrial Wildlife	11%		11%	
136	Conservation of Biological Diversity	9%		9%	
605	Natural Resource and Environmental Economics	3%		3%	
608	Community Resource Planning and Development	11%		11%	
721	Insects and Other Pests Affecting Humans	8%		8%	
722	Zoonotic Diseases and Parasites Affecting Humans	3%		3%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	1%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	5.5	0.0	11.0	0.0
Actual Paid	2.1	0.0	19.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
250567	0	640597	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
163932	0	632829	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Vector Borne Diseases

Used surveillance data accumulated over 21 years to develop user-friendly tools to pinpoint risk, both spatially and seasonally.

Determined landscape patterns that present the greatest risk for encountering a tick bite.

Formulated landscape plans to reduce the chances of encounters between ticks and people.

Created a web-based decision support system. Using this system, people will compile a customized risk index and then follow links that will help them devise short- and long-term disease prevention action plans.

Studied the salivary glands of ticks to find compounds from ticks with potential pharmacological value, formulate novel vaccination strategies to prevent tick-transmitted infections, develop bio-molecular assays for tick-borne pathogens, and elucidate transmission dynamics of pathogens among tick vectors and vertebrate hosts.

Climate Change

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

Extension programs created locally relevant programs focused on land and community management. In cooperation with stakeholders and partner agencies, we identified needs and built upon successful local programs to create and disseminate new materials, tools and curricula in RI and New England.

Our water quality programs continued development, delivery, training and application of proven water quality management tools and techniques such as:

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

The Environment and Adaptive Agro-ecosystems

Sustaining wildlife through habitat management is a critical issue for RI. Migrating song birds require suitable food sources to complete their migration and coastal lands have undergone extreme changes in vegetation, potentially imperiling migration success and fecundity for many native species. Ruffed Grouse are of particular concern in southern New England because they are a native game bird species that is currently too rare to sustain a hunting season and they serve as a "sentinel species" for the response of many species to the success or failure of management of early successional forests. Although vernal ponds in forested watersheds provide essential habitat for a host of organisms, the fecundity of these organisms is highly linked to forest disturbance and management, requiring a careful understanding of the underlying ecology. Invasive plants threaten the integrity of New England habitats and could affect biodiversity within the state. Research and extension programs are planned to assess invasives and develop strategies for mitigation.

Sustainable Energy

Promoted alternative fuel technologies and fuel economy measures at the individual and fleet level to decrease use of petroleum in the transportation sector.

Promoted completion of energy audits for increased energy efficiency and adoption of conservation behaviors for decreased energy consumption at the individual and small business level.

Energy audit and greenhouse gas (GHG) inventory in selected municipalities/businesses

Feasibility and implementation of energy efficiency and renewable energy technologies.

Municipal energy training:

- o Training for municipal officials and employees
- o Climate Showcase Community conferences

Residential Energy Education:

- o Participants pledge 10% energy savings
- o Trained volunteers conduct locally-based education and outreach

Outreach Activities:

- o Sustainable energy page on local websites
- o Community workshop

Traditional and web media

2. Brief description of the target audience

Target Audience

Vector Borne Diseases

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

Climate Change

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

The Environment and Adaptive Agro-ecosystems

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

Sustainable Energy

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

3. How was eXtension used?

An eXtension webinar was presented in the All Bugs Good and Bad webinar series (April 4, 2014). See <https://learn.extension.org/events/1381>

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	14688	506000	787	1000

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

Patent Applications Submitted

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	2	17	19

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed publications

Year	Actual
2014	16

Output #2

Output Measure

- Books and monographs

Year	Actual
2014	2

Output #3

Output Measure

- Abstracts

Year	Actual
2014	40

Output #4

Output Measure

- Conference proceedings

Year	Actual
2014	17

Output #5

Output Measure

- Fact sheets, bulletins and newsletters

Year	Actual
2014	98

Output #6

Output Measure

- Training manuals (includes instructional CD?s)

Year	Actual
2014	22

Output #7

Output Measure

- Scientific/professional presentations

Year	Actual
2014	104

Output #8

Output Measure

- Workshops (including short courses)

Year	Actual
2014	97

Output #9

Output Measure

- Conferences hosted

Year	Actual
2014	8

Output #10

Output Measure

- Website development and refinement

Year	Actual
2014	254

Output #11

Output Measure

- Public presentations

Year	Actual
2014	87

Output #12

Output Measure

- Public service announcements

Year	Actual
2014	50

Output #13

Output Measure

- Student training

Year	Actual
2014	340

Output #14

Output Measure

- Thesis/dissertation

Year	Actual
2014	10

Output #15

Output Measure

- Postdoctoral training

Year	Actual
2014	2

Output #16

Output Measure

- Webinars

Year	Actual
2014	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Identify areas of high risk for vector borne diseases in Rhode Island
2	Create tick surveillance database
3	Create web-based decision support system to reduce risk to vector borne diseases.
4	Reduce tick abundance community-wide
5	Increased (%) of in the proportion of professionals and the public knowledgeable about maintenance, improvement and challenges of climate variability and climate change related to onsite wastewater treatment.
6	Increased (%) development of locally based water resource data for use by communities and the public that can assist in risk assessment and management related to watershed changes, climate variability and climate change.
7	Increase in targeted households and professionals gaining knowledge of testing, treatment and protection of private well water and management options related to land use, climate variability and climate change. Increase in targeted households and professionals gaining research-based knowledge of testing, treatment and protection of private well water.
8	Increase in the proportion of the public and professionals knowledgeable about management of storm water and options for addressing risks related to watershed changes, climate variability and climate.
9	Development of a rapid-response to public concerns about local HAB's. Increased development of locally based water resource data for use by communities and the public that can assist in risk assessment and management related to watershed changes, climate variability and climate change.
10	Increased understanding by wildlife biologists, NGOs, local and state officials through publications and talks on people's willingness to support ecosystems and conservation.
11	Increased understanding by wildlife biologists and managers through publications and talks of how habitat quality and management practices affect populations of migrating song birds.
12	Our proposed research would increase understanding of three critical issues: inadequate GIS-based information about the spatial extent of early successional habitat, inadequate use of the Adaptive Management Paradigm to evaluate past and present efforts to expand early successional habitat, and inadequate understanding of how certain forest management activities affect populations of key wildlife species. Our proposed research will directly strengthen outreach programs to promote better targeted and more effective forest management interventions in southern New England.
13	Increased development of new subaqueous soils interpretive approaches and dissemination of these approaches to other scientists and natural resource managers through publications, workshops or talks.

