Annual Report of Accomplishments and Results 2006

Rhode Island
Agricultural Experiment Station
and
Cooperative Extension

Dr. Jeffrey R. Seemann, Director

A report to the USDA-CSREES on progress under the Joint Plan of Work for FY2000-2004 and the Plan of Work Update: Fiscal years 2005-2006

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WHAT IS COVERED IN THIS REPORT

This Report covers accomplishments during the period from October 1, 2005-September 30, 2006 and corresponds to the *5-Year Joint Plan of Work for FY2000-2004* ("the Plan") and the *Plan of Work Update: Fiscal Years 2005-2006* ("the Plan of Work Update") for the **Rhode Island Agricultural Experiment Station** (RI AES; "the Station") and for **Rhode Island Cooperative Extension** (RI CE; "Extension"), administrative units of the **University of Rhode Island** (URI, "the University") and the College of the Environment and Life Sciences (CELS). It is organized following the format prescribed in the **Guidance for the Annual Report of Accomplishments and Results**, with the following modifications.

- We have appended the current **Call for Proposals** for the Station to document the procedures used for merit and peer review for all projects begun in fiscal year 2006. (See additional comments under Program Review Process). We are now calling this program CELS CARES (College of the Environment and Life Sciences Community Access to Research and Extension Services).
- We have appended a **Portfolio of Current Projects** for the Station, providing brief outlines for all projects approved for FY2006.

EXECUTIVE SUMMARY OF THE ANNUAL REPORT
Annual Report of Accomplishments and Results
Rhode Island Agricultural Experiment Station &
Rhode Island Cooperative Extension
FY2006

In this report we describe the activities of the Rhode Island Agricultural Experiment Station (RI AES) and Rhode Island Cooperative Extension (RI CE) collectively referred to as the Land Grant programs. RI AES and RI CE are collaborative elements within the College of the Environment and Life Sciences (CELS) at the University of Rhode Island. Administrative oversight of RIAES and RICE is provided by the Dean of CELS. Day to day management of the Land Grant programs is provided by the Associate Dean, Research and Outreach. The programs and projects supported within the research and outreach portfolios span a wide range of disciplines, from the natural sciences to the social sciences and use great breadth in approach. The Land Grant programs are focused around 7 programs that include: 1) Landscape Horticulture, 2) Aquaculture Biotechnology and Fishing, 3) Health and Well-being of Animals, 4) Food Safety, 5) Nutrition, 6) Natural Resources and the Environment and 7) Sustainable and Nurturing Communities.

CELS CARES

In FY 2006 we launched the CELS CARES initiative. (The RFP's for this initiative are attached in the appendix.) This program supports innovative extension and integrated work. The Station and Extension are integral components of the missions of the College and University. The collaborative relationship with our federal partner, CSREES, has enabled our scientists, staff and students to leverage additional resources that provide cutting edge knowledge, new results, essential services and desirable programming for all Rhode Islanders.

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PLANNED PROGRAMS

GOAL 1: AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN THE GLOBAL ECONOMY

PROGRAM 1: LANDSCAPE HORTICULTURE AND TECHNOLOGY FOR SUSTAINABLE AGRICULTURE.

Situation and Priorities:

Rhode Island's AES and CE programs in agricultural system management emphasize the green industries (turfgrass and ornamental horticulture) of this state because of their relative importance to the economy of the state. We address the needs of the state in a coordinated program of research and outreach that covers plant production, landscape design, landscape use, installation, and maintenance. Through these activities we impact directly thousands of green industry professionals, homeowners, and all citizens and visitors utilizing managed landscapes (parks, ball fields, and golf courses) throughout Rhode Island. Our focus is to maintain an economically viable industry with environmentally benign practices.

Our program in landscape horticulture does a superb job of integrating research and outreach. Research faculty work very closely with CE faculty, educators and staff and provide the basis for the coordinated outreach efforts in Invasive Species, Emerging Infectious Diseases, Ornamental/Green Agriculture, Integrated Pest Management and Molecular Biology.

Knowledge Area: KA 103. Management of Saline and Sodic Soils and Salinity

Situation:

Situation 1: Winter road salt use kills the grass and other perennial vegetation along roadsides, particularly within 5 feet of the pavement. The lack of grass leads to increased erosion from water running off the pavement. The dead grass, and the weeds that replace it in summer, detract from the beauty of the roadside landscape. The damage is particularly severe along major highways, where it is seen by many visitors from outside the state. The necessity of re-seeding the roadsides, controlling weeds, and repairing erosion damage increase maintenance costs.

Situation 2: RIDOT builds roadside embankments with a thin layer of topsoil covering the sculpted subsoil/gravel embankment. The current grass mix does a poor job of rooting into the subsoil and anchoring the slope, resulting in severe erosion. The erosion is unattractive, and can result in debris on the roadway or undercutting of the pavement.

Outputs:

- A study has been initiated to identify grasses with better salt tolerance for use along roadsides.

- We evaluated rooting depth of twenty species of native grasses and turf grasses. 14 species were identified which root more deeply than the common red fescue that currently dominates roadsides.
- *Grant proposals and Problem Statements*:
    - Brown, Rebecca. The Identification of Grasses with Improved Salt Tolerance for Roadside Use. Funded by Hatch
    - Brown, Rebecca, and Joseph Gorres. Development of Salt Tolerant Grasses for Roadside Use. Under consideration by RIDOT.
    - Brown, Rebecca and Leslie Weston. Regional Evaluation of Grasses for Roadside Use in New England. Problem Statement submitted to the National Highway Cooperative Research Program.

Outcomes/Impact::

- Grass taxa tolerant of salt stress would be in great demand by producers and users.
- Deep rooted grasses will be more resistant to drought and cold stress, and will be preferred for use in easily-eroded areas.

Source of funds:

☐ Smith-Lever
☐ Hatch
☒ State
☒ Other (please list)

- RIDOT "Evaluation of Native Grasses for Highway Slope Stabilization and Salt Tolerance"
- Start-up funds

Scope of impact: State and regional

Knowledge Area: KA 202. Plant Genetic Resources

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- Start-up funds

Scope of impact: State and regional

Situation 3- RIAES work in this area focuses on acquiring, preserving, characterizing, and developing plant genetic resources for the environmental plant production (nursery) industry. Our efforts use trial gardens and replicated plots to collect and evaluate plant materials. This represents ex-situ preservation, and promotes the preservation of species and within-species variation. The objective of this program is to evaluate trees and shrubs for sustainability and ornamental potential in the northeast and to provide the results to growers, landscapers and consumers. The focus of RIAES germplasm collection activities in FY2006 was to transfer, from commercial nurseries and collections, shade tree and shrub germplasm for introduction to the nursery and landscape industries in the northeastern USA.

Situation 4- The tree and shrub breeding program at the University of Rhode Island seeks to develop novel cultivars of woody landscape plants that provide both aesthetic appeal and contribute to the overall goal of enhancing sustainable landscapes. Currently, our emphasis is on developing novel cultivars and superior breeding germplasm through chemical mutagenesis of open pollinated seeds and *in vitro* grown plants and plant parts. Protocols for *in vitro* regeneration of several ornamental plant species are being developed. Once established, these protocols will

be used for developing novel plants by *in vitro* mutagenesis. Separately, elucidating the molecular genetic underpinnings behind the remontant (reblooming) flowering characteristic recently discovered in some *Hydrangea macrophylla* genotypes could enhance breeding efforts and crop production methods.

Outputs:

- Twenty-four new plant taxa were accessioned. These are being grown in the field and in containers at the East Farm Agricultural Experiment Station for evaluation of landscape value, cold hardiness and specific environmental (eg. salt, humidity) and pest (eg. fire blight, Japanese beetle, Hemlock wooly adelgid) tolerances.
- Accessions from previous years are studied for facility of propagation by seed, cuttings and grafting.
- 2,500 woody plant propagules were distributed to cooperating nurseries and arboreta, and to the public on a limited basis.
- Over 8,000 mutagenized seedlings were field-planted at the Agronomy Farm at the University of Rhode Island.
- More than 15,000 seeds representing 13 different plant species have been treated with chemical mutagenesis of open pollinated seeds. Several seedlings have been selected as potential new cultivars based on unique characteristics such as leaf variegation, growth habit (dwarfness) and unusual leaf morphology and pigmentation.
- Methods for establishing aseptic cultures of *Hydrangea macrophylla*, *Callicarpa dichotoma* and *Clethra alnifolia* have been determined. In addition, callus induction and root organogenesis have been optimized.
- A collaborative relationship has been established with USDA-ARS scientists to facilitate research of the remontant flowering trait in *Hydrangea macrophylla*.
- Research is ongoing on the use of etiolation technology for propagation of difficult-to-root accessions. In particular are studies using phenyalanine ammonia lyase inhibitors to mimic the effect of withholding light from stock plants.
- Documentation of accessions and propagation results are being maintained in FileMaker database software which is being adapted to WWW access using ASP and server technology.
- In collaboration with scientists at UMASS and Harvard University, adelgid-resistant germplasm of *Tsuga canadensis*, Eastern Hemlock, was collected and propagated by stem cuttings and by grafting onto seedling Eastern Hemlock. This work has been expanded to include scientists in Biological Sciences at URI, as well as Forest Service collaborators in Pennsylvania.
- Thirteen taxa of *Pinus* are being maintained in long term *in situ* plots in Rhode Island coastal areas for evaluation of salt tolerance.
- A replicated trial of shade tolerance of *Picea orientalis*, Oriental Spruce, was evaluated at the East Farm AES.

Outcomes/Impact::

- RI-AES activities have significantly increased the availability of new landscape plants in the northeast. In particular, efforts to locate and increase germplasm of cold-hardy and salt-tolerant conifers will aid in the struggle to replace existing populations threatened by insect and disease problems.

- RI-AES works closely with local committees to insure that new germplasm accessions do not pose a risk of invasiveness in the northeast region.
- More than 2,500 propagules were distributed to cooperating nurseries and arboreta, and to the public on a limited basis.
- Lack of genetic variability is a block to plant improvement using traditional breeding methods. Crossing alone will not introduce or enhance a desirable trait if the genetic potential does not exist in a population. Mutation breeding efforts at URI will lead to the development of plants with novel genotypes not available in wild or cultivated populations. Plants resulting from this program will benefit the nursery industry by satisfying consumer demand for novel landscape plants.
- Work toward understanding the molecular genetic control of remontant flowering in *H. macrophylla* will serve to enhance efforts to introgress this trait into other germplasm as well as contribute to the scientific community by furthering our understanding of the control of flowering in diverse plant species.
- Oriental spruce, if shade tolerant, would be a good replacement for adelgid-prone Eastern Hemlock.

Source of funds:
☒Smith-Lever
☒Hatch
☒State
☒Other (please list)
- Rhode Island Nursery and Landscape Association, Gloeckner Foundation, plant sales, nursery grants-in-aid.

Scope of impact: State and regional

Situation 5- The complete sequence of the rice genome (*Oryza sativa* ssp. japonica cv. Nipponbare) is near completion. In order to learn the biological function of the estimated 40,000 genes in grasses related to rice, functional genomics tools have to developed and implemented. Specifically, this project is designed to develop and implement technologies necessary to generate the transgenic plant materials required to functionally define the rice genome through transposon insertional mutagenesis. This will contribute to functionally defining the individual genes within the rice genome. Specific objectives to be attained through this project include: 1) Development of efficient gene transfer methods to recover adequate numbers of rice (cv Nippon bare) transformants as independent single gene copy insertion events. 2) Introduction of test gene constructs to evaluate the feasibility of creating dispersed transpositions of genetically engineered Ds elements such that each plant in the population has a single transposon-disrupted gene. 3) Develop training opportunities in plant transgenics and functional genomics for undergraduate and graduate students at URI through involvement in the research activities of this project.

Outputs:

- Students at all levels (high school, undergraduate and graduate) trained in molecular biology, plant tissue culture and plant transgenics.

- A set of transgenic rice rice plants that carry dispersed transpositions of genetically engineered Ds elements such that each plant in the population has a single transposon-disrupted gene for use by this laboratory and the research community at large.

Outcomes/Impact:

We have met our first objective with the production of the necessary transgenic rice plants (cv Nippon bare) with sufficient independent single gene copy insertion events to support the development of an insertional mutagenesis library. We have produced over 274 independent transgenic events that were demonstrated to carry the construct for transposon mutagenesis. These T0 plants were analyzed for pollen viability by microscopy. The presence of the transgene was determined by PCR and Southern blot analyses. Appropriate T0 plants were then shipped to our collaborators at CIAT, in Cali, Columbia to perform the appropriate crosses. The progeny of those crosses were then shipped to us for further analysis in the T1 generation.

- Test gene constructs have been verified to create dispersed transpositions of genetically engineered Ds elements in each plant in the population as a single transposon-disrupted gene. We have also verified that the specific maize pollen specific promoter (MPSP) element used to select for dispersed transpositions is functioning in these transgenic rice plants. We are now awaiting the flowering of the T1 plants to conclude this phase of the analysis before publication. We are now planning to cross these plants to wild type rice to generate a large scale knock-out library that can be screened for independent mutants. Once the mutants have been identified the gene responsible for the phenotype can be cloned and characterized.
- During the accomplishment of generating the required transgenic lines for this project we have implemented training opportunities in plant transgenics and functional genomics for undergraduate and graduate students at URI through involvement in the research activities of this project and published several abstracts at professional meetings.

Source of funds:
☐ Smith-Lever
☒ Hatch
☐ State
☐ Other (please list)

Scope of impact: Regional, national and international.

Knowledge Areas: KA 204. Plant Product Quality and Utility (Preharvest)
KA 205. Plant Management Systems

Situation:

Nursery crop producers in Rhode Island and the Northeast are challenged to be competitive in the regional and national industry. Prime concerns are the impact of Federal and State regulation, water quality issues, labor issues, and the availability of new plants, particularly natives, to stimulate sales. Growers need access to research information on plant production

practices, including plant propagation, growing media formulations and management. Growers and policy makers also need results of surveys on the health and welfare of the industry and its workforce.

Outputs:

- Research on the propagation of native temperate woody plants in the family Lauraceae. Stem and root cuttings of *Lindera benzoin*, spicebush, and *Sassafras albidum*, sassafras tree, were collected at strategic times during the year and propagated in different rooting media with a range of hormone concentrations.
- Thirty-eight taxa of succulents have been accessioned and grown in replicated mesocosms to investigate suitable growing media and cold hardiness. Data analysis and manuscript preparation completed.
- Greenhouse upgrades were expanded to include ebb-and-flood benching and computer-controlled shade.
- RI provided data for the evaluation of regional trade flows and marketing practices in the nursery industry by distributing a common questionnaire soliciting information regarding management and marketing practices, production information, and detailed sales information regarding interstate movement of the product and the volume of business with various types of buyers.
- RI cooperated in the development of a national-level Landscape Horticulture Labor Survey funded by the Horticulture Research Institution and centered at OSU.
- RI also collaborated on the National Nursery Survey, collecting data for Rhode Island nurseries and reviewing the revised manuscript of Economic Impacts of the Green Industry in the United States, (www.utextension.utk.edu/hbin/ greenimpact.html)

Publications

- Sicuranza J., N. Castrataro, B. Johnson, and B. Maynard. 2005. Softwood Cutting Propagation of Native Lauraceae (Lindera benzoin (L.) Bl. and Sassafras albidum (Nutt.) Nees.) as Alternatives to Invasive Horticultural Plants. Proc. Int. Plant Prop. Soc. 55: 415-417.
- Sicuranza J., N. Castrataro, B. Johnson, and B. Maynard. 2006. Evaluation of Native Alternatives to Invasive Horticultural Plants. American Society for Horticultural Science. NE Regional Meeting, Poster Presentation.
- Castrataro, N. 2006. Soil Mix and Plant Materials for Washington Bridge. M.S. Thesis.

Outcomes/Impact::

- Information on the propagation of *Lindera* and *Sassafras* were presented at a regional conference of horticultural scientists.
- Our research on plant growth and marketing boosted industry sales and increased production potential by identifying plants that will stimulate consumer interest and increase purchasing.
- Information and practices for optimizing production potential of new crops was generated for growers. Specifically information on the propagation of native temperate woody plants will offer new profit venues for RI farmers.
- Research on sustainable roadside planters has had an impact on public enjoyment of scenic bikeways and associated thoroughfares.

- Participation in surveys and economic analyses had a positive impact on the competitiveness of the green industry in RI and the northeast region, and provided input to national assessments of the ornamental plant industry, as reported in *Economic Impacts of the Green Industry in the United States*, (www.utextension.utk.edu/hbin/greenimpact.html) which has been published as a Southern Cooperative Series Bulletin.

Source of funds:
☒Smith-Lever
☒Hatch
☒State
☒Other (please list)

- New England Nursery Association grant-in-aid to CE
- Rhode Island Nursery and Landscape Association grant-in-aid
- USDA Special Grant "Nursery Production RI", 2003-2006

Scope of impact: State, regional, national

Knowledge Area: KA 205. Plant Management Systems (Master Gardener and CE Programs)

Situation:

Despite years of educational activity aimed at minimizing chemical inputs to residential and non-agricultural landscapes, sales of lawn fertilizers, herbicides and insecticides continue to rise. The URI Extension and Outreach Center in the College of the Environment and Life Sciences is uniquely positioned to reach key target audiences throughout Rhode Island with programs designed to minimize pesticide use and to promote Integrated Pest Management practices.

The Center has developed a successful model for influencing the behavior of individuals in their own backyard. The model's success is based on the fact that gardening is the number one hobby in the United States. We are able to use this passion for gardening as an avenue for communicating a wealth of information on environmental issues directly tied to behaviors at home. Our research and outreach programs are integrated and they target the players involved in residential landscape management, including research scientists, educators, landscapers, landscape architects, garden centers, growers, Master Gardeners, decision makers, and the general public. Additionally, our staff is well positioned to leverage state wide media outlets including television (NBC Affiliate Channel 10's Plant Pro), newspapers and monthly magazines.

Through our Master Gardener Program, we train volunteers who work with us to educate the backyard gardener and homeowner. These volunteers provide literally thousands of hours of volunteer time to extend environmental and horticultural information to the residents of southern New England. Simultaneously, through the URI GreenShare program, we educate the professionals in the garden industry. The public often turns to garden center employees, landscapers or arborists for advice on garden management topics. With the support of our partner in the green industry, the Rhode Island Nursery and Landscape Association, we have established the URI Botanical Gardens. The URI Botanical Gardens provide real life examples of sustainable landscaping and are used to train college students, green industry professionals and

homeowners. The gardens are also the setting for a hands-on environmental educational program for school children called the Learning Landscape Environmental Education program. Over 2000 school children visit the gardens each year for a program that engages all their senses to better understand the environment. Finally, we have established a new Coastal Landscape Program. The program builds on the GreenShare Program and the URI CE Healthy Landscapes program, a grant-funded educational endeavor (see www.healthylandscapes.org). The program includes a list of sustainable plants which are non-invasive and will withstand the coastal environment and development of a certification program for professionals who work in the coastal area. The certification program, which will be launched in FY 2007, will included courses for Professional Engineers, Landscape Architects,Landscape Installation and Maintenance companies and others. Protocols for turf management in coastal areas and low impact development techniques to manage stormwater on-site will be key components of the training.

The Center also launched a partnership with the City of Providence. Through this partnership, an Extension and Outreach Office will be set up at the Roger Williams Park Botanical Center in Providence. This office will allow URI Extension and Outreach in programs to reach a much larger and more diverse audience.

In addition to these targeted programs, the URI Extension and Outreach Center also runs events that serve the general public, including GreenShare Field Day, Spring Seminar, URI Summer Gardening School (a series of summer evening seminars held in the Learning Landscape Demonstration Gardens), URI Fall Gardening School (a subset of the URI Master Gardener Basic Training, intended for people who do not want the volunteer commitment of the Master Gardener Program), East Farm Open House and Crabapple Festival, and the Turf Field Day. Through these programs, we potentially reach the totality of the Rhode Island citizenry.

Outputs:

- Conducted an 8 session (3 hours/session) training program – "Ecology of Managed Landscapes" for staff of the RI Coastal Resource Management Council (RI CRMC)
- Developed and published on the web the Coastal Sustainable Plant List. This list has been incorporated in coastal buffer zone regulations promulgated by the RI CRMC.
- Conducted a field Coastal Plant Identification course for RI CRMC staff.
- Developed a draft "turf management protocol" for incorporation in CRMC regulations governing landscape management on the coast.
- Developed a draft "Suburban Design Manual" to provide guidelines for coastal landscape management regulations in suburban areas.
- Developed the curriculum for a pilot certification program which will be mandated by RI CRMC regulations for coastal landscape practitioners.
- Initiated partnership with the NE Regional Water Quality Group on a project entitled "Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds."
- Organized and chaired a workshop entitled "Facilitating Implementation of Residential Turf IPM" presented at the National IPM Symposium in St. Louis, MO in April, 2006. http://www.ipmcenters.org/ipmsymposiumv/sessions/index.html
- Worked regionally and nationally to develop standardized guidelines for residential turf management in environmentally sensitive area. by participating in the Community IPM Working Group, part of the Northeastern IPM Center and funded through the USDA's Cooperative Research, Extension, and Education Service (CSREES).

- Joined residential IPM and water quality leaders from across the country at the Scott's Miracle Gro "Environmental Summit", Marysville, Ohio, July, 2006
- Conducted twoMaster Composter/Master Recycler Training Programs
- Worked with Master Composter and Recycler volunteers and the RIRRC to construct a school garden at Whiteknact Elementary in North Providence, RI
- Participated in sustainability, waste reduction and management programs at URI.
- Installed a solar energy system at the Extension and Outreach Office.
- The Learning Landscape children's environmental education program operated school field trips in the URI Botanical Gardens in the spring and fall of 2006.
- Operation Seed Sort, a program uniquely tied to the Learning Landscape program for children and URI Master Gardener Programs, sorted and distributed seeds to schools, youth groups, community farms, and other appropriate recipients.
- Participated in the development of the Children's Garden Network: A Garden at Every School by 2010. (www.
- Sold the Rhode Island Master Gardener Training Manual to the Master Gardener Programs in Vermont, Massachusetts and ., The manual was written by URI faculty and staff and other RI horticultural professionals and edited and published by a URI Master Gardener volunteer and retired publishing executive.
- Conducted a 4 session URI GreenShare WinterSchool training program for green industry professionals.
- Conducted a 16 week Master Gardener training program. In partnership with the Center and the State Master Gardener Coordinator, Master Gardeners:
    - Staffed a toll-free gardening and environmental telephone and email hotline.
    - Grew and harvested fresh food for local food banks through the Master Gardener "Plant a Row for the Hungry Program."
    - Along with staff, conducted a speaker's bureau on environmental and horticultural subjects.
    - Worked with the Food Safety and Nutrition program on the Garden to Table (GAP) program. Master Gardners did follow-up interviews and training for home gardeners about safe food handling for the produce grown in backyards.
    - Hosted the Northeast Regional Master Gardener Conference in Newport, RI in June 5-8, 2006.
    - Developed and conducted a horticultural therapy program at the Hattie Ida Chaffee Home in East Providence, RI
    - Designed and installed a sustainable rose garden in the URI Botanical Gardens and initiated sustainability evaluations.
    - Participated in the Lilac Phenology Network to determine changes in weather and climate patterns.
- Conducted a six week Summer Gardening School in the URI Botanical Gardens.
- Conducted an eight week Fall Gardening School
- Conducted a series of training programs for the green industry as part of the GreenShare Program.
- Conducted two public festivals, GreenShare Field Day and the East Farm Open House.
- Participated in the Healthy Landscapes Program: Described in detail in (Goal 4, Program 6 of this report).

- The Center supports 4 student internships.
- URI CELSExtension and Outreach "Plant Pro" segments air every Saturday and every other Wednesday on WJAR, the NBC affiliate station in Rhode Island and the television station with the largest market share in the region. Filmed in the URI Botanical Gardens and Greenhouses, the segments emphasize environmentally friendly gardening tips for both backyard and professional gardeners. The segment is hosted by Dr. Marion Gold, Director of the Extension and Outreach Center, with periodic appearances by other URI scientists and staff and horticulturists from throughout RI.

Outcomes/Impact::

- Participation in the Community IPM Working Group has lead to the "**Green-Blue Summit: Clean Water through Residential Integrated Pest Management (IPM)** which will be held in July, 2007. http://northeastipm.org/greenbluesummit.cfm
- Through the Master Composter Program, 73 individuals were trained in the fundamentals of composting and recycling and have donated over 250 hours of volunteer time to public service programs. Beneficial partnerships have been formed with local organizations. These partnerships have helped to promote waste reduction and educate communities about composting and recycling. Some of the partners include: The Apeiron Institute for Sustainable Living, the Southside Community Land Trust, the URI Renewable Energy Club and Earth Care Farm. Through our internship program, we have provided 6 undergraduate and graduate students with hands-on experience in community outreach programs.
- The Learning Landscape Program provided environmental education to at least 1,950 children, parents and educators through 31 field trips from 26 schools across the state. Over 36 Master Gardener volunteers were trained to lead the field trips.
- Learning Landscape Program evaluations provided positive feedback and indicated that the program complemented their in-school curriculums.
- Operation Seed Sort reached out to thousands of Rhode Islanders through direct seed distribution (over 50,000 seed packets distributed). In addition, the program helped to increase Extension visibility and generate good will in the community while making use of a valuable agricultural resource.
- Over 106 new Master Gardeners were trained along with 24 URI undergraduates.
- Over 325 active Master Gardener volunteers donated 48,911 hours or 26.8 FTE at a donated value equivalent of $978,220 (valued at $20/hour).
- The Master Gardener Hotline responded to an average of 440 calls/month from March - November. Over 110 email questions were answered each month from Januayr – December.
- Over 1,000 people were reached through our speaker's bureau including presentations to 33 groups on environmental and horticultural topics.
- Over 125 Master Gardener volunteers staffed educational booths at 35 events throughout the year. Over 10,000 RI homeowners increased their awareness of sustainability issues and knowledge of how to implement environmentally sound home and garden practices.
- Over 100 URI "Plant Pro" segments were produced. The noon segments have an average viewership of 55,000 households and 45,000 households watch the Saturday shows. We estimate 7 million homeowner contacts annually.

- Over 200 members of the green industries attended URI GreenShare Winter School training programs.
- Over 400 people attended the Summer and Fall Gardening Schools.
- A Spring Gardening Seminar hosted by URI and the URI Master Gardeners was attended by 150 members of the general public.
- Over 5,000 attended our East Farm Open House and GreenShare Field Day public educational events.
- We continued to update our web site including on-line fact sheets giving up-to-date recommendations for managing insects, diseases, and other aspects of the home landscape. Over 250 fact sheets are on the web at: www.uri.edu/ce/factsheets/sheets/.

Source of funds:
☒Smith-Lever
☒Hatch
☒State
☒Other (please list)
- USDA Special Grant, "RI-Nursery Industry", 2003-2006

Scope of impact: State and regional. The Center Programs reach the public, the Green Industry, Master Gardeners and public agencies within Rhode Island. The programs are connected to other extension programs throughout New England, through participation and coordination with the Sustainable Landscapes Focus Area of the CSREES 406 New England Water Quality Program. In addition, the Center coordinates activities on residential IPM through the community IPM working group of the CSREES 406 Northeast Integrated IPM Regional Program.

Knowledge Area: KA 211. Insects, Mites, and Other Arthropods Affecting Plants

Situations:

Situation 1- Rhode Island has a long history of apple growing. Growing apples is a dynamic enterprise that requires close monitoring of pests and recommendations based on the latest research. At the University of Rhode Island, we have managed a successful Integrated Pest Management program for over 20 years. Apple production involves using many pesticides. The amount of pesticides required can be reduced with adequate scouting for pests and choosing pesticides wisely. The university can provide assistance by identifying pests, assessing pest populations, and making control recommendations.

The URI Plant Clinic identifies plant pests and makes control recommendations to commercial growers and homeowners. In order for homeowners to make intelligent decisions about controlling pests, a proper identification of each pest is essential. The same is true for commercial growers. The URI Plant Clinic is available for identifying insects, diseases, and weeds and providing control recommendations.

The Rhode Island Nursery and Landscape Association (RINLA) asked URI Cooperative Extension to make more on-farm visits to aid in identifying pest and production problems. URI answered this call by making many solicited and unsolicited farm visits in 2006.

In 2005, Rhode Island NRCS, USDA approached URI Cooperative Extension to develop Pest Management Plans with NRCS contracted growers. These growers covered a wide range of agriculture in Rhode Island including nursery, turf, vegetable, fruit, livestock and dairy farms.