14	Increased (%) forest and conservation geospatial information resources, and increased usage of these resources by government organizations, NGOs and the public.
15	Increased awareness of the effects of human-induced land-cover change and provided insights into the extent and rate of land-cover changes in Rhode Island and the impacts of human activity on characteristics of forest landscape over the last four decades through generated data and maps.
16	Increased US state and federal regulators understanding of avian-wind turbine interactions. This information is also useful to conservation NGOs interested in protecting avian resources in the region.
17	Increased understanding and acceptance by the nursery industry, the general public, professional groups, and research scientists through patents, publications and talks of the occurrence and value of adelgid-resistant eastern hemlocks.
18	Master Energy Training will be conducted to educate RI residents, small businesses and municipalities so that they can make informed decisions that will reduce their consumption of fossil fuels and their carbon footprint through energy conservation, efficiency and use of clean energy resources.
19	Through the Energy Fellows Program, we will provide URI undergraduate and graduate students with the opportunity to gain invaluable experience addressing real-world energy issues.
20	NIFA energy programs at URI are coordinated with the DOE-funded Ocean State Clean Cities Coalition to provide a broader array of program and services for RI stakeholders concerned about energy issues.
21	Through the Renewable Energy Siting Partnership, a URI team of skilled professionals in the fields of energy, research and planning will develop tools, guidelines and data analysis that can be used by Rhode Island's cities and towns to site and manage this new activity. Additionally, the RESP project will make state and municipal energy information accessible to the public through the creation of a comprehensive online energy database.
22	Through a partnership with Rhode Island Department of Transportation we will capitalize on the wealth of both experience and funding available at the state and federal levels to accelerate and facilitate reduction of diesel pollution from work performed on projects managed by RIDOT.
23	Increased understanding by scientists and decision makers through publications and presentations of the management implications related to plant genome size influences on competitive ability and susceptibility to herbivory.
24	Increased understanding of the private and public sector and scientists of economic valuation of air quality and greenhouse gas emissions through publications and presentations
25	Advance understanding by scientists and decision makers of demand and supply of ecosystem services (ES) from watersheds in the rural-urban fringe at a policy-relevant scale by integrating information from hydrology, spatial science, and economics.
26	Models will be developed for coastal managers that will enable them to assess potential for coastal marsh restoration to enhance C sequestration in those ecosystems.
27	Increased understanding by scientists, conservationists, and land managers through publications and presentations of the management implications of forest fragmentation and creation of early-successional habitat on turtle populations.
28	Increased understanding of the management implications of how amphibian and reptile populations respond to the impacts of forest loss and pollution.
29	Increased understanding of the management and risks of watershed nitrogen delivery.

30	Increased understanding of how wildlife populations may respond to climate change.
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Outcome #1

1. Outcome Measures

Identify areas of high risk for vector borne diseases in Rhode Island

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rhode Island possesses one of the most concentrated blacklegged tick populations in the United States affecting a majority of its citizens. Risk maps are useful in communicating relative levels of risk and changing risk patterns.

What has been done

A Rhode Island statewide TickEncounter Risk Survey has been conducted for 21 consecutive years to assess relative abundance of nymphal blacklegged ticks. Ticks have been sampled following a standardized protocol at the same 60 sites and the data are used to generate interpolated risk maps in a GIS.

Results

In 2014, for the third year in a row, nymphal blacklegged tick abundance was the highest recorded in the 21 year period, increasing 0.3% statewide when compared with the previous nymphal blacklegged tick record of 2013. In 2014, overall nymphal tick abundance was 62% higher than the previous 5 yr average, with significant increases noted in Cumberland, Portsmouth, and the western border of the state.

4. Associated Knowledge Areas

KA Code Knowledge Area

721	Insects and Other Pests Affecting Humans
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #2

1. Outcome Measures

Create tick surveillance database

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The results of this work are being used to develop models predicting risk for vector tick encounters and tick-borne disease. The information will benefit citizens as well as public health planners. The long-term nature of this database also has demonstrated its utility in identifying potential climate and climate change impacts on tick-borne diseases in Rhode Island.

What has been done

The 21 year Rhode Island statewide TickEncounter Risk Survey database is stored on a local network share drive for ease of use for investigators, but is backed-up monthly in ESRI FileGeodatabase format. After new additions to the database are made, it is copied to a large raid array, and that is moved to a cloned raid array every 6 months. The data are also available in text file format for analysis in SAS. Field data are stored with UTM coordinates Zone 19 North American Datum1983.