Outputs:

- Visited 22 orchards in Rhode Island from April through September, averaging 4.4 visits per orchard for the season.
- Delivered IPM techniques and recommendations through 14 weekly-recorded phone messages and the URI Apple IPM website (www.uri.edu/research/ipm). Through the Apple IPM website, provided scouting reports and daily pest alert updates through the degree-day and weather program called Orchard Radar. The phone message texts were uploaded to the website weekly.
- Collaborated with the University of Massachusetts in hosting 3 twilight fruit growers' meetings; one in April, May, and June. We also hosted the Rhode Island Fruit Growers' Association Annual Meeting in March and their Summer Tour in July.
- Took leaf tissue analysis samples and/or soil samples at 12 farms in Rhode Island.
- Provided 290 pest identifications and control recommendations for samples submitted to the URI Plant Clinic. Individual reports were sent to each client.
- Made 48 nursery visits to 20 nurseries throughout Rhode Island to aid in pest and production problems, or to let the growers know they could call on URI Cooperative Extension for help.
- Served on the RINLA Education Committee to help organize the RINLA Winter School Meetings. Participated in 4 meetings and countless phone calls and emails.
- Developed or implemented pest management plans with 19 NRCS growers in 2006.

Outcomes/Impact:

- Rhode Island apple growers applied 23% fewer fungicides, 36% fewer insecticides and 67% fewer miticides than is recommended in the New England Apple Pest Management Guide.
- Conducted 5 educational meetings for the Rhode Island Fruit Growers Association. These meetings were attended by an average of 36 growers per meeting.
- The 290 individualized pest control recommendations made through the Plant Protection Clinic resulted in appropriate pest control actions. Many of these clients might have incorrectly applied pesticides without proper pest identifications and our recommendations.
- Pest or production recommendations were made to 26 different nursery or landscape businesses.
- Secured 6 speakers for the RINLA Winter School and coordinating 4 hours of pesticide recertification credits for the meetings.
- Encouraged a variety of NRCS contracted growers to embrace IPM practices and use pesticides less likely to contaminate surface and ground water. An example of this is encouraging field corn growers to use Round-up Ready corn rather than use the herbicide atrazine, or releasing biological control agents to control invasive weeds.

Source of funds:
☒Smith-Lever
☒Hatch
☒State
☒Other (please list)

- Legislative Grant: RI-Nursery Industry

Scope of impact: State and regional. This work impacts Rhode Island and Massachusetts apple growers, the nursery and landscape business in Rhode Island, and many Rhode Island farmers contracted with NRCS. The existence of the URI Plant Clinic affects all gardeners and commercial growers in Rhode Island.

Situation 2- Golf courses are a major component in the recreational economy of the Northeast and other regions of the United States. Because golf courses are maintained at increasingly high levels of management, the use of all classes of pesticides on golf courses is rapidly increasing. All grass is susceptible to plant-parasitic nematodes and golf courses have had an especially difficult time controlling these pathogens. While the organophosphate, fenamiphos, can be used to treat nematodes on golf courses, it is a highly toxic chemical being used in a high traffic environment. Additionally, it is not considered 100% effective. The primary goal of this project is to examine the cultural and environmental conditions that increase plant-parasitic nematode populations on golf courses and to determine the best strategies for mitigating these factors.

Situation 3- Fresh market vegetable production in the Northeast is continually declining in favor of more profitable and less labor and chemical intensive crops. One reason for the rapid decline in vegetable production in the Northeast is the considerable expense of controlling both fungal and nematode diseases. Lettuce is particularly susceptible to nematode pathogens and often increases the populations of plant-pathogenic nematodes in the soil, following each year of production. In an attempt to increase the profitability of local and regional vegetable growers, the current study is attempting to incorporate plant-parasitic nematode resistance into locally adapted lettuce varieties and explore alternative, environmentally compatible strategies for nematode control.

Outputs:

- A survey of the distribution, frequency and population levels over time of plant-parasitic nematodes was conducted on 114 greens from 38 different golf courses throughout southern New England.
- An analysis was undertaken to determine the effect of soil physical properties and various cultural management practices on population levels of plant-parasitic nematodes.

Publications

- Jordan, K. S. and Mitkowski, N.A. 2007. Soil characteristics and management practices associated with population levels of plant-parasitic nematodes on golf course greens in southern New England. Agronomy Journal *(submitted).*
- Boesch, B.B. and Mitkowski, N.A. 2006. Management factors affecting the quality of velvet bentgrass on sand and soil based greens. Applied Turfgrass Science *(in press)*
- Mitkowski, N.A. and Colucci, S. 2006. A limited number of vegetative compatibility groups exist within *Sclerotinia homoeocarpa*. Journal of Phytopathology 154:500-503.
- Jordan, K. S. and Mitkowski, N. A. 2006. Population dynamics of plant-parasitic nematodes in golf course greens turf in southern New England. Plant Disease 90:501-505.

Outcomes/Impact::

- Our research demonstrates golf course age and grass species have the most significant impact on predicting levels of plant-parasitic nematodes on golf course putting greens.
- With the impending loss of fenamiphos (the only nematicide registered for turfgrass use) golf courses will have to increasingly rely on cultural methods of nematode control, specifically, increasing cutting heights and transitioning to creeping bentgrass.
- Creeping bentgrass sustains lower nematode populations than velvet bentgrass, a result that confirms anecdotal observations.
- Newer courses are less prone to damaging populations than older courses and increases in phosphorous, organic matter or sand can also lead to higher populations of nematodes.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
☐ Other (please list)

Scope of impact: Regional, national, international. The scope of impact of this research is at the national to international level, even though it was only undertaken at the regional level. Golf courses exist across the globe and all courses in temperate climates often face the exact same problems. The determination of which factors influence plant-parasitic nematodes of golf courses can be applied to any golf course in a temperate and possibly even subtropical environment. Lettuce production occur both regionally and nationally and improved varieties can be utilized throughout the country.

Knowledge Area: KA 212. Pathogens and Nematodes Affecting Plants

Situations:

Situation 1- Leaf rust (*Puccinia poa-sudetica*) is a problem for sod producers in Rhode Island and across New England. It damages Kentucky bluegrass in the fall, reducing producers' ability to sell the sod, and may increase winter damage.

Outputs:

- We are conducting a study to determine which varieties of Kentucky bluegrass are most susceptible to the rust, and which are most tolerant.
- A second year of rust resistance data was collected on the 100 commercially available varieties and 90 experimental lines of the 2000 Kentucky Bluegrass NTEP, and a first year of data was collected on the 92 entries in the 2006 URI Kentucky Bluegrass Trial.

Outcomes/Impact::

- 11 varieties were identified with good levels of rust tolerance
- A report was submitted to the New England Sod Producers Association

Source of funds:

☐ Smith-Lever
☒ Hatch (pending)
☒ State
☒ Other (please list)

- Gifts from the turf seed production and sod production industries to the URI Foundation
- URI Start-up funds

Scope of impact: State and regional

Knowledge Area: KA 215. Biological Control of Pests Affecting Plants

Situations:

Situation 1- Non-native plants and animals that are accidentally introduced into North America typically come without the natural enemies that keep them in check in their native habitats. Freed from these natural controls, these aliens often reproduce and spread with abandon, adversely affecting the environment, the economy, and human health. In many cases these problems can be solved by reacquainting the pests with their effective natural enemies in a deliberate process called Classical Biological Control. We are using this process to address key insect and weed pests in Rhode Island including lily leaf beetle, common reed, and swallow-worts as well as following up on past releases against birch leaf miner, purple loosestrife, cypress spurge, and hemlock wooly adelgid.

Outputs:

- The lily leaf beetle, *Lilioceris lilii*, first reported in the U.S. in 1992, has spread throughout New England and northeastern Canada where it is eliminating native and cultivated lilies from its range. This insect is controlled by six parasitoids in Europe. After evaluating biology and host specificity of the European parasitoids *Tetrastichus setifer*, *Lemophagus errabundus* and *Diaparsis jucunda* we obtained USDA approval for field releases.
- We found in 2006 confirming evidence that the parasitoid *Tetrastichus setifer* is established in RI, MA, ME, and NH as a result of our releases. We found *T. setifer* has spread at least 5 miles from the release plot and *Lemophagus errabundus* has spread over one mile.

- Lily leaf beetle populations have declined substantially at the two oldest release sites in MA and RI.
- We reared 20,000 additional *Galerucella* beetles for release against purple loosestrife throughout Rhode Island with the cooperation of the RI Dept. of Transportation, the Wood/Pawcatuck Association, NRCS and the Town of North Kingstown in 2006.
- We have tracked density and parasitism rates of birch leafminer since releasing the European parasitoid *Lathrolestes nigricollis* against this pest in 1994. Populations of this pest have declined to a point that we have not seen any damage from this pest in Rhode Island since 2003. Pest populations were virtually undetectable throughout the northeast in 2006.
- While monitoring the successful control of Cypress spurge at Watson farm, Jamestown RI, we discovered black swallow-wort moving into the pastures. Subsequent surveys in 2006 revealed populations of this toxic plant in 8 of 19 pastures surveyed throughout the state, including 7 horse pastures.
- We collected 5 European natural enemies of swallow-worts and we are now researching them in the URI quarantine laboratory as possible biological control agents for this invasive plant in North America.
- We have developed a method of propagating cuttings from putatively resistant Canadian hemlocks that survived in forests that were devastated by the hemlock woolly adelgid (HWA). Preliminary experiments show a potentially high level of HWA resistance.

Publications

- Lambert, A.M., K. Winiarski*, and R.A. Casagrande. 2006. Distribution and Impact of *Lipara* Species on Native and Exotic *Phragmites australis*. *Aquatic Botany*. In press.
- Lambert, A.M. and R.A. Casagrande. 2006. Distribution of Native and Exotic *Phragmites australis* in Rhode Island. *Northeastern Naturalist*. In press.
- Lambert, A,M. and R.A. Casagrande. 2006. No Evidence of Fungal Endophytes in Native and Exotic *Phragmites australis*. *Northeastern Naturalist*. In press.

Outcomes/Impact:

- As a result of our establishment of lily leaf beetle parasitoids, there have been local declines in pest populations, reduced pesticide use, enhanced survival of native lilies.
- The spread and population increase of the parasitoids we released against birch leafminer has resulted in a substantial reduction (eventual elimination) of birch leafminer pesticide applications throughout the northeast, and increased aesthetics and survival of previously-infested trees.
- We submitted a NE IPM grant on the swallow-wort biocontrol project and scheduled several presentations including meetings of Entomological Society of America, NY Invasive Plant Council Annual Meeting, and the International Congress of Biological Control.
- If preliminary results hold up, the hemlock adelgid work could have enormous impact. Our vegetatively-propagated native hemlocks with HWA resistance could be widely used in reforesting dead hemlock stands throughout the northeast.
- Purple loosestrife and cypress spurge populations continue to decline state-wide

Source of funds:
☒Smith-Lever
☒Hatch
☒State
☒Other (please list)

- North American Lily Society

Scope of impact: State and regional

Situation 2- Oriental beetles and Japanese Beetles severely impact the health of lawn and golf course turfgrasses, as well as sod production facilities. Large sums of money and amounts of pesticide are used each year for control of these pests. Effective biological control methods are needed to reduce chemical and monetary inputs in turf care.

Outputs:

- In a mating disruption experiment, six traps baited with 30 µg of pheromone were placed in a landscape known to be infested with oriental beetles. Traps were changed and beetles captured were counted weekly throughout the flight period. 26,899 beetles were captured over the flight period in 2006. Cup changer samples of the turf in the fall revealed no oriental beetle larvae. One hypothesis is that the high concentration of pheromone in an area repels other females from laying eggs in that area. Females marking an egg laying site has been documented for other insect species.
- In 2004, we established milky disease, *Paenibacillus popilliae*, in turf known to be infested with Japanese beetles. The unique aspect of the milky disease establishment was that every square centimeter in our 4í X 4í plots received an ìeffectiveî dose of bacteria. Evaluation of plots one and two years after establishment showed no statistically significant difference between treated and control plots. This experiment was conducted in an area with soil temperatures that are supposed to be conducive to milky disease infectivity (i.e. > 21oC). Laboratory studies with grubs placed in incubators at 30oC show a small percentage of most populations will develop milky disease if kept at this relatively high temperature.
- We have demonstrated 90% control of Japanese and oriental beetle larvae with rates of Bacillus thuringensis japonensis toxin as low as 100 g toxin / ha.

Outcomes/Impact:

- Individuals managing extensive acreage or intensive turfgrass areas have alternative strategies for controlling insect pests in turf. Use of these biological alternatives will result in less exposure of applicators and the public to more toxic traditional chemical controls. Groundwater protection will improve environmental quality.

Source of Funds:
☒Smith-Lever
☒Hatch
☒State
☒Other (please list)

- Industry Grants-in-Aid

Scope of Impact: State and regional

Knowledge Area: KA 721. Insects and Other Pests Affecting Humans

Situation:

The vector-borne and zoonotic diseases program includes our projects on zoonotic disease surveillance and management, and on conventional and biological control of tick and mosquito vectors. Key elements of the program continue to focus on enhancing surveillance, improving diagnostics, gaining knowledge on vector-pathogen interactions, and developing and implementing vector control strategies that are appropriate for communities. They represent an important capacity for research and outreach in vector-borne and other zoonotic diseases that is critical for protecting animals and humans in Rhode Island and throughout the northeastern region. Moreover, ongoing surveillance for disease agents and continued development and implementation of rational vector-borne disease management plans are key elements for a public health approach to bioterrorism preparedness.

We maintain close ties with the Rhode Island Office of Mosquito Abatement Coordination, the Rhode Island Department of Health, and Brown University's Center for Biodefense and Emerging Pathogens. We collaborate by maintaining a statewide tick surveillance effort, and implementing interactive education-based disease prevention programming in the highest risk areas. We provide expertise and capacity for a wide variety of zoonotic diseases, including Lyme disease, Babesiosis, human anaplasmosis (formerly HGE), West Nile Virus, EEE, and other diseases of major public concern.