Results

TickEncounter Risk Survey data collected between May - July 2014 were added to the database (see above). The database was used to assess long-term disease trends and to investigate climate/weather impacts on tick encounter risk. We showed that nymphal blacklegged tick encounter risk each year is determined by the number of tick adverse moisture events (TAME) occurring during June of the same year. A TAME is defined as a localized (tick habitat) relative

humidity <80% lasting 8 hrs or more>. Eight or more TAMES in one season always resulted in a significantly lower nymphal tick population which was correlated with lower Lyme disease incidence rates.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Create web-based decision support system to reduce risk to vector borne diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Across America, 300,000 new cases of Lyme disease are diagnosed each year, and there are other dangerous tickborne diseases, too; but there are scant few expert resources for translating tick sciences to benefit the public. URI's TickEncounter Resource Center (TERC) is a national leader in linking the best of tick science to peoples' lived experiences. TERC's web site (www.TickEncounter.org) and its tools and content engage, educate and empower TickSmart actions to help people be TickSafe.

What has been done

Launched in 2006, TickEncounter is a unique web-based outreach and decision-support platform aimed at linking the best of tick science to people's lived experiences. TickEncounter distinguishes itself from most other tick resources by providing an engaging graphic interface with seasonally and geographically relevant messages empowering tick bite protection. Various tools

are included but all attempt to conform to the 4 tenants of the Health Belief Model for behavior change. In 2014, TickSpotters was established as an interactive, crowd-sourced tick survey across America.

Results

TickEncounter analytics revealed that the site posted 927,909 sessions and 803,507 unique users in 2014; there were 1,792,107 pages viewed, an increase of 92.7% over 2013. In addition to this, we placed 15 guest blogs with 13 different web-based blog sites which generated a significant but unknown number of additional views of TickEncounter related decision support materials. We distributed >35,000 tick identification magnets and >2,500 TickSmart Daily Tickcheck Reminder cards to individuals and organizations across the United States, and responded to >1,500 e-mail inquiries generated through the web site channel. Our social media channels continued to grow with >1,500 new Facebook "likes" in 2014 and >600 new followers on Twitter (@TickEncounter and @theTickGuy). TickEncounter's Youtube channel has had 4,703,903 lifetime views with 656,351 views during 2014 and an estimated 531,716 minutes watched. Our popular "How to remove a tick" video was watched 611,411 times (467,730 minutes) in 2014.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Reduce tick abundance community-wide

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Increased (%) of in the proportion of professionals and the public knowledgeable about maintenance, improvement and challenges of climate variability and climate change related to onsite wastewater treatment.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Approximately 30% of Rhode Islanders rely on onsite wastewater treatment systems (OWTS) to treat wastewater. Rural and suburban communities, lacking municipal sewers, rely on them entirely. In the humid northeast US it is expected that wetter and warmer climatic conditions will result in poorer treatment potential in conventional OWTS. Sea level rise in densely developed coastal areas of RI also causes a rise in groundwater tables in those areas and will result in a reduction in separation distance between OWTS and water tables. This will result in a reduction in treatment potential, and an expected reduction in ground and surface water quality. RI Department of Environmental Management and local community decision makers need research data and outreach support to develop regulations and policy that will protect public and environmental health.

What has been done

In 2014 URI researchers made invited presentations at five conferences about climate change and OWTS reaching approximately 235 wastewater practitioners, board of health officials, regulatory decision makers and coastal resource managers. We continued our outreach efforts to promote advanced OWTS technologies as a best management practice to mitigate the expected loss of treatment potential in OWTS located in at-risk areas for climate change impacts.

Results

URI project staff educated wastewater practitioners about advanced OWTS, helping to raise the knowledge base and proficiency of these wastewater designers. Approximately 40% of all OWTS applications that these designers submit to the RI Department of Environmental Management are for advanced OWTS. Use of advanced OWTS that denitrify wastewater are now required in state-designated watersheds that are nitrogen sensitive. This has helped protect these watersheds from further degradation and may help to mitigate the impacts of climate variability and climate change.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
112	Watershed Protection and Management

131	Alternative Uses of Land
133	Pollution Prevention and Mitigation

Outcome #6

1. Outcome Measures

Increased (%) development of locally based water resource data for use by communities and the public that can assist in risk assessment and management related to watershed changes, climate variability and climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Seasonal droughts, rising nutrient levels, nuisance algae blooms and the spread of invasive aquatic plants have increased awareness that water quantity and quality is a concern for the public and local, state and national decision makers. Agency resources, both staff and financial, to monitor water resources in New England have always been insufficient, while the need increases yearly. Monitoring is long-term, with best decisions based on at least 10 years of data. Detecting trends and threats to local waters is increasingly becoming the responsibility of local communities and watershed organizations. Even the simple measurement of water temperature has become recognized as valuable, not just in documenting climate change, but in its role in nutrient cycling, plant and algae proliferation, and potential and actual effects on people and animals.

What has been done

URI Watershed Watch has become the largest and premier long-term volunteer water quality monitoring and citizen science program in RI, and is a model for other states and organizations. We have held multiple training sessions for new and returning volunteers. Now approximately 350 citizen scientists conduct ecological monitoring on ~270 locations primarily in RI, sponsored by more than 40 local organizations, measuring water clarity, temperature, oxygen content, pH and alkalinity, processing samples for chlorophyll and collecting samples for lab analyses of nutrients and bacteria during the six month monitoring season. Sites are 1/3 lakes or ponds, 1/3

rivers and streams, 1/3 estuaries, bays, and salt ponds. Co-hosted NE Lakes conference to educate lake and watershed organizations about lake and watershed ecology. Invited speaker at Land Trust and Citizen Science conferences. This year we obtained significant grant funding to develop an easily searchable relational database to house the decades of data, which can be used by program volunteers, their program coordinators, environmental and agency professionals. We are active at the local to national scale in lake-related efforts. We are on the RI DEM-DOH Cyanobacteria Task Force, as well as the EPA-NE and NEIWPC ones. Our Coastal Fellow has also participated in these meetings and implemented the inaugural EPA-NE effort in RI.

Results

Because of Extension-led volunteer monitoring an unparalleled, long term record of water clarity, temperature, oxygen content, nutrients and bacteria levels now exists in most NE states, with more than 25 years of data from the URI Watershed Watch program. Over 20,000 annual data points aggregated into site-specific monitoring results were posted on the URIWW website and distributed to sponsoring organizations as well as RI DEM & US EPA in this fiscal year alone. Regulatory agencies have used the data to create regulations to protect excellent water quality as well as to document poor water quality, and to help best direct their resources. WW results are used for 303d listing. Extension has used monitoring results to target programs to specific geographic areas. Local groups have used the data to take action to enact local ordinances to promote farm and homeowner awareness and action to deal with local runoff and erosion issues. These data are also now being used to document surface water temperature changes and also track cyanobacteria blooms as well as deep water hypoxia and anoxia.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Increase in targeted households and professionals gaining knowledge of testing, treatment and protection of private well water and management options related to land use, climate variability and climate change. Increase in targeted households and professionals gaining research-based knowledge of testing, treatment and protection of private well water.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Protection of municipal drinking water receives increased attention as water suppliers are now required to test, report and treat for numerous water quality contaminants. Surprisingly, private wells, which serve 10% of the state's population, are not protected under the Safe Drinking Water Act or other federal programs. Private well owners are largely responsible for ensuring that their well water is safe for them and their families to drink. These residents need to be aware of contaminant risks to their drinking water sources and how to protect against such risks. Changing property laws and regulations in the state have increased demand for well water testing educational materials. Education and technical assistance about protecting private sources of drinking water is critical to the health and safety of families relying on private wells. Audiences include private well owners, scientists and researchers, educators, federal, state, and local policymakers, and non-profit organizations. Given the large number of Rhode Islanders (100,000) who rely on private wells, this Extension program has used a variety of methods to educate and provide technical assistance to the state's private well owners.

What has been done

Total number of clientele contacts (workshops, face-to-face interactions): 583, including nine community workshops held across the state. In January, 2014 we updated the workshop presentation and format based on our review of workshop evaluations. In addition, in February 2014, we piloted an approach to increase the number of workshop participants who have their water tested. Two days after the workshop, we returned to the community to pick up test kits and take them to the RI Dept. of Health testing lab. To date, we have found that this has facilitated and increased private well testing. We participated in the RI Home Show at the RI Convention Center, April 3 - 6, 2014 and spoke with hundreds of private well owners. We implemented and piloted an intercept campaign at RI farmers' markets in a continuing effort to meet private well owners in their own community. URI undergraduates were hired and trained to attend these events. We launched a completely updated program website web.uri.edu/safewater. Annually the website receives 40,000 hits. The Program's quarterly newsletter is sent to 500 private well owners. Technical assistance is also provided via phone and email. Invited speaker at the National Ground Water Association's Annual Expo., Private Well Symposium, December 3 - 6, 2013. Invited presenter on the Center for Disease Control's National Private Well Working Group's quarterly webinar series, February 20, 2014.

Results

Post workshop evaluations conducted annually show that workshop participants are taking action to protect their private well, most notably, 67% of workshop participants had their water tested and 65% inspected their wellhead area for possible pollution problems. Our newly developed Private Well Tip Sheet series received a 2014 Clear Mark Award of Distinction for revised materials from the National Center for Plain Language. The tip sheet "Are you a smart well owner?" received a 2014 Clear Mark Award of Distinction and the best of category. We have an article accepted for publication in the Journal of Extension: McCann, A. & Stableford, S. "Know

Your Audience, Ask Your Audience."

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #8

1. Outcome Measures

Increase in the proportion of the public and professionals knowledgeable about management of storm water and options for addressing risks related to watershed changes, climate variability and climate.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Storm water pollution is a major cause of impaired water quality in RI, leading to swimming beach closures, shellfishing bans, loss of recreational value, and degraded habitat. Most RI municipalities are at least partly urbanized and own storm sewer systems that contribute to the problem. Under EPA Rules and the RI Storm Water Discharge Permit program, municipalities are required to implement storm water management programs to reduce storm water pollution. To demonstrate compliance, the municipal programs must address several minimum standards including education and outreach to the public about storm water pollution and actions citizens can take; and involving the public in local storm water management programs. These requirements, while necessary, represent a significant burden for most municipalities already struggling with few staff, shrinking budgets, and in most cases, limited expertise in education and outreach.

What has been done

We have provided education and outreach to municipal officials, watershed groups, the public, and educators on managing storm water runoff. We organized three workshops on wetlands protection and gave presentations on other storm water management topics for local officials and

environmental professionals. We helped develop a new Emergency Response Planning Guide dealing with flooding and other storm events and assisted in conducting training in use of the guide through five workshops. We worked with agency partners to make new tools available to municipalities, including new small scale sub-watershed maps for use in storm water management planning; an updated soils database with new fields useful in project review; and co-created a database of wetland buffer ordinances. We continued to make educational materials available to storm water managers and watershed groups that are freely available to use directly or customize. We responded to requests for information and technical assistance, and launched a new version of the RIStormwaterSolutions.org website with a new look and improved navigation.

Results

RI municipalities throughout the state used or customized URI educational materials to educate residents about storm water pollution using flyers, town hall notices, adding content to their own websites or linking to ours, posting storm water cartoons and other notices in the newspaper, and sponsoring educational events and cleanups, enabling them to develop effective storm water management programs. RI Department of Transportation also demonstrated compliance with public education and involvement requirements based on URI outreach. The local wetland ordinance database and literature review is being used by a legislative task force to recommend more protective state buffer standards that address local concerns. Soil depth and quality standards developed by RI NEMO were incorporated into the updated 2014 RI Soil Erosion and Sediment Control Handbook, which will set the standard for all development regulated by State agencies and municipalities.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Development of a rapid-response to public concerns about local HAB's. Increased development of locally based water resource data for use by communities and the public that can assist in risk assessment and management related to watershed changes, climate variability and climate change.