Outputs:

- Expanded our outreach infrastructure for implementing community-based tick control and tick-bite prevention awareness. In addition to continuing our back-yard interactive workshop program called "Do You Hate Ticks As Much As We Do?", Rhode Island's Governor proclaimed June 3 2006 as Tick Control Awareness Day (TCAD) focusing attention on tick control statewide through planned public events and media attention.
- In 2006, in addition to TCAD programming, we held 7 tick-bite prevention and tick control awareness workshops attended by >300 people.
- Developed a tick survival model using a quadratic equation based on duration of exposure to different humidity levels under laboratory conditions.
- Launched a high-quality, interactive, health information delivery and decision support site on the internet (www.tickencounter.org).
- Added another year to our continuous deer tick statewide surveillance data from 1993 (now 14 continuous years).
- Used RNAi to suppress gene expression as a means of exploring the role of specific tick salivary gland genes in bloodfeeding and pathogen transmission.
- Completed studies indicating that acquired tick immunity from multiple natural tick exposures results in 50-75% protection from Lyme disease spirochete infection in a Guinea pig model.

Publications

- Rodgers SE and TN Mather. 2006. Evaluating satellite sensor-derived indices for Lyme disease risk prediction. **J. Med. Entomol.** 43:337-343.
- Connally, N.P., H.S. Ginsberg, and T.N. Mather. 2006. Assessing peridomestic entomological factors as predictos for Lyme disease. **J. Vect. Ecol.** 31:1-7.
- Kotsyfakis, M., A. Sá-Nunes, , I.M. Francischetti, T.N. Mather, J.F. Andersen, and J.M. Ribeiro. 2006. Antiinflammatory and immunosuppressive activity of sialostatin L, a salivary cystatin from the tick *Ixodes scapularis*. **J. Biol. Chem.** 281:26298-26307.
- Ribeiro, J.M.C., A-C Francisco, I.M.B. Francischetti, B.J. Mans, T.N. Mather, J.G. Valenzuela, and S.K. Wikel. 2006. An annotated catalog of salivary gland transcripts from *Ixodes scapularis* ticks. **Insect Biochem. Mol. Biol.** 36:111-129.
- Massung, R.F., T.N. Mather, and M. L. Levin. 2006. Reservoir competency of goats for the Ap-Variant 1 Strain of *Anaplasma phagocytophilum*. **Infect. Immun.** 74:1373-1375.

Outcomes/Impact::

- This program informs homeowners in the highest risk neighborhoods (identified from tick surveillance and risk mapping) in three southern Rhode Island towns about the most appropriate strategies for preventing tick bites. The message is kept simple - protect yourself, protect your yard, protect your pet - and the program serves to connect people at risk with commercial vendors of tick control products and services. Due to the success of last year's workshops we plan more for 2006 launched by a state-wide tick awareness day in the spring.
- We have increased understanding of the distribution of Lyme disease within Rhode Island. We will use this understanding to calculate and plan for future disease prevention activities in Rhode Island and the northeastern USA. Backyard workshops have established the University of Rhode Island as an authority on Lyme disease and tick-bite prevention activities in local communities.
- We have increased understanding of disease prevention behavior and a potentially more robust method for delivering appropriate tick-bite precautions. Our HIDDSS framework (www.tickencounter.org) will be a useful mechanism for communicating disease risk to residents in the Lyme disease endemic northeast. We also are increasing our understanding of the physiological relationships between ticks and their environment, particularly the relationship between tick survival and atmospheric humidity levels in forested tick habitats.
- Significant laboratory results for tick survival and humidity have lead us to develop a field experiment to assess and update the laboratory-developed tick survival model. We will use actual humidity data collected in forested sites throughout Rhode Island during a period of high nymphal tick abundance. If a field model of tick survival and humidity is successful, it will be possible to make predictions of tick activity on a state-wide scale in near-real time. Our goal is to test whether regularly updated tick risk forecast maps will serve to increase stakeholder awareness of ticks and associated diseases at times when they are at greatest risk from a tick bite. This may result in improved disease prevention behavior and disease reduction.
- Studies confirmed that aquired tick immunity and not humoral suppression of salivary immuno-modulators results in significant levels of protection from infection with Lyme disease spirochetes in a Guinea pig model.

- We identified several immuno-suppressive molecules present in tick saliva that are likely impediments to developing a highly effective anti-tick vaccine. These findings are setting new directions for anti-tick vaccine development research.
- The program receives significant local media coverage promoting both the work of scientists at URI, and tick awareness for disease reduction.
- www.tickencounter.org is averaging about 50 visitors per day from all over the world.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
☒ Other (please list)

- CDC grant "Assessing Community-based Tick Control for LD Mitigation"
- USDA Special Grant "Tick-borne disease prevention, RI" (RI002003-06284 and RI002005-06174)
- NIH grant, RI01 AI37230, "Role of Tick Saliva in Lyme Disease and Vaccine Strategy".
- Donations from private corporations and individuals.

Scope of impact: State, regional and national. Our program is likely to have state, regional and national significance. Specifically, residents of Rhode Island will be impacted during our tick control and awareness programs. It is also likely that our HIDDSS system initially will be largely based around information for the local Rhode Island and Massachusetts areas. Once the information system is working and has been thoroughly tested, tick risk information will be provided to a larger audience in states throughout the northeastern US. Tick risk modeling also will be extended to encompass populations living in this region. Vaccine developments will be of national or international significance.

PROGRAM 2: AQUACULTURE BIOTECHNOLOGY AND FISHING.

SITUATION AND PRIORITIES:

In Rhode Island, the aquaculture industry is almost exclusively oysters. The desire is to expand the industry, in terms of both increasing production of oysters and developing industries for other species (mostly saltwater, but also freshwater) in a sustainable manner. Problems encountered in expanding the industry include diseases, user conflicts for coastal waters, and high costs of production for new species. In recent years, our approach to solving these priority problems has involved a combination of efforts funded by RI AES/CE formula funds, USDA Special Grants for Environmental Biotechnology, and the RI Aquaculture Initiative (RIAI) (funded by a special Congressional appropriation through the RI Coastal Resources Management Council). Our priorities for solving the disease issue include surveys of the diseases in RI shellfish, development of disease-resistant oyster strains, and development of vaccines. Those for solving the user conflict issue include development and maintenance of a web-based, resource utilization map for RI coastal waters, as well as research on the value of shellfish aquaculture gear as habitat for juvenile fish. Finally, priorities for the high production cost issue include research on new diets for summer flounder culture and integration of freshwater aquaculture with terrestrial agriculture. The loss of our finfish aquaculture extension specialist just prior to FY 2006 has impacted our ability to advance the freshwater aquaculture initiative. During 2006, we began implementation of a Cooperative Agreement with the USDA Natural Resources Conservation Service (NRCS) office in Warwick, RI, to provide them with technical assistance in the development of documents and training for Best Management Practices (BMPs) in both freshwater and marine aquaculture and specifically assisted them in the inclusion of shellfish aquaculture in their Environmental Quality Incentive Program (EQIP).

Knowledge Area: KA 302. Nutrient Utilization in Animals

Situation:

Aquaculture production continues to expand worldwide and the largest cost component in the aquaculture is feed, with fish meal being a major feed component. Replacement of fish meal and oil with plant products provides three primary benefits: cost reduction, avoiding over-exploitation of ocean fisheries and elimination of PCB and mercury contaminant problems in the aquaculture product. The challenges of plant protein feed development are the nutritional limiting factors and improvement of feed palatability. These problems could be overcome by eliminating anti-nutrition factors, balancing amino acid profile, and improving palatability. The overall goal of Hatch project RI00H86 is to develop plant protein-based aquaculture feeds prepared with soy, corn gluten and canola protein concentrate using a potentially important aquaculture species, summer flounder. A summer flounder industry has developed in China, based on broodstock obtained from the U.S., but high costs of production in the U.S. have inhibited industry development here. Reduction of production costs through replacement of expensive fish meal with cheaper plant proteins is a goal of this research. In FY 2006, we built on our previous research that showed that soybean meal (SBM), corn gluten meal (CGM), or canola protein concentrate (CPC) used individually could replace up to 40% of fish meal in summer flounder diets, yielding lower growth of the fish but also a significant reduction in cost/kg of fish produced. Our most recent

experiment examined replacement of fish meal with a SBM-CGM-CPC combination, plus (in separate treatments) added amino acids, phytase, or taurine. All provided growth and food conversion ratio of summer flounder juveniles equal to that on a fish meal diet, but significantly better than the diet with only SBM replacing fish meal; thus, this represents an important advance over our previous work.

Processing of wild-caught squid in the Northeast U.S. leaves about 40% of the squid behind as a "waste" product destined for landfills. Previous research at URI has shown that this material can be hydrolyzed and suggested that squid hydrolysate may have potential as a highly digestible aquaculture feed ingredient for marine fish larval diets or as a feed additive for grow-out diets. We have developed and tested a diet for larval summer flounder and found that it performed as well as or better than live feed (artemia nauplii) or a commercially available larval diet. Use of a larval diet based on "waste" material could reduce the cost of summer flounder hatchery production. We also tested squid hydrolysate as a feeding attractant to be added to summer flounder diets in which SBM replaced 40% of fish meal. In this study, there was no difference in growth or food conversion ratio for fish fed diets containing fish meal only, 40% replacement of fish meal with SBM, or 40% SBM replacement plus squid hydrolysate; however, the study only lasted five weeks (due to facility constraints), so we are not able to forecast longer term efficacy of the use of squid hydrolysate in these diets.
Our extension efforts in this area include contacts with both the summer flounder industry and feed manufacturers. In addition, we have begun discussions with the New England Zebrafish Husbandry Association to work toward the standardization of the nutrition of zebrafish, an animal model widely used by molecular geneticists and developmental biologists.

Outputs:

- Presented talk entitled "Summer flounder culture in the Northeast: lessons learned" at the American Fisheries Society annual meeting in Lake Placid, NY
- Presented talk entitled "Cyprinid nutrition" to the New England Zebrafish Husbandry Association in Boston, MA

Publications

- Enterria, A. 2006. Partial replacement of fish meal with plant protein sources in diets for summer flounder (*Paralichthys dentatus*). M.S. Thesis, University of Rhode Island.
- Lian, P.Z., C.M. Lee and D.A. Bengtson. In press. Development of a squid hydrolysate-based larval diet and its feeding performance on summer flounder, *Paralichthys dentatus*, larvae. J. World Aquacult. Soc.

Source of funds:

Hatch
State
Other

- USDA/NRCS
- USDA Equipment Grant

Knowledge Area: KA 307. Animal Management Systems

Situation:

Rhode Island is a densely populated state and its coastal waters are used for a wide variety of activities: recreation, fishing, shipping, etc. The predominant aquaculture industry, oyster culture, has had difficulty expanding, because other users regard it as a conflicting user of the coastal water that may have a negative impact on the environment. Hatch project RI00H327 ("Assessing the value of shellfish aquaculture gear as fish habitat") has documented the populations of juvenile fish that find shelter in oyster aquaculture gear and compared them with populations of juvenile fish in control areas (natural rocky reefs and one custom-built artificial reef). Surveys were done at 3 aquaculture sites and 5 natural reef sites from July to October, in both 2004 and 2005, and completion of data analysis occurred in FY 2006. The basic approach was to conduct a mark-recapture study at each of the 8 sites. Based on these surveys, cunner, *Tautogalabrus adsperus*, were more abundant on natural rocky reefs and the artificial reef than on oyster grow-out sites, whereas scup, *Stenotomus chrysops*, and tautog, *Tautoga onitis*, displayed the opposite pattern and were most abundant on aquaculture sites. The relative density of black sea bass, *Centropristis striata*, was similar in all habitats. Scup on natural reefs grow about 1.5 times faster than scup on grow-out cages, but their apparent survival rate is about 25% higher on aquaculture sites than on natural reefs. Based on these criteria, oyster grow-out cages provide habitat for reef-associated fishes that is at least as good in quality as natural habitat.

With funding from the USDA/NRCS office in Warwick, RI, we provided technical assistance to their development and implementation of a program to incorporate RI shellfish farmers in the Environmental Quality Incentives Program (EQIP). This essentially extension activity included outreach to the growers themselves, as well as training for the NRCS staff who would be monitoring the EQIP contracts. In addition, we began work on a white paper to identify all the ways in which aquaculture (freshwater or marine) might affect the five resources (air, animals, plants, soil, and water) in which NRCS is interested. Finally, we initiated an environmental and disease monitoring program to document the benefits of the EQIP shellfish aquaculture program.

Outputs:

- Presentation on results of Hatch project RI00H327 to the 7th International Temperate Reef Symposium, June 2006, Santa Barbara, CA
- Presentation on results of Hatch project RI00H327 to the VIIth International Congress on the Biology of Fish, July 2006, St. John's, Canada
- Presentation to EQIP aquaculture farmers at USDA/NRCS office
- Presentation to train USDA/NRCS staff in basics of shellfish aquaculture

Publications

- Tallman, J. C. and G. E. Forrester. In press. Oyster grow-out cages function as artificial reefs for temperate fishes. Trans. Amer. Fish. Soc.

Outcomes/Impact:

- The Rhode Island Aquaculture Coordinator is using the results of Hatch project RI00H327 for decision making related to applications for oyster aquaculture leases.

- Eleven Rhode Island shellfish farmers received 3-year USDA/NRCS EQIP contracts.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
X Other (please list):
USDA/NRCS project 681106506 "Technical assistance to NRCS and freshwater and marine aquaculture producers on the development of technical documents and training"

Knowledge Area: KA 311. Animal Diseases

Situation:

Disease has a major negative impact on aquaculture production, both shellfish and finfish. Oyster diseases have been the subject of intensive investigation for over a decade, but still strike many oysters before they can be brought to market. Because immunization of shellfish is not an option, efforts focus on development of disease-resistant strains of oysters. RI researchers currently work in that area, funded primarily by the Rhode Island Aquaculture Initiative. Finfish can be immunized, so research efforts have centered on development of vaccines that can be delivered to fish of commercial aquaculture importance as early in life as possible. RI00H402 ("Nutrient-based approach to vaccine development for bacterial pathogens") attempts to use the nutritional approach to design innovative ways of protecting animals against infection with bacterial enteropathogens. It is known that bacterial enteropathogens use nutrients present in intestinal mucus for growth during infection. However, the nutrients have not been identified. Investigators use both fish and mammalian models to investigate fundamental mechanisms of colonization of intestines by pathogenic bacteria. Work in the past year has concentrated on mechanisms of activation of the EmpA metalloprotease virulence factor of *Vibrio anguillarum*, a bacterium that infects fish. *Vibrio anguillarum* secretes the EmpA metalloprotease virulence factor during infection of fish as a 45 kDa proenzyme (pro-EmpA) that is activated by proteolytic processing resulting in a 36 kDa mature enzyme. We have now identified a gene that encodes the EmpA processing protease (*epp*) that is responsible for the activation of pro-EmpA to the mature active form of EmpA. The *epp* gene has been cloned and sequenced. Sequence analysis suggests that Epp is a metalloprotease. *V. anguillarum* strains containing a mutation in *epp* are negative for EmpA protease activity. When the *epp* mutation is complemented EmpA activity is restored. We have also identified an additional gene involved in the regulation of EmpA expression. This gene is a homologue of *cpxR*, which is a regulatory gene associated with responses to membrane and periplasmic stress in bacteria. We have found that *cpxR* mutants have reduced amounts of EmpA activity. It is interesting to note that mutations in *epp* and in *cpxR* do not affect the growth of *V. anguillarum* in any growth medium (glucose salts, Luria broth plus 2% NaCl, or fish GI mucus-containing broths).