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Increased understanding by wildlife biologists, NGOs, local and state officials through publications and talks on people's willingness to support ecosystems and conservation.

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Increased understanding by wildlife biologists and managers through publications and talks of how habitat quality and management practices affect populations of migrating song birds.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many forest owners, including private forest owners, land trusts, or NGOs, state and federal agencies, are interested in managing their forests to improve habitat for songbirds and other wildlife species. However, there are still many outstanding questions about the most effective methods for achieving this. Furthermore, there have been few attempts to date to assess the impact of forest management on wildlife

What has been done

A series of outreach events have been conducted to increase awareness of forest owners about how habitat quality and management practices affect populations of migrating song birds.

Preliminary field studies have been conducted on how to create habitat for wildlife and assess various approaches to monitoring the quality of the resulting habitat.

Results

Awareness about the relationship between forest management and wildlife habitat has been increased for many landowners as a result of the outreach activities. Graduate and undergraduate students and research technicians have demonstrated that (a) using a robel pole is a promising approach to monitor the quality of habitat created through forest management; (b) locating small clear cuts near wetlands increases their habitat value for songbirds.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

Our proposed research would increase understanding of three critical issues: inadequate GIS-based information about the spatial extent of early successional habitat, inadequate use of the Adaptive Management Paradigm to evaluate past and present efforts to expand early successional habitat, and inadequate understanding of how certain forest management activities affect populations of key wildlife species. Our proposed research will directly strengthen outreach programs to promote better targeted and more effective forest management interventions in southern New England.

Not Reporting on this Outcome Measure

Outcome #13

1. Outcome Measures

Increased development of new subaqueous soils interpretive approaches and dissemination of these approaches to other scientists and natural resource managers through publications, workshops or talks.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2014

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Seventy-five percent of the world's population lives within 50 miles of the coast. In the United States that number is predicted to be reached in the next 30 years. Coastal ecosystems are used for a myriad of purposes under the umbrellas of transportation, recreation, and livelihood. These ecosystems are under tremendous pressure from anthropogenic activities (i.e. pollution, dredging) and associated climate change responses (i.e. sea level rise and storms such as super-storm Sandy). Anyone trying to manage or conserve shallow subtidal systems can use our subaqueous soil maps and the associated use and management interpretations that we are developing. Users include federal agencies (USDA-NRCS, US-EPA, NOAA), state agencies (RI-DEM, RI-CRMC), nonprofits (TNC, Save the Bay), and producers (East Coast Shellfish Growers Association).

What has been done

In this project, we tested various subaqueous soil types to determine the most productive areas for shellfish aquaculture, evaluating which aquaculture method (on-bottom or suspended) may be the best approach depending on the soil type, and examining how soil type is related to coastal acidity. In our associated outreach efforts we coordinated with coastal managers, regulators, and aquaculture specialists to ensure that the results from our studies are delivered directly to the stakeholders and the general public via our website. We also presented our findings at several regional and national meetings.

Results

We found multiple factors that explained differences in oyster growth and survival among soil types including the type of seed, the year of the experiment, and time of year. There appears to be minimal difference between growth in on-bottom vs bag-and-rack (suspended) aquaculture. Younger oysters were more prone to predation on the bottom, but on-the-bottom oysters were of higher quality. Our preliminary studies of water column/soil pH and shell dissolution suggest that coastal acidification differs significantly among soils and in some soils it may be impacting recruitment of oysters in the wild. We partnered with NRCS to develop ecological site data for subaqueous soils and partnered with TNC to support their investigations of oyster restoration and recruitment siting. As a result of these partnerships we expect to build a series of science-based aquaculture, restoration, and oyster recruitment site selection metrics. We delivered presentations at the national meetings of the Soil Science Society of America, the ACE/MAS/ISCR Conference, Groton CT, and the NEERS Conference, Block Island, RI. We have continued to increase the awareness of the utility of subaqueous soil data by supporting the release of updated soil data in partnership with the USDA NRCS and the RIGIS consortium.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

Increased (%) forest and conservation geospatial information resources, and increased usage of these resources by government organizations, NGOs and the public.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The University of Rhode Island Renewable Resources Extension Act Program (URI RREA) focuses on extending and supporting the use of geospatial technologies to support natural resource management in our State. We work to meet our goals through a blend of online services, mentoring and advising conservation organizations, and traditional instructor-led training. Natural resource managers and local decision makers comprise our target audience. This audience typically consists of local and state government agencies, community volunteers non-profit organizations, and businesses.

What has been done

Five instructor-led classes were conducted. We continued hosting and maintaining the RI Geographic Information System (RIGIS) online data clearinghouse and the URI GPS Base Station. We supported the development of approximately 12 forest stewardship plans. We supported the publications of nine articles and blog posts. URI RREA scientists also collaborated with the Watch Hill Conservancy, Watch Hill Fire District, Northern Rhode Island Conservation District, Rhode Island Heritage Species (rare plants and animals) Database partners, and the USGS on four additional research and outreach initiatives.

Results

58 participants attended our instructor-led classes. The RIGIS online data clearinghouse distributed more than 6 TB of data. More than 5 GB of correction files were downloaded from the URI GPS Base Station. The 113 map services affiliated with the Rhode Island Digital Atlas responded to over 25 million requests. Our program resulted in at least 700 direct and 5,000 indirect contacts with individuals who took advantage of the services and events provided by our

team over this reporting period.

4. Associated Knowledge Areas

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

Outcome #15

1. Outcome Measures

Increased awareness of the effects of human-induced land-cover change and provided insights into the extent and rate of land-cover changes in Rhode Island and the impacts of human activity on characteristics of forest landscape over the last four decades through generated data and maps.

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

Increased US state and federal regulators understanding of avian-wind turbine interactions. This information is also useful to conservation NGOs interested in protecting avian resources in the region.

Not Reporting on this Outcome Measure

Outcome #17

1. Outcome Measures

Increased understanding and acceptance by the nursery industry, the general public, professional groups, and research scientists through patents, publications and talks of the occurrence and value of adelgid-resistant eastern hemlocks.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Hemlock is the only native shade-tolerant conifer on the east coast. Ecologically, it provides a year-round source of shelter for animals such as deer, and shades and cools headwater streams. This makes it a prime provider of habitat for trout and other cool-water aquatic species, which has led it to be dubbed a 'foundation species', i.e., essential to local ecosystems. Hemlock is currently under threat due to an insect pest called the Hemlock Woolly Adelgid (HWA).

What has been done

We have identified HWA-resistant trees. They were cross-pollinated and the seedlings were grown out in a controlled environment along with other seedlings from HWA-susceptible eastern hemlock. Last year, all plants were infected with HWA, and were monitored for infestation levels, survival, and growth. As would be expected for sexually-produced plants, seedling susceptibility varied, but the HWA-resistant seedlings were more vigorous despite the presence of the pest.

Results

We have confirmed the presence of HWA resistance in a small number of eastern hemlocks, and worked with both grafted and propagated cuttings (prior work) as well as sexually-produced seedlings (the current project) to demonstrate that resistance persists across multiple growth forms. While our seedling experiment is not yet complete, it certainly seems as if some of the HWA-resistant seedlings possess both HWA resistance and tolerance, making them a valuable resource for a range of future work.

4. Associated Knowledge Areas

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

Outcome #18

1. Outcome Measures

Master Energy Training will be conducted to educate RI residents, small businesses and municipalities so that they can make informed decisions that will reduce their consumption of fossil fuels and their carbon footprint through energy conservation, efficiency and use of clean energy resources.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Costly, non-renewable fuel sources such as natural gas, fuel oil and gasoline supply the vast majority of Rhode Island energy services to municipalities, businesses and homeowners. Energy prices in RI are also among the highest in the country, leaving homeowners, small businesses, municipalities, and state agencies with the challenge of managing energy costs and associated environmental impacts. By empowering individuals through education and access to science-based resources, widespread implementation of energy conservation behaviors and support and purchase of diverse and alternative sources of energy will follow.

What has been done

In response to feedback from previously held URI Master Energy trainings, we adopted and improved upon this train-the-trainer education model, offering two day-long educational "schools" aimed at facilitating behavior change toward energy efficiency and conservation behaviors and adoption of renewable energy technologies. Our team also designed, coordinated and executed URI Sustainability Week, a collaboration between the URI Office of Sustainability and the URI Outreach Center to raise awareness of departmental efforts and communicate the mission of Cooperative Extension externally, and the Sustainability Office internally, to the URI community and beyond. We also hosted event workshops to showcase the energy efficiency initiatives of municipalities through the EPA Climate Showcase Communities Program with the goals of encouraging residents to adopt similar initiatives on a residential scale.

Results

Home Energy School was attended by 52 RI residents, and Renewable Energy School was attended by 43 RI residents. The two municipal EPA workshops offered were attended by 75 people in total. Of these four education programs, over 75 individuals took action to implement efficiency measures and/or renewable energy in their homes by scheduling energy audits with the local utility and committing to a "Find Your Four" Campaign for adoption of conservation behaviors. URI Sustainability Week programming was attended by over 500 people on and off-campus.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #19

1. Outcome Measures

Through the Energy Fellows Program, we will provide URI undergraduate and graduate students with the opportunity to gain invaluable experience addressing real-world energy issues.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many students enrolled at URI are passionate about sustainability and interested in energy efficiency, conservation and renewable energy topics. Students seek opportunities outside of the classroom to explore their interests and gain professional experience. Rhode Island also has a growing need for a well-trained energy workforce, and energy companies are looking for new graduates with experience and training in the energy field.

What has been done

Our 2013 URI Energy Fellows Program graduated 14 Energy Fellows engaged in projects with staff at the URI Outreach Center, Commerce RI (quasi-state economic agency), the RI Office of Energy Resources, and the Ocean State Clean Cities Coalition. Our 2014 program welcomed 12 Energy Fellows in January 2014 from a variety of majors. This cohort of students was afforded the opportunity to work on real-world, current energy projects in interdisciplinary teams. Fellows received training in general energy topics through presentations from energy professionals, field trips, and conference attendance as well as specialized training in leadership and communications. Fellows actively participated in outreach events and presented their work to the University community and general public at an academic poster session at the end of the year.

Results

Our 2013 Energy Fellows Program graduates obtained an understanding of current energy issues in the State of Rhode Island and their potential role in managing those issues in the energy field. Our students were prepared with professional skills and training needed to succeed in that workforce. More than 75% of the students who graduated from URI following the completion of the program secured jobs at a variety of energy companies and organizations, while others were accepted to challenging graduate programs.

4. Associated Knowledge Areas

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

Outcome #20

1. Outcome Measures

NIFA energy programs at URI are coordinated with the DOE-funded Ocean State Clean Cities Coalition to provide a broader array of program and services for RI stakeholders concerned about energy issues.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Vehicle purchases are one of the more significant economic choices households make. The general public should have a greater understanding of the total cost of vehicle ownership, in particular in regards to fuel choices. Rhode Island citizens should also understand how their vehicle choices and driver behavior affect the environment and our demand for natural resources.

What has been done

In 2014, URI (as host of Ocean State Clean Cities Coalition) co-sponsored six fleet-focused outreach events and one consumer-focused outreach event (National Drive Electric Week) which has been reported to the US DOE.