In addition, we pursued nutritional studies of *Salmonella typhimurium* pathogenesis. Seven different sugar catabolism deletion mutants of *Salmonella typhimurium* SR-11 were constructed and tested for virulence in BALB/c mice. The deletions were such that they prevented catabolism of L-arabinose (Δ*araBAD*), L-fucose (Δ*fucAO*), D-gluconate Δ*idnK* Δ*gntK*), N-acetyl-D-glucosamine (Δ*nagE*), D-mannose (Δ*manA*), sialic acid (Δ*nanAT*), and D-ribose (Δ*rbsK*). None of the

Salmonella typhimurium SR-11 deletion mutants proved to be avirulent when fed orally to BALB/c mice (10^8 cfu/mouse); however, the L-fucose mutant and the D-mannose mutant were attenuated, i.e., although all the mice infected died, they died several days later than the control mice infected with the wildtype *Salmonella typhimurium* SR-11. These data suggest that *S. typhimurium* SR-11 uses more than one sugar during infection. If so, constructing mutants unable to utilize several sugars that attenuate may result in avirulence, e.g it will of great interest to contruct an *S. typhimurium* SR-11 Δ*fucAO* Δ*manA* and test its virulence.

Last year, we reported that *S. typhimurium* SR-11 needs a complete TCA cycle for full virulence (Tchawa Yimga, M., et al, Infect. Immun. 74:1130-1140, 2006), i.e. deletion of several TCA cycle genes individually resulted in attenuation in BALB/c mice, but not avirulence. This year, we focused on the reaction leading from succinate to fumarate. This reaction can be carried out by two *S. typhimurium* SR-11 enzymes, succinate dehydrogenase and fumarate reductase. Although the *S. typhimurium* SR-11 fumarate reductase mutant (Δ*frdABCD*) is fully virulent and the succinate dehydrogenase mutant (Δ*sdhCDA*) is only slightly attenuated, the double mutant (Δ*frdABCD* Δ*sdhCDA*) was found to be totally avirulent and of greater importance, fully protected BALB/c mice against subsequent infection with 10^8 cfu of wildtype *S. typhimurium* SR-11.

Outputs:

- Poster presentation on the *Vibrio anguillarum* work at the American Society for Microbiology meeting
- Presentation at annual RI Shellfish Aquaculture class for potential shellfish farmers in RI
- Brochure on management of shellfish diseases
- Presentation entitled "Delivery of vaccines and therapeutants to aquacultured organisms using microorganisms" at Symposium on Microbiology and Biotechnology: Past, Present, and Future, Roger Williams University.

Publications

- Gauger E, Smolowitz R, Uhlinger K, Casey J, Gómez-Chiarri M. 2006. *Vibrio harveyi* and other bacterial pathogens in cultured summer flounder. Aquaculture 260:10-20.

Outcomes/Impact:

- The *S. typhimurium* SR-11 Δ*frdABCD* Δ*sdhCDA* strain has been sent to Intervet International in Millsboro, DE, with whom we have a confidentiality agreement, for testing in February as a possible vaccine strain for chickens. If the nutrient approach to constructing bacterial strains that as live vaccines can protect farm animals from being colonized with bacterial enteropathogens is successful, hundreds of millions of dollars could be saved annually in losses to farmers and in human workdays gained.

Source of funds:

Hatch
State
Other

- NRI

GOAL 2: A SAFE AND SECURE FOOD AND FIBER SYSTEM

Situation and Priorities:

A safe food and fiber system spans the health of domestic livestock and cultured fish to the health of the consumer. Animal husbandry practices that promote the health and well-being of animals and fish simultaneously create safer and higher quality food products, yet addresses societal concerns about appropriate husbandry practices used in our agricultural/aquacultural systems. Equally important is that the management practices address the need to be highly competitive in our global economy. Last, a secure food system is one that prevents contamination of food by any source, as well as facilitates a predictable and steady supply of high quality and safe foods.

We report new progress in Programs 3 and 4. We have improved physical capacity to meet the goals of Program 3 by constructing and/or improving facilities for finfish and shellfish vaccine work. Progress in program 4 has been made possible through significant extramural funding to support program excellence in food safety outreach.

PROGRAM 3: HEALTH AND WELL BEING OF FISH AND ANIMALS.

Knowledge Area: KA 311. Animal Diseases

Situation:

This knowledge area is supported by work dedicated to resolution of aquaculture-related diseases. Station scientists have initiated a series of studies to characterize bacterial genes involved in the growth of enteric pathogens of fish. This work has served as the foundation for the development of vaccines against bacteria that harm cultured fish. This work is supported, in part, by Hatch funds. Outputs/Outcomes/Impacts of our current work are described in this report under Goal 1, Program 2: Knowledge Area 311-Animal Diseases.

PROGRAM 4: FOOD SAFETY.

Knowledge Areas: KA 711. Insure Food Products are Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources and KA 712. Protect Food from Contamination by Pathogenic Microorganisms, Parasites and Naturally Occurring Toxins

Situation:

There is a need for food safety information throughout the diverse Rhode Island community of educators, consumers, food service workers, food industry personnel and processors, and commercial fruit and vegetable growers. Federal and state regulations mandate specific training that promotes compliance in the RI food industry. Program expertise will continue to provide regional support for a variety of educational activities.

Outputs:

HACCP/SCP and other food safety training and presentations:

3-day Seafood HACCP	Sept. 20-22, 2005	Connecticut	17 participants
	May 15 -17, 2006	Rhode Island	22 participants
1-day Internet HACCP	Oct. 6, 2005	Connecticut	8 participants
	May 2, 2006	Rhode Island	13 participants
	Sept. 19, 2006	Connecticut	6 participants
Meat/Poultry HACCP	March 22-23, 2006.	Connecticut	24 participants
GAP Training	July 31, 2006	Rhode Island	12 participants
HACCP School	October 5, 2005	Rhode Island	24 participants
Foodservice	October 25, 2005		20 participants
	Februrary 22, 2006		10 participants
	May 9, 2006		14 participants
Community Service to Teach	Sept. 30, 2005	Rhode Island	18 participants

Food Safety (American Assn of FCS – Northeast Regional Conference)

Community Service related to Knowledge Areas
Member RI Food Safety Task Force
Participant RI Food Safety Partnership – funded by CDC; Advisory committee
Member, RI Healthy Schools Coalition
RI Farm Viability Committee
National Partnership of School Food Safety Education member.
Member, Narragansett District Health and Safety Committee
Steering committee of the National Seafood HACCP Alliance.

Consumer Lecture Series 2006 (and end of 2005 series).
The lecture series focused on the marine environment; target audience was the general public. (Joint sponsorship with Sea Grant Extension and Communication)

Sharks in New England Waters	September 20, 2005	34 participants
Life on Coastal Lands in Colonial New England.	June 14, 2006	86 participants
Be Happy, Eat Seafood: Balancing Benefits &Risks	Aug. 3, 2006	27 participants
Healthy Seafood from Your Coast to Your Table	August 23, 2006	39 participants

Eleventh Annual Food Safety Workshop, "Fear Factor – A Realistic Look at Food Safety" October 6, 2005. 96 participants. Coordinators: Martha Patnoad and Lori Pivarnik

Interviewed for Providence Journal (Dec. 2005) and NBC 10 (WJAR) (Aug., 2006) on food labeling and seafood safety.

Grants

Garden to table: Food safety practices of home gardeners. USDA/CSREES. 10/30/03 – 9/30/07. $384,000.

Inactivation of viruses by pressure in ready-to-eat foods. USDA/CSREES. . 9/04 – 9/07. University of Delaware, D. Hoover (PI), Doris Hicks (PI). L. Pivarnik (Co-PI): $40, 448.

Food safety education for high school and transition special needs students. USDA/CSREES. $590,439. 9/05-8/08.

An internet training program on sanitation, good manufacturing and hygienic practices for food processors, wholesalers and warehouses. USDA/CSREES. Cornell University, K. Gall. Total:$444,655. L. Pivarnik: $30,000. 9/05-8/08

Elimination and reduction of risk factors associated with foodborne Illness, RI Department of Health, Year 1 of five year project, $50.160, April 2005.; Year 2, $99,679. Year 3, 104,000

Developing the Best Outreach Message for Consumers on the Safe Handling and Utilization of Seafood and Seafood Products. NFI. Univ. of Delaware, D. Hicks, PI, L. Pivarnik, Co/PI: $19,600

Increasing and Improving Meat and Poultry Oathogen Reduction and HACCP Options for Plants in the Northeast. USDA. D. Wright Hirsch, Univ. of Connecticut, PI. Lori Pivarnik, Collaborator. Sept. 2006-Sept. 2009.

Publications

Pivarnik, LF, Hicks, D, Jahncke, M and Gall, K. 2006. Needs Assessment Survey of Sanitation, Good Manufacturing and Hygienic Training Practices for Food Processors, Wholesalers and Warehouse Operators. Accepted for Publication. Food Protection Trends

Pivarnik, LF, Patnoad, MS, Leydon, NL and Gable, RK. 2006. New England home gardeners' food safety knowledge of fresh fruits and vegetables. Food Protection Trends. 26(5):298-309.

Pivarnik, LF, Donath, H, Patnoad, MS, and Roheim, C. 2005. New England consumers' willingness to pay for fresh fruits and vegetables grown on GAP-certified farms. Food Protection Trends. 25(4): 256-266.

Outcomes/Impact:

- Produced the "Seafood Savvy", a HACCP Update newsletter (Joint publication between URI and UConn) that is distributed to over 600 participants in CT and RI HACCP courses. The newsletter provides industry with current information regulations. The project is ongoing.
- As of Sept. 2006, there were 17 GAP Certified farms in RI, a direct result of training provided under this Knowledge Area.
- The URI CE Food Safety Education Program continues to be part of a RI School Food Safety Partnership (RI Department of Education (RIDE), Kids First, and the RI Department of Health (RIDOH)). This CDC funded project has completed its fifth year.

The project will be funded for 5 more years through March 2008. At the close of the sixth year of the project, thirty-eight elementary, middle and high schools in both rural and urban areas of the state are active participants. Developed a School Food Safe Action Guide.

- The Food Safety Education Specialists continue to provide consultations and educational opportunities to educators, regulators and food safety professionals on the development and implementation of school food safety policies using the policy guided developed as part of a previously funded USDA project. In addition, they provide consultations to the food industry and consumers, through the URI Gardening and Food Safety Hotline. Of importance were the "Food Safety House" and Detective Mike Robe's Fantastic Journey.
- URI is part of a three state USDA/CREES funded project-Food Safety Training and Certification for under-educated and Limited English Proficient Food Handlers that began in September 2003.
- The state mandated that 15 hour Food Safety Certification and 6-hour Food Safety Recertification courses were offered throughout the state. Three sections of the certification course and one section of the recertification course were offered in Spanish.
- URI staff continue to fulfill the goals of the CREES/USDA grant entitled "Garden to Table: Food Safety Practices of Home Gardeners." Structured on-site interviews were conducted with 94 home gardeners and showed that home gardeners did not understand that bacteria on home grown produce comes from a variety of sources and that little association exists between microbiological food safety issues and organic practices.
- With support of the RI Department of Environmental Health, Division of Agriculture, the outreach activities of the USDA/CREES Good Agricultural Practices New England Project continues.
- The seafood/food safety specialist continues to part of the National Seafood HACCP Alliance and the National Sea Grant Seafood Science and Technology Theme Team as well as the Narragansett District Health and Safety Committee.

Source of funds:
☒Smith-Lever
☐Hatch
☒State
☒Other (please list)

Scope of impact: Local, state, national

GOAL 3: A HEALTHY, WELL-NOURISHED POPULATION

PROGRAM 5: NUTRITION.

Situation and Priorities:

Obesity is an enormous public health issue for Americans of all ages. Like the nation, Rhode Island has experienced substantial increases in overweight and obesity among all groups of residents. Such increases have profound effects on our state's health care system, since obesity is strongly associated with several chronic diseases including type 2 diabetes, cardiovascular disease and asthma. According to NHANES data, 64% of U.S. adults exceed the "normal" range for BMI. In RI, 33% of adults are overweight and 17% of adults are considered obese; 25% of the state's children and adolescents are either overweight of obese, with minorities disproportionately affected. Additionally, adolescents from lower income families have an even greater prevalence of overweight when compared with white adolescents from higher income families. Improved eating habits and food related behaviors would have a significant impact on overweight and obesity, but, for example, only about ¼ of the state's adult population consumes the minimum of five daily servings of fruits and vegetables. Although the official unemployment rate in RI has mostly been near or below national rates, substantial numbers of Rhode Islanders have given up looking for work or work only part-time. Hispanics, African-Americans, youth and less educated Rhode Islanders suffer disproportionately from a lack of job opportunities. The poverty rate in RI is 10.7% and Providence is the 4th poorest city in the U.S. Six percent of working families had incomes below the federal poverty level, giving RI the second highest rate of poverty in New England. Not surprisingly, the number of food stamp recipients has remained relatively constant at approximately 75,000. The need for nutrition education targeting economically disadvantaged families and older adults is greater than ever. It is the priority of the URI-RI Food Stamp Nutrition Education Initiative to assist households with limited resources in enhancing overall health through improved diet quality, resource management practices, shopping/budgeting skills and food safety practices.

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

Situation:

The most recent edition of the US Dietary Guidelines makes an urgent call for data clarifying the effects of carbohydrates, particularly sugars, on human health. Appropriate dietary recommendations for healthy weight management are urgent given the current US food supply and the obesity epidemic. This work investigates how individual differences in metabolic and hormonal mechanisms may impact their responses to different carbohydrate types, and thus their appetite regulation. Subjects with a wide range of body weights were studied.