Results

The Coalition displaced nearly 800,000 gallons of petroleum, which was reported to the US DOE

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #21

1. Outcome Measures

Through the Renewable Energy Siting Partnership, a URI team of skilled professionals in the fields of energy, research and planning will develop tools, guidelines and data analysis that can be used by Rhode Island's cities and towns to site and manage this new activity. Additionally, the RESP project will make state and municipal energy information accessible to the public through the creation of a comprehensive online energy database.

Not Reporting on this Outcome Measure

Outcome #22

1. Outcome Measures

Through a partnership with Rhode Island Department of Transportation we will capitalize on the wealth of both experience and funding available at the state and federal levels to accelerate and facilitate reduction of diesel pollution from work performed on projects managed by RIDOT.

Not Reporting on this Outcome Measure

Outcome #23

1. Outcome Measures

Increased understanding by scientists and decision makers through publications and presentations of the management implications related to plant genome size influences on competitive ability and susceptibility to herbivory.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Researchers who study weeds and invasive species are particularly interested in how the environment interacts with plant genome size. Global change has the potential to increase or decrease the range and success of species based on how it interacts with genome size. Therefore, researchers modeling range and expansions will benefit from these data. In addition, agricultural and natural area managers are interested in this information to help manage weedy species into the future. Finally, genome size may be a potential tool for biosecurity screening so this research is of interest to federal and state agencies.

What has been done

A global collection of Phragmites (from all 5 species in the genus) has been amassed and are currently being grown in three common gardens, including at URI. All plants have been screened for genome size. An experiment is currently underway comparing plant traits for unique clones across all phylogeographic groups, genome sizes and ploidy levels. Plant tissues are being analyzed for phenolics, CN, above and belowground biomass, herbivory, toughness, etc. In addition, the effects of phylogeographic group and genome size is being analyzed for microbial communities for a subset of the clones being examined.

Results

Significant differences in genome size have been found for the native, introduced and Gulf Coast lineages of Phragmites in North America. In addition, high levels of genome size and ploidy diversity have been found across the genus. Distinct microbial communities appear to be controlled by lineage as well.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
721	Insects and Other Pests Affecting Humans

Outcome #24

1. Outcome Measures

Increased understanding of the private and public sector and scientists of economic valuation of air quality and greenhouse gas emissions through publications and presentations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Effective balancing of economic forces and unwanted byproducts of economic activity is critical for sustaining human health and wellbeing. Insights into the valuation of air pollution and greenhouse gas emissions will generate new understanding of how our economy should evolve and will evolve if left unchecked.

What has been done

Monte Carlo analysis extended to accommodate three-dimensional surface. Results are inconsistent with prior work. Currently striving to understand modeling assumptions that are critical to determining optimal spatial interpolation strategy. Estimated relationship between housing prices in Rhode Island and proximity to wind turbines. Downloaded Google trends data at media market level. Match with monthly temperature and precipitation records. Analyzed consumption patterns of 300 sample AC units in central California that participated in a Direct Load Control program.

Results

Results suggest no statistically significant relationship between turbines and house prices. Results suggest that weather fluctuations consistent with climate change projections cause people to seek information about climate change. Concluded that AC usage increases relative to normal before and after a curtailment event.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

133 Pollution Prevention and Mitigation
608 Community Resource Planning and Development

Outcome #25

1. Outcome Measures

Advance understanding by scientists and decision makers of demand and supply of ecosystem services (ES) from watersheds in the rural-urban fringe at a policy-relevant scale by integrating information from hydrology, spatial science, and economics.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Federal and state agencies (NRCS, DEM, EPA, USDA), conservation districts, Providence Water and conservation organizations are interested in ways to enhance ecosystem services, understand their benefits to the communities, and where their resources and efforts should be targeted.

What has been done

We conducted a field experiment where the suppliers of improved water quality and its beneficiaries of those services make decisions through a market-like process on both sides of the market. In this market process, consumers reveal their marginal willingness to contribute payment for improvements in water quality, which we then used to construct an average revenue curve to serve as a demand curve. We also conducted a reverse auction on the supply side, in which livestock owners bid for payments to adopt best management practices for manure management. We use the spatially-explicit Soil and Water Assessment Tool (SWAT) model to quantify the effect of on-farm management practices to the resultant changes in water quality. The information from the bids and the resulting changes in water quality from SWAT allowed construction of the supply curve for water quality improvements. The average revenue and supply curves were combined to determine a market clearing price. Upon consultation with the stakeholders, we made decisions to model three ecosystem services (carbon, nutrient retention, habitat for key species). We collected and compiled a number of spatial data sets and parameters to calibrate the INVEST model.

Results

Local livestock owners who participated and won experimental auctions in our supply side experiments adopted new best manure management practices to prevent phosphorus input into water bodies nearby their farms. Nearly 100 residents in the watershed participated in the demand-side experiment to reveal their preference for water quality improvement. Quality of water in local waterways and ultimately in the Scituate reservoir is expected to improve although the degree of improvement is minimal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
608	Community Resource Planning and Development

Outcome #26

1. Outcome Measures

Models will be developed for coastal managers that will enable them to assess potential for coastal marsh restoration to enhance C sequestration in those ecosystems.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Coastal managers are interested in estimating functions such as carbon sequestration in marshes and knowing how those functions change in response to restoration, pollution, or rising sea levels. They aim to optimize these functions and need a cost-effective means of measuring them.

What has been done

Through collaboration, an empirical model for estimating greenhouse gas emissions from coastal marshes has been developed based on 4 sites in Waquoit Bay MA.