Outputs:

- Pilot data were collected in 96 healthy young males and females.
- Metabolic data collection is complete in 12 lean and 12 overweight and obese males. All subjects completed a preliminary visit for fitness testing, body composition analyses and questionnaires. They then came to the lab for two randomized test visits, in the morning

after an overnight fast, to test responses to meals sweetened with two different sugars. Baseline metabolism and appetite were measured, and blood was collected before feeding the test meal. Metabolic and subjective appetite responses to the meal were then measured for three hours, after which an ad libitum lunch was served to objectively assess appetite. ("Metabolic, hormonal and appetitive responses to different carbohydrates in lean and obese adults" – CSREES – RI00H87)

Publications:

- Melanson KJ, Carpenter C, Balestracci K, Kresge D, Wei W, Greene GW. Relationships among Dietary Behaviors, Appetite, and Subject Characteristics in Young Adults. *Obesity Research* 2005; 13 (S): 262-P.
- Kresge D, Greene GW, Carpenter C, Balestracci K, Wei W, Melanson KJ. Relationships Between Ratings of Hunger and Satiety and Biomarkers of Satiety May Be Influenced by BMI. *Obesity Research* 2005; 13 (S): 182-P.
- Wei W, Melanson KJ. Metabolic and appetitive responses to test d rinks sweetened by fructose or glucose in overweight males. *Obesity* 2006; 14 (9S): A218.

Outcomes/Impact:

- Two masters students have been trained and completed their thesis projects related to these studies.
- Data on the health effects of sugars is critical for making dietary recommendations. This current project provides such data, and considers the possibility that carbohydrates may exert different effects in different individuals. Findings suggest significant differences in metabolism after the different test carbohydrates, without differential impacts on appetite. However, relationships among metabolic responses, appetite, and subject characteristics differed between the sugars. Recommendations for intakes of sugars may need to be individualized.
- Results from this series of studies have been used as foundational data for two new grant applications submitted to further investigate significant relationships.

Source of funds:
Smith-Lever
Hatch
State
Other (please list)

Scope of impact: State, Regional and National

Knowledge Area: KA 703. Nutrition Education and Behavior

Situation:

The number of overweight children, adolescents and adults has increased significantly. Intake of fruits and vegetables is markedly lower than Dietary Guidelines recommendations and intakes are particularly low in the economically disadvantaged, those who live in urban areas and older adults (65+ years of age). Poor families have many disadvantages that lead to sub-optimal food choices and limited access to physical activity. RI EFNEP data suggest that only 4.3% of targeted populations consume a diet consistent with the Dietary Guidelines. Data collected through the RI Food Stamp Nutrition Education Program indicate that low-income older adults do not consume even minimally adequate amounts of fruit, vegetables, total grains, whole grains or calcium rich foods. In fact, almost 70% of older adults participating in community-based assessments were either overweight or obese.

Outputs:

- 347 low-income families and 1,751 youth were reached though participation in EFNEP. Of those participants, 38% were minorities.
- 25 nutrition education workshops were conducted at Farmer's Markets throughout the state. A community nutrition educator demonstrated healthy recipes, answered consumer nutrition questions and distributed printed information to 2,409 patrons.
- 207 community-based workshops were presented to over 4,856 older adult contacts throughout Rhode Island and southeastern Connecticut.
- Toll-free information hotlines of the RI Food Stamp Nutrition Education Initiative received 1331 telephone contacts.
- 1023 middle-school aged children participated in after-school programming at urban Boys and Girls Clubs/Kids Café's and 21st Century Community Leaning Centers.
- A new social marketing campaign "Best Nutritional Value for your Dollar" (three-month) was launched and appeared as exterior panels on 60 buses and as interior posters on 110 buses that traveled statewide, making approximately 2,100,000 impressions. A short text message promoting consumption of these foods, free information and a prominent toll-free number was incorporated into the panel.
- 19 food demonstrations focusing on a plant based diet and increasing fruit and vegetables while maintaining weight were presented to 1348 food stamp eligibles at food stamp offices throughout the state.
- 2 video productions, 3 issues of the newsletter the *Good News Café*, and 12 issues of *Nutrition to Go* reached over 418,400 senior contacts in RI and CT.
- 110 men and women in Home Confinement, RI Adult Correctional Institute, tested the previously designed IFAFS *Fruit and Vegetable Connection* intervention materials.
- NRI RI002004-0555 Behavior Change for Obesity Prevention in Young Adults (eight participating institutions) completed eighteen (18) on-line focus groups (n=231) homogenous by gender and university. Groups assessed college students' perceived needs for nutrition education as well as barriers and enablers of healthy weight maintenance. Data were used in the development of 10 on-line healthy weight maintenance lessons that will be revised and pilot tested in FY 2006-2007.
- NE-1023 Regional Research Project on Aging continued a multistate research effort to investigate whole grain intake in older populations (RI is a Lead Station). A new whole

grain screener and nutrition research intervention related to whole grain food intake in aging was tested in Rhode Island, producing an MS Thesis (below).

- Development, testing and distribution of a new newsletter series (10 issues; *The Farm Fresh Table*) designed to promote patronage at local Farmers' Markets and to increase fresh produce consumption by low-income Rhode Islanders. Distributed to over 700 market patrons during the summer of 2006.
- Completed over 200 surveys of RI Farmers' Market patrons related to fruit and vegetable consumption.

Publications

- Daniel L Kresge, Geoffrey W Greene, Courtney Huard, Kate Balestracci, Wei Wei, Kathleen J Melanson. Relationships among dietary behaviors, appetite and subjects characteristics in young adults. Paper presented at FASEB March 2006.
- Park A, Nitzke S, Kritsch K, Lohse B, Kattelmann K, White A, Hoerr S, Greene G, Boesckner L: F&V Express Bites: A Stage-Tailored Web Program Aimed to Increase Fruit and Vegetable Intake in Young Adults. Paper presented at EB and SNE.
- Greene B, Stone, E, Sebelia, L, Rossi, C. Attitudes towards diet, exercise, and body image in Latino women: Focus group results. Poster presented at the 5th Annual Conference of the International Society of Behavioral Nutrition and Physical Activity. Boston, MA July 13-16, 2006
- Colannino, K. Whole Grain Intake and Assessment of Health Benefits in an Aging Population. MS Thesis, University of Rhode Island, 2006 (Fey-Yensan, N. major advisor).

Outcomes/Impact:

- Thousands of low-income, high-risk Rhode Islanders are reached through face to face nutrition education efforts in their communities through EFNEP and FSNE programs. In addition, 25% of programs are offered in Spanish.
- At program exit, 925.5% of adult EFNEP participants showed positive change in at least one food group; 34% had a diet that provided at least half the recommended number of servings from each of the food groups.
- A sampling of 1250 children participating in after-school programming at Boys and Girls Clubs/Kids Café's showed a 83% increase in their ability to choose healthy snacks and a 51% in their ability to consume recommended levels of fruits and vegetables on a daily basis.
- As a result of a "Best Nutritional Value for your Dollar" survey of 255 RIPTA riders, an increase in the consumption of 5 (frozen peas, cabbage, canned tomatoes, mixed vegetables and celery) of the 12 foods determined to have the highest nutritional value for the least cost approached statistical significance. Orange juice consumption was significantly increased in those surveyed. 83% of the sample resided in zip codes identified as high food stamp neighborhoods.
- As a result of food stamp office healthy eating demonstrations, 100% of those surveyed responded that they would prepare the observed healthy recipe at home for their family.
- As a result of the Parolee Fruit and Vegetable study, the number of servings usually eaten by the participant increased by 1 serving. There was an increase in self-efficacy but not decisional balance.

- The on-line focus group format was efficient and effective in reaching college students. Gender differences and similarities in the influences on food and physical activity behavior can be used to develop intervention programs. Intrapersonal, interpersonal, environmental barriers and enablers of healthy weight maintenance were identified.
- In cooperation with EFNEP, NC-219R: two focus groups in Spanish were completed with 20 young to middle-aged Latino women. Based on the qualitative data, a 5-week program was developed and implemented in Spanish for Latino women using a Health at Any Size approach focusing on healthful eating and exercise. Thirty-nine women (100%) completed the 5-week program, which was successful in helping with short-term weight maintenance and improved diet and exercise behaviors.
- Existing instruments (the NCI Fruit and Vegetable Screener) have limitations in assessing intake in young adults. In addition, young adults do not appear to differentiate between cups and servings of fruits and vegetables. Latinas perceived significant barriers towards increasing fruit and vegetable intake as well as increasing exercise. However, a culturally tailored intervention appeared to be positively received and to have a positive short-term impact on behavior. Educational materials developed for Latino women should be in Spanish using colorful magazine-style format with pictures and limited text.
- Behavior change as a result of SNAP programming for older adults (from baseline): an increase of 91-97% in the consumption of fruits and vegetables and in the number of seniors washing their hands more often than before and during food preparation; 82-85% now engage in more physical activity, read nutrition labels; 75-78% now use leftovers within two days; shop from a list more often.
- Behavior change as a result of home day care provider training showed 100% of survey respondents indicated a change towards more age-appropriate serving sized for children in their care; 75% indicated an increase in the amount of physical activity the children received each day; and 75% utilized a greater use of the Division of Responsibility concept in child feeding.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
☒ Other (please list)
USDA FNS

Scope of impact: Local, state, national

Knowledge Area: KA 704. Nutrition and Hunger in the Population

Situation:

Hunger is among the greatest problem faced by our global community. In Rhode Island, over 21% of our children and 10% of our older residents live in poverty. Close to 51,000 Rhode Islanders rely on a complex network of food pantries, soup kitchens, and shelters to feed themselves and their families every month. Over 100,000 Rhode Islanders depend on at least one federal nutrition program, including Women, Infants and Children (WIC), School Breakfast, School Lunch or the Food Stamp program, for food. Nutrition risk associated with homelessness, particularly for women and children, is a growing concern in Rhode Island.

Hunger, food insecurity and poor nutrition are integrally liked with poverty. Food insecurity is seen in all demographic categories, but is disproportionately represented in older adults, young children, and the working poor. One out of every eleven Rhode Islanders is food insecure. In 2004, 4.2% of all RI households experienced food insecurity with hunger, representing about 43,000 individuals.

The URI Partnership in Food, Hunger and Nutrition utilizes a community/institutional model where students and faculty will work within both the academic and external communities to more comprehensively study and seek solutions to hunger and food insecurity. This model integrates training, research, service learning and outreach into communities in RI where food insecurity is most prevalent.

Outputs:

- Food Resource Locator: Development of the first phase of a web-interface to help social service agencies and individuals locate food resources in Rhode Island. The FRL, called URI GET FOOD has been beta tested and will be unveiled for general access in May, 2007.
- Interdisciplinary Field Experience in Food, Hunger and Nutrition – Two undergraduate students had supervised field experiences at the RI Free Clinic and Crossroads RI.
- In the Fall semester 2006, the Partnership faculty, staff and graduate students taught in 13 URI 101 sections and in one high school class reaching over 300 students.
- Food Security Fellows Program: Faculty in the College of Nursing, researched food experiences and daily survival strategies related to hunger among 150 homeless clients in Providence.
- Participate in and direct advisory committees such as Food Stamp Advisory Committee and "Women Ending Hunger" a group affiliated with the Rhode Island Community Food Bank.
- Making Ends Meet*,* a qualitative study of how low-income Rhode Island families with limited resources make decisions related to food was piloted during spring/summer 2006 with ten subjects.
- Working collaboratively with the URI Environmental Data Center, the Partnership has mapped resources related to food such as food outlets, congregate meal sites, and public transportation through the state. Resources can be shown on a backdrop of poverty levels. Windshield surveys of five rural communities were completed by 2 Nursing Honors students in summer 2006. Community based surveys were developed to assess barriers to food acquisition, and approximately 250 consumers in five rural Rhode Island towns will be surveyed in FY 07. A price survey of 26 food stores was initiated in 2006 and will be completed in FY 07.
- In conjunction with RI Department of Education strategies for promoting Summer Food Service Program (Summer Food program for low-income children) participation were developed. Strategies included recorded phone messages sent to every Providence parent, distribution of electronic or paper summer lunch site maps to every principal, teacher and elementary student. Maps were prominently displayed on the Providence Schools homepage.
- Partnership faculty, graduate research assistants, and undergraduate students (five people) were a continuing presence, offering nutrition classes, gathering research data, and supervising undergrad students at the Free Clinic and Crossroads in Providence, RI.

- Rhode Island Indian Council Conservation District and Southern RI: A URI Nutrition and Food Sciences graduate student taught members of the RI Indian Council Conservation District about food security and nutrition in relation to an on-site garden and traditional culture.
- The Partnership developed plans for a food security assessment in five rural Rhode Island Communities. GIS maps graphically depict the lack of resources and significant poverty, especially among children and older adults. Funding from the RI Department of Health helped fund development of a community council composed of representatives from the 5 towns.
- Scientific posters were presented at the URI Coastal Fellows Competition, the Eastern National Nursing Research Society (2 sessions), and the National Association of Community Health Educators.
- Initial development of a web-interface to help social service agencies and individuals locate food resources in Rhode Island.

Outcomes/Impact:

- Increased Summer Food Program participation in Providence, RI (summer 2006)
- Increased awareness of global and local poverty and food insecurity, and improved attitudes toward low-income, food insecure families in a population of over 300 URI freshman students.
- Created a Collaborative of 10 community based agencies, governmental-municipal entities and URI to assess food security among low-income populations, to educate communities about the problem, and to develop relevant solutions.
- Trained 3 graduate students (Interdisciplinary- Nursing, Nutrition and Psychology) and 6 undergraduate students in the field (worked with community agencies to apply knowledge, conduct research and develop and implement solutions related to food insecurity).
- Developed and focus group tested Food Access Maps resulting in ten improved maps for use in web and paper applications by state agencies (RI Department of Health, RI Department of Education, Rhode Island Department of Human Services, Rhode island Department of Elderly Affairs) and NGOs (Rhode Island Community Food Bank, CrossRoads, RI).
- Created and improved a data base on the food access issues facing Rhode Islanders.

Funding:

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
☒ Other (please list)
URI Partnership funding

Scope of impact: State and local.

GOAL 4: GREATER HARMONY BETWEEN AGRICULTURE AND THE ENVIRONMENT

PROGRAM 6: NATURAL RESOURCES AND THE ENVIRONMENT.

Situation and Priorities:

The strength of this program area is steeped in the linkages between AES and CE, and on sound individual research and extension programs. Faculty and staff in this area are among the most productive and well respected nationwide. Our program in Natural Resources and the Environment is built on the recognition that protecting and restoring the quality of land and water resources in Rhode Island requires close coordination between efforts that work with a wide spectrum of audiences and topics. Our efforts are directed towards land use and water quality, since stewardship of land and water resources can integrate a wide variety of science and management efforts. Other themes include: Critical Habitats; Geospatial Technologies for Natural Resource Management; Wetlands Restoration and Protection; Soil Evaluation; Forest Management and Natural Resources Management. We also coordinate our efforts with aspects of Goal 1, particularly research and outreach projects on sustainable (including low-pesticide) agriculture, with emphasis on the role of biological control for pest management of insects, ticks, and invasive plants.

Knowledge Area: KA 101. Appraisal of Soil Resources.

Situations:

Situation 1- Coastal managers, resource specialists, and wetland scientists have considerable interest in subaerial, intertidal, and subtidal (soils) as they attempt to assess estuarine health and plan related management activities. Making these coastal management decisions, however, has been hindered by the lack of basic information on the soil types, distributions, and relationships between soils and geographic or geomorphic form within the coastal and adjacent littoral zones. Scientists working in this area have been hindered by a lack of specific terminology relating soils, landforms, and parent materials. In addition, there is a need for amendments to the soil classification system to accommodate the unique characteristics of subaqueous soils. Little is known about the effect of sustained excess nutrient loadings, regular occurrences of algal blooms, and extended hypoxic or anoxic conditions on subaqueous soils at a landscape unit scale. There are considerable uncertainties regarding the affect of alteration of coastal wetlands on the physical, chemical, and hydrological properties of the soils that are critical for water quality functions such a denitrification. Our work is focused on answering questions such as: do the subaqueous soil-landscape models developed for one estuary hold for another having similar geographic and geomorphic characteristics; are there temporal or seasonal variations in soil properties such as redox potential that correspond with water quality parameters such as dissolved oxygen and turbidity; do morphologic indicators of estuarine health (i.e., A horizon thickness or color) correspond with chemical indices such as redox potential or organic carbon content; how has the addition of human transported materials (HTM) to coastal wetlands affected the physical, chemical, and hydrologic properties of these soil resources relative to denitrification capacity. .

Outputs:

- Development of a set of standard terms for use in describing landforms and parent materials for subaqueous soils http://nesoil.com/sas/Glossary-Subaqueous%20Soils.pdf. These terms have been incorporated into the National Soil Survey Handbook for soil scientists and others to use as a standard reference for describing these features consistently. As work continues and new terms are needed, they can be proposed for addition to the NSSH.
- Proposed additions to Soil Taxonomy to accommodate the unique characteristics of subaqueous soils http://nesoil.com/sas/Subaqueoustaxonomy.htm
- Bathymetric maps (1:6000 scale) have been completed for Ninigret Pond, Quonochontaug Pond, Greenwich Bay, Wickford Harbor, and Little Narragansett Bay that can be used for numerous purposes.
- Organized a symposium focused on subaqueous soils at the 2006 National Meetings of the Soil Science Society of America: Subaqueous Soils: A New Frontier in Wetland Soils.
- Funding granted from NOAA ($800 K) and NRCS ($100 K) to further develop methods and applications of subaqueous soils through the Mapcoast Partnership.

Publications

- Bradley, M.P. and M.H. Stolt. 2006. Landscape-level seagrass-sediment relations in a coastal lagoon. Aquatic Botany 84:121-128.
- Stolt, M.H. 2006. Sampling and analysis of soils collected in shallow-subtidal habitats. Soil Science Society of America International Meetings, Indianapolis, IN.
- Payne, M.K., and M.H. Stolt. 2006. Subaqueous landscapes and soils within southern New England open embayments. Soil Science Society of America International Meetings, Indianapolis, IN.
- Payne, M.K., and M.H. Stolt. 2006. Subaqueous Soils, Water Quality, and Estuary Health. International Union of Soil Scientists, Philadelphia, PA..

Outcomes/Impact:

- Two M.S. graduate students and 4 undergraduates (including two Coastal Fellows) learned field and laboratory techniques to sample and test soils, monitor groundwater hydrology fluctuations and tidal cycles, and conduct hypothesis-based research on subaqueous soils, water quality-soil relationships, coastal processes in various estuaries.
- Learned more about anthropogenic effects on coastal and subaqueous soils in estuaries.
- Framing of integrated NSF and NRI proposals focused on subaqueous soils and carbon sequestration.
- Strengthening of our partnership with agencies such as NRCS and EPA through our MapCoast research and application group (see www.ci.uri.edu/projects/mapcoast/).

Source of funds:

☐ Smith-Lever
☒ Hatch, Multistate
☒ State
☐ Other (please list)

Scope of impact: Our continuing work in subaqueous soils has aided in the development in strong ties with the NRCS, EPA, and RI CRMC. Our work has initiated efforts by the NRCS to

begin to assemble the workings of a regional office in Rhode Island focused on subaqueous soils. National-level documents have been proposed or implemented for use in subaqueous soils research, description, and survey.

Situation 2- The cause and effects of global warming and change are two of the most debated scientific questions of the current century. A common thread between these issues is the disruption of the carbon cycle and anthropogenic activity. Thus, understanding how land use change affects carbon flux, especially in soils (soils are the largest pool of terrestrial carbon), is critical to developing strategies for managing carbon stocks. For example, many expect that in the near future, industry will be required to maintain carbon stocks or credits in the form of forest lands in order to offset the carbon released to the atmosphere. Assigning a value of carbon sequestration is extremely difficult because considerable uncertainties exist in the rates that carbon is sequestered in the soils, and the effects of forest age, forest type, soil drainage class, and soil type on the rates. Questions remain on the best approach to estimate carbon sequestration in forest soils. As much as 44% of the carbon stored within the soils of headwater watersheds is stored in the hydric riparian soils. Calculating C-sequestration is usually done by examining forest soils of different ages that have regenerated following agricultural abandonment. Riparian hydric soils, however, have never been plowed, thus another approach is necessary to provide an age to calculate C-sequestration rates.. Our work is focused on answering questions such as: how has land-use change (forest to agricultural land, or agricultural to developments) within a watershed affected carbon sequestration rates in riparian zone soils? Do the forms of carbon, and thus the activity of carbon relative to flux, change in riparian zones as a result of land use change? Are deciduous or coniferous forests more likely to store more carbon in the soil? Does soil type significantly affect the amount of carbon stored in the soil? How long will it take for significant carbon to accumulate; and what is the best way to make these measures?

Outputs:

- Stolt, M.H., and M. Zavada. 2006. Developing stratigraphic markers for use in identifying effects of land use change in soils. Funded proposal ($100 K) through the USDA-NRI.
- Richardson, M., and M.H. Stolt. 2006. Balancing Watershed Level Soil Carbon Budgets Using Process-Level Measures. International Meeting of the Union of Soil Scientists, Philadelphia, PA..
- Donohue, S.W., M.H. Stolt, A..J. Gold, and P.M. Groffman. 2006. Effects of Anthropogenic Disturbance on Riparian Hydric Soils in Urbanizing Coastal Landscapes. International Union of Soil Scientists, Philadelphia, PA.
- Richardson, M., and M.H. Stolt. 2005. Carbon Sequestration and Flux in Southern New England Forests. Oral presentation, 2005 Technical Conference of the Society of Soil Scientists of Southern New England, Storrs, CT.
- Richardson, M., and M.H. Stolt. 2005. Soil carbon sequestration and flux in southern New England forests. Annual Meetings of the Soil Science Society of America, Salt Lake City, UT.

Outcomes/Impact:

- Two M.S. graduate students and 4 undergraduates (including two Coastal Fellows) learned field and laboratory techniques to sample and test soils, monitor carbon flux, and

conduct hypothesis-based research on upland and riparian soils relative to carbon distribution, sequestration, and flux.
- Learned more about anthropogenic effects on carbon storage and flux in forested upland and riparian soils.

Scope of impact: Our continuing work resulted in the development of two new approaches (paired site and stratigraphic marker) to estimate carbon sequestration for further scientific testing.

Source of funds:

☐Smith-Lever
X Hatch
☐State
☐Other (please list).

Knowledge Area: KA 112. Watershed Protection and Management.

Situations:

Situation 1- The New England Region Water Quality Program was funded to create a unified New England Water Quality Program to improve and protect water quality through the use of science-based knowledge. Our New England Program builds upon the strengths and partnerships of the six New England Land Grant University Water Quality Programs. We apply our programmatic strengths to priority areas within EPA Region One to advance water quality goals within high-value watersheds and aquifers.

The goal of the New England Program is to improve water quality management through educational knowledge and extension programming that emerges from a research base. Extension programs have a unique role in the Region that compliments our partners' efforts. We use state-of- the-art approaches to tailor our programs to the unique attributes of a given watershed and the concerns of communities and producers. To address the water quality challenges of rural New England, we create and implement locally relevant programs focused on land and community management. We work at both the local and region scale. We develop, test and refine programs with case studies at the local level that leverage other sources of support. At the regional scale, in cooperation with stakeholders and partner agencies, we identify needs and build upon successful local programs to create and disseminate new materials, tools and curricula for use throughout New England. Our long term goal is to strengthen the Land Grant Universities' capacity to deliver an integrated water quality program built upon the USDA-CSREES National Integrated Water Quality Program (NIWQP) goals that educate, empower, and engage agricultural producers, residents and communities throughout New England to become effective stewards of their local water resources. This project allows us to strengthen our regional approach and effectiveness to deliver research-based education throughout New England.

Objectives in FY 06 included:

1. Facilitate incorporation of the best available science in regionally developed water quality education and outreach programs that improve the quality of New England's surface and ground water resources in agricultural and rural watersheds.

2. Encourage the adoption of behaviors and activities that result in water quality improvement and protection through thematic programming in: Drinking Water and Human Health; Watershed Management; Pollution Assessment and Prevention; and Nutrient and Pesticide Management.
3. Conduct water quality needs assessments for the Region and Focus Areas and report on partnerships and progress in water quality improvement.
4. Work with partners to promote voluntary approaches to water quality management at the local level.
5. Serve as a repository for all reports from water quality projects funded by the CSREES NIWQP and other projects deemed appropriate by the Regional Management Team.
6. Continue to develop and maintain both the NIWQP and the New England Water Quality Program websites.
7. Maintain linkages of the New England website to other aspects of the national website.
8. Participate in national activities that strengthen the capacity of the NIWQP.

Outputs:

Regional Coordination

- In 2005-2006, the New England Regional Water Quality Program teamed with the Massachusetts Water Resources Research Center to co-sponsor the New England Regional Water Resources Conference.
- The New England Regional Water Program, through the Volunteer Water Quality Monitoring Focus Area Team co-sponsored and co-developed of the 2006 New England Lakes Conference held June 2 – 3, 2006 at the University of Maine. Other conference co-sponsors included the New England Chapter of the North American Management Society; the Maine Volunteer Lake Monitoring Program, and the Maine Congress of Lake Associations.
- The New England Regional Water Program, through our Sustainable Landscapes Focus Area Team co-sponsored the 2006 Northeast Regional Master Gardner Conference held June 6 – 8, 2006 in Newport, RI. The New England Regional Water Program hosted workshops and displays on sustainable landscaping and water quality protection and working with volunteers to maximize program effectiveness were offered.
- The New England Regional Water Program co-sponsored northern New England conference "Reducing and Preventing Beach Closures on Lakes and Rivers in Northern New England", on May 5, 2006 in Fairlee, Vermont.
- The New England Regional Water Program co-sponsored the 2006 Land and Water Conservation Summit at the University of Rhode Island on March 11, 2006.
- Train future water quality professionals by providing training opportunities to enhance graduate and undergraduate experiential and classroom education through dedicated internships, graduate assistantships, and enhancement of undergraduate and graduate courses.
- The New England region has committed to improving our ability to develop, deliver and assess educational programs as individual states and as a coordinated group. With that end in mind, we have invested in partnerships and training designed to improve those skills individually and as a group. A few highlights include:

    - In November 2005 helped set and evaluate objectives for a regional private well symposium. Educational objectives were exceeded. See report included in New England Private Well Initiative.

- Participated in an evaluation study on NH NEMO conducted by an outside researcher. Presented findings at the CSREES National Water Quality

The New England Regional Water Program website is updated and maintained to reflect the strengths and accomplishments of the New England Regional Water Program and to highlight upcoming regional events. The New England Regional Water Program website continues to be updated and expanded. The website represents the overall New England Program as well as the New England Focus Areas. This site serves to represent our thematic-based programs to Federal, State and local agencies and organizations and assists with strengthening the New England Program with partnering agencies. In addition, the website articulates the capacity of the New England Regional Water Program to address our focus areas and allows the focus area teams to serve as a resource to Extension programs within the region and the nation. Use statistics are collected daily on the New England Regional website. Since the website went on-line in September 2001, there have been over 355,000 requests, with a daily average of 211 requests. Our busiest month to date was March 2006 with over 17,000 requests.

National, Multistate coordination and program delivery:
The University of Rhode Island through its role with the New England Regional Water Quality Program continued its leadership in the maintenance, updating and growth of the Website for the NIWQP. The major new effort concerned the development of Nutrient and Pesticide Management Theme pages. While these pages are still in development, a detailed outline citing over 150 programs and their accomplishments from across the nation was created through:

- Scouring all websites of the National Water Program Network, reviewing hundreds of CRIS records, and independent web searches.
- Developing a logical framework to capture the breadth and depth of NIWQP research, extension and education activities throughout the nation.
- Hosting conference calls with a team of national experts to polish the framework and identify quality programs from around the nation.
- Review and comment on the evolving structure and examples by the national experts.

Other efforts include:

- Modifications to the format of logos per the request of the CSL or network web developers.
- Marketed website to search engines.
- Continued routine maintenance of hardware that hosts the website, as well as maintenance of the website itself, including updates to the website's search engine.
- Hosting a workshop for Regional and National Facilitation Project web developers at the 2006 CSREES National Water Conference in San Antonio, TX.
- Maintained current events calendar.
- Posted CSREES Road Map for Water
- Posted info on Agricultural Water Security under Water Conservation and Agricultural Water Management National Theme
- Researching search engine for National website to search all regional websites
- Issued new set of logos, eliminating "Quality" from the name. Generated a new Black and White logo for download.