Results

The model (described above) can be used to estimate greenhouse gas emissions based on a few, relatively simple factors (such as surface soil temperature or salinity). This shows promise for this approach but more work is needed to validate the model in additional sites and to apply it to longer term C sequestration rates.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
608	Community Resource Planning and Development

Outcome #27

1. Outcome Measures

Increased understanding by scientists, conservationists, and land managers through publications and presentations of the management implications of forest fragmentation and creation of early-successional habitat on turtle populations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is a need to create more early-successional habitat in southern New England for species dependent upon this habitat type, yet increased forest management activities may negatively impact wildlife species that require large contiguous patches of mature forest, such as some turtles. The objective of this project is to evaluate the impacts of forest fragmentation, caused by residential development and creation of early-successional habitat, on turtle populations. We will use the results of this study to help guide forest management in Rhode Island by working with natural resource agencies, land conservation trusts, and private landowners.

What has been done

We are examining the impacts of forest fragmentation on turtle populations in Rhode Island. Although we have one final year of field data to collect and are not able to publish this work yet, we have given many presentations to scientists and land managers within the state, as well as to interested public groups.

Results

We have one final year of data collection to complete but have preliminary results. We have made contact with many landowners, land trusts, other conservation organizations, and interested members of the public in Rhode Island to inform them about our research and ask for their participation. These contacts have laid the foundation for future strengthening of outreach programs based on the results of our field research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
608	Community Resource Planning and Development

Outcome #28

1. Outcome Measures

Increased understanding of the management implications of how amphibian and reptile populations respond to the impacts of forest loss and pollution.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Globally, nearly 30% of amphibians and 40% of reptiles are threatened due to a number of factors, but forest loss and degradation are considered to be the greatest contributor. This study examines three important types of forest impacts, outright loss, partial development, and contamination by pollutants, for their effects on amphibian and reptile populations. These issues are important to the public, scientists, and land managers as they affect our ability to sustainably manage natural resources.

What has been done

We are examining the amount of forest needed to protect stream-breeding amphibians by studying their movements and habitat use adjacent to streams, as well as survival rates in each habitat type. We are studying how partial development of forest habitats affects snake populations by tracking their movements and survival in habitats impacted and unimpacted by humans. We are conducting research on how pollutants from roads impact wetland amphibians and reptiles by documenting transport of salts to wetlands and status of amphibian and reptile populations in those wetlands. As this work is still in progress we have not published it yet, but we have given presentations to multiple public groups, scientists at multiple universities, and land managers in the state.

Results

We are beginning our final season of data collection on each of these studies, but we have preliminary results. Stream-breeding amphibians spend the majority of their time in adjacent forested landscapes suggesting that terrestrial habitats are essential for maintaining viable populations. Snake populations in partially developed areas exhibit high levels of mortality compared with those in undeveloped areas. Finally, salt concentrations in wetlands appear to affect the distributions of amphibians on the landscape but not that of turtle populations. We anticipate that some of this work will be used by land trust organizations and state agency personnel to adjust the ways that amphibian and reptile populations are managed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #29

1. Outcome Measures

Increased understanding of the management and risks of watershed nitrogen delivery.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The export of nitrogen (N) from coastal watersheds can exert profound effects on the function and value of coastal estuaries. The goal of our research is to characterize the extent of in-stream nitrate removal in low gradient streams and identify stream attributes that relate to elevated nitrate removal rates. This will enable us to contribute to the scientific dialog and management that seeks to target site-specific nitrate control strategies to locales with high potential for export to coastal waters.

What has been done

A new geospatial tool, N-Sink, was developed by NEMO programs and USDA NRCS. It creates alternative scenarios in a watershed to help land use managers identify the best strategies to minimize watershed N export. We also conducted process-level studies in intermittent streams and beaver ponds and found them to be substantial watershed N sinks. These findings will be incorporated into N-Sink and transmitted to other models and tools through our regional network. We also elucidated watershed characteristics that impact the management of sustainable river flows.

Results

N-Sink's usability was improved and the tool was shared with NRCS and NEMO programs. It allows non-technical users to estimate watershed N removal from any watershed location. It is now available on many watersheds that drain directly to RI and CT coastal watersheds. The N processing function of intermittent streams is comparable to higher order streams. Forested intermittent streams have unique structures - pools, debris dams, and hyporheic flow - that enhance hydrologic retention and N removal potential. Mass balance mesocosm study of N cycling in beaver ponds demonstrates that these locations are important N sinks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #30

1. Outcome Measures

Increased understanding of how wildlife populations may respond to climate change.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Global climate change is well documented and predicted to increase in severity and variability in the future. The impact of climate change on wildlife populations and agricultural systems is uncertain. Understanding the mechanisms by which populations may respond to climate change is critical for predicting future impacts. Whether populations have the capacity to respond through evolutionary adaptation or environmentally induced plasticity has important implications for population persistence over the long term.

What has been done

Two studies were conducted with the assistance of two graduate students and two undergraduate students. First, to gain insight into the evolutionary dynamics of species invasions, we conducted a population-genetic study that found invasive brown anoles were invading a portion of their native range occupied by a distinct evolutionary lineage. Second, we conducted a study comparing microhabitat use by lizards in natural forests and disturbed habitats to understand if these environments cause divergence in physiological traits, such as body temperature. Results from these projects were presented at the University of Rhode Island Coastal Fellows Symposium (Dec. 2014).

Results

For the first study, we detected genetically and phenotypically intermediate individuals within the "native" population. This suggests the transport of lizards from an established invasive population to a native population by humans, resulting in genetic mixing of invasive and native populations. For the second study, we found substantial differences in the thermal microclimates available for lizards. Natural forests were cooler and less variable than disturbed sites. Consequently, lizard body temperatures were cooler and lizards did not actively thermoregulate in forest. These differences in thermal physiology may limit the spread of these invasive lizards into some

microclimates.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

None

Key Items of Evaluation

None