Outcomes: New England Regional Water Quality Program

- Coordinated and facilitated collaboration among partnering agencies to strengthen the New England Regional Water Quality Program in priority rural and agricultural watershed areas.
- Increased opportunities for state agency representatives, consulting professionals, and others to participate in Land Grant universities' programs.
- Maintenance and strengthening of coordination and communication with Federal and state agencies in delivery of research-based education and development of a watershed-based approach to state water resource management.
- Enhanced coordination among Extension and research faculty and staff with Extension water quality programs throughout New England and the Nation.

Source of funds:

☒Smith-Lever
☒Hatch, Multistate
☒State
☒Other (please list)

- 406 CSREES National Integrated Water Quality Program

Scope of impact: We continue to be the host of the New England Water Quality Program and look forward to having a local, state, regional and national scope of impact.

Situations:

Situation 2- The export of nitrogen (N) from coastal watersheds can exert profound effects on the function and value of coastal estuaries. Harmful algal blooms, hypoxia and destruction of critical spawning habitat are among the many problems linked to elevated watershed N contributions to coastal waters. One of the major advances in watershed science over the last 25 years has been the realization that certain areas of the landscape have a capacity to function as "sinks" for N. Riparian zones have a high potential to function as sinks because of their position at the interface between terrestrial and aquatic components of the landscape and because they can possess organically enriched, anaerobic soils that support groundwater denitrification (the microbial process converting nitrate to N gases). Recently, a number of studies have suggested that in-stream processing – removal that occurs while nitrate is being transmitted through river networks to coastal waters -- may be an important sink for watershed N.

Our research aims to understand the factors that control the variability of watershed N sinks. Of particular interest to us is whether geomorphology, hydrology, or watershed setting impacts the ability of riparian areas to serve as N sinks. Our assessment of groundwater denitrification capacity is conducted using the push-pull methodology coupled with the use of 15N and conservative tracers. Essential elements of our studies are also the assessment of hydrology (water table depth and flowpaths) and soils. We have conducted studies in riparian zones of different geomorphology (glacial fluvial and alluvial), during different seasons, within different watershed settings (pristine, agricultural, and urban), and adjacent to both streams and estuaries. Also, we have begun to assess if the reach-scale isotope method has the resolution necessary to evaluate in-stream denitrification rates in the settings and conditions found within lower-order streams in Rhode Island.

Outputs:

- Funding granted from RI Agricultural Experiment Station (McIntire Stennis) to select sites and begin hypothesis-based research on in-stream N removal.
- Art Gold co-chaired a symposium on *Advances in Challenges in Reducing Nitrogen Export from Rural Watersheds* at the 2006 CSREES National Water Conference. This symposium highlighted recent advances in understanding and managing nitrogen losses from rural and agricultural lands and offered suggestions to meet the research and extension challenges to reduce the risk of watershed nitrogen export.

Publications

- Donohue, S.W., M.H. Stolt, A.J. Gold, and P.M. Groffman. 2006. Effects of anthropogenic disturbance on riparian hydric soils in urbanizing coastal landscapes. 18th World Congress of Soil Abstracts. Philadelphia, PA.
- Watson, T.K. 2006. Groundwater nitrate removal capacity of riparian zones in urbanizing watersheds. M.S. thesis. University of Rhode Island, Kingston, RI.
- Addy, K., A.J. Gold, M.H. Stolt, and P.M. Groffman. 2006. Groundwater Nitrate Removal Capacity of Filled Salt Marshes, Eos Trans. AGU. 87(36), Jt. Assem. Suppl., Abstract B23A-05.
- Watson, T.K., A. Gold, K. Addy, M. Stolt, P. Groffman, and Q. Kellogg. 2006. Groundwater Nitrate Removal Capacity of Riparian Zones in Urbanizing Watersheds, Eos Trans. AGU. 87(36), Jt. Assem. Suppl., Abstract B23A-04.
- Watson, T.K., A. Gold, K. Addy, M. Stolt, P.M. Groffman, and D.Q. Kellogg. 2005. Groundwater nitrate removal capacity of riparian zones in urbanizing watersheds. Proceedings of the SSSA Annual Meeting. Salt Lake City, UT.
- Groffman, P.M., A. Gold, D. Kellogg, S. Kaushal, N. Gurwick, P.M. Mayer, M.H. Stolt, and L.E. Band. 2005. Riparian denitrification in forested and urban/suburban watersheds. Proceedings of the SSSA Annual Meeting. Salt Lake City, UT.
- Addy, K., A. Gold, B. Nowicki, J. McKenna, M. Stolt, and P. Groffman. 2005. Denitrification capacity in a subterranean estuary below a Rhode Island (USA) fringing salt marsh. Estuaries. 28(6):896-908.
- Kellogg, D.Q.N. 2005. The influence of geomorphic setting on ground water denitrification in forested riparian wetlands. Ph.D. thesis. University of Rhode Island, Kingston, RI.

Outcomes/Impact:

- Students (3 undergraduates, including 1 Coastal Fellow; two M.S. graduate students; and one Ph.D. graduate student) learned laboratory and field techniques to sample and test stream and ground water, assess stream and ground water hydrology, and conduct hypothesis-based research on groundwater and in-stream nitrate dynamics in various riparian and stream settings.
- Learned more about the factors controlling groundwater nitrate dynamics in riparian zones.
- Determined where further N research was essential, adapted current hypothesis-based research, and submitted research proposals that will advance knowledge on the N problem.
- Helped in the targeting of riparian restoration efforts.
- Incorporated results into TMDL assessment.

- Helped riparian management decisions.
- Helped determine where source reduction of N was essential.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
☒ Other (please list)

- Gold, A., R. Jeffrey, P. August, A. McCann. 2004-2008. The New England Regional Water Quality Program. CSREES/NIWQP $613,000
- Gold, A. and B. Nowicki. 2005-2007. Evaluating In-Stream Denitrification: Pilot Studies and Site Characterization. CSREES/NRICGP $95,000.

Scope of impact: Via our close relationship with URI NEMO (Non-point Education for Municipal Officials), town/city planners and other local land use-decision makers throughout Rhode Island were able to incorporate our research findings into their riparian management and restoration efforts. In addition, RI DEM Sustainable Watersheds Office solicited our research group for guidance on how to prioritize riparian zones in their multi-million dollar riparian restoration project in the Greenwich Bay Watershed. CRMC utilized our research information on coastal riparian buffers. The Greenwich Bay Initiative synthesized our research results as they wrote and adopted the Greenwich Bay Special Area Management Plan. National and international researchers interested in riparian zones and other nitrogen sinks viewed our publications and conference materials, in particular the Nitrogen Symposium co-chaired by Art Gold at the 2006 CSREES National Water Conference, which helped to refine the future direction of research on watershed nitrogen cycling and Extension efforts to implement riparian management and restoration efforts.

Situations:

Situation 3- URI Home*A*Syst is a voluntary residential pollution prevention program linked to the national Home*A*Syst/Farm*A*Syst network. Home*A*Syst provides customized workshops, publications, an extensive web site, and other educational resources and tools to individuals, community leaders, groups and organizations, and local, state and Federal agencies to promote informed decision-making and guide people to the necessary steps for reducing risks to the environment and human health. The program covers topics including drinking water protection, sustainable landscaping, animal waste management, household hazardous waste, and riparian buffer protection.

Working in cooperation with the Rhode Island Department of Health, URI Home*A*Syst provides information and training to private well owners on proper testing, treatment, and maintenance of their drinking water supply. In addition, private well owners are provided with the tools and knowledge to assess and reduce water quality contamination risks around their homes. Ten percent of Rhode Islanders get their drinking water from private wells. These owners are responsible for the quality of their drinking water and require assistance on proper actions to take to accomplish this protection.

In September 2002, URI Home*A*Syst received funding from USDA CSREES 406 National Water Quality Program for a three year project entitled *Protecting Water Quality in Rural Landscapes: A Comprehensive Community Nonpoint Source Education Program.* This project was funded

to generate and deliver an Extension education program aimed at pollution prevention best management practices (BMPs) that encompass the concerns posed by landowners and land users within a local Rhode Island community that exemplifies rural southern New England's mixed land use watersheds. Our program primarily targets landowners and residents on parcels of about 10 acres or less who usually "slip through the cracks" and are excluded from traditional agricultural and forestry programs addressing everything from water quality protection to enhanced viability. Furthermore, the issues and concerns that shape this group of landowners' and residents' behaviors and decisions are often significantly different from those of commercial farmers. In addition, we target educational programs and training to Green Industry Professionals and retail garden center employees. This project, which we have termed Healthy Landscapes, builds on the strengths and partnerships within the University of Rhode Island (URI) Cooperative Extension (CE) system, local, state, and federal agencies, as well as the coordination efforts within the New England Region Water Quality Program. Within the University of Rhode Island Cooperative Extension, we have combined the strengths and expertise of our Cooperative Extension Water Quality, Sustainable Landscapes, and Master Gardener Programs. This project has provided these programs with opportunities to strengthen existing and develop new programming, as well as foster an enhanced collaboration.

In September 2006, URI Home*A*Syst receive funding from USDA CSREES 406 National Water Quality Program for a three year project entitled *Livestock on Small Acreages: Protecting Water Resources and Health, A Train-the-trainer Extension Education Program.* URI Home*A*Syst will partner with the URI 4-H Program to generate and deliver an adoption-outreach Extension Education Program focused on pollution prevention best management practices (BMPs) for small acreage livestock owners and managers. This work will primarily target landowners and residents, including 4-H animal science club leaders, members and their parents, living on parcels of approximately 10 acres or less. These individuals usually "slip through the cracks", are often ineligible for traditional agricultural assistance programs, and the issues and concerns that shape this group of landowners' and residents' behaviors and decisions are often significantly different from those of commercial farmers.

Outputs:

Private Drinking Water Well Protection – Rhode Island:

- Nine educational workshops were held throughout Rhode Island for private well owners. One of these programs was held in cooperation with the RI Realtor's Association and was continuing education for these professionals. These workshops are offered in cooperation with the Rhode Island Department of Health and local organizations. Over 260 people attended the program.
- Completed production of a video for educational television on private well protection. Distribution of program and airing will begin in January 2007.
- Received funding from USDA Healthy Homes Program (2006) to develop web site materials to support existing private well protection programs for Connecticut and Rhode Island private well owners. We will develop a supporting website that will build off a recently produced US Environmental Protection Agency and New England Regional Water Quality Program funded private well protection poster and its associated materials. These graphics will be the focus of the website materials. We will develop two types of materials: one that is suitable for high speed internet users and will include animation, video and the ability to be interactive; and, a second that will be appropriate and

accessible for low speed internet users that will include graphic materials without the animation and video. This is a joint project with the Universities of Rhode Island and Connecticut and will be in support of the New England Private Well Initiative.

- Completed the development of two new factsheets:
  Selecting a Private Well Contractor
  Private Well Yield
  These factsheets have been reviewed by RI HEALTH. Final versions have been placed on program template and made available at workshops and posted on the website at http://www.uri.edu/ce/wq/has/html/has_wellfacts.html.

- Mailed 8700 tri-fold brochures to residents of Glocester, Foster, and Scituate. In addition, the North Kingstown Water Department mailed 1,000 copies of tri-fold brochure to private well owners in North Kingstown.
- Completed design and printing of two (2) private well displays. Beginning in June 2006 the 2 displays have been traveling to libraries and town halls throughout the state for up to one-month intervals, including:
  - May 30 – June 5, 2006: Charlestown Public Library
  - July 3 – 31, 2006: North Kingston Public Library
  - August 1 – 31, 2006: Little Compton Public Library
  - August 15 – September 15, 2006: North Smithfield Public Library

Private Drinking Water Well Protection – New England
The URI Home*A*Syst Program in partnership with the New England Regional Water Program worked to sponsor a New England Private Well Symposium on November 14, 2005 in Portsmouth, NH. Ninety-five people attended the program representing a diverse audience of federal, state, and local agency and organization staff, university researchers, Extension faculty and staff, private non-profit organizations, and private sector professionals. The goal of the 2005 New England Private Well Symposium was to bring together professionals working in the field of private well protection and provide the opportunity to communicate current research, share programming and educational approaches and materials, and to interact with each other in an effort to reduce the risks associated with groundwater use to private well water users. The Program Planning Committee sought to integrate research, Extension, and education interests in a one-day forum to enhance the protection of private drinking water supplies throughout New England.

Outputs:
Sustainable Landscaping:
- Developed a slideshow and script for the URI Master Gardener Speakers Bureau. Trained 11 Master Gardeners to give this presentation. Two public presentations have been made in West Greenwich and Jamestown, and another is planned in Scituate in September 2006.
- Presented on Healthy Landscapes at the annual URI Master Gardener Training Program and for the Town of Scituate Conservation Commission and Northern Rhode Island Conservation District. Attended 13 events with display.
- Continue to monitor and maintain the North Kingstown Town Hall demonstration rain garden through May 2007. Installed a ground-mounted sign, October 2005.
- Developed and distributed a rain garden brochure.
- An article on the rain garden and program were featured in the March 2006 issue of *South County Living Magazine*.
- 5 articles were written for the North Kingstown newsletter, *The Puddle*.

- Conducted exit interviews with 3 demonstration sites (5 owners).
- Developed and distributed a final report, *Cultivating Change: Engaging Community Participation in Water Quality Protection. Accomplishments and Impacts of an Extension Education Program.*
- Healthy Landscapes Program materials and message are continuously incorporated into several programs and events sponsored by the URI CE Education Center and Master Gardener Programs, including the "Gardening with the Masters Tour" and "Summer and Fall Gardening School Series" held at the URI Botanical Gardens.
- In January 2006, URI CE staff shared methods and resources with the Northern Rhode Island Conservation District and Town of Scitutate Conservation Commission to develop local demonstration sites and assist with outreach and evaluation that focus on stormwater management practices and other healthy landscapes practices.
- Attended events and coordinated regional programming as part of the New England Region Water Quality Program's Sustainable Landscaping Focus Area. Presented a regional training on the Healthy Landscapes Program and working with volunteers at the Northeast Region Master Gardener Conference in Newport, RI, June 2006.

Outputs:

Animal Waste Management:

In September 2006, URI Home*A*Syst received funding from USDA CSREES 406 National Water Quality Program for a three year project entitled *Livestock on Small Acreages: Protecting Water Resources and Health, A Train-the-trainer Extension Education Program.*

Outcomes/Impact:

- *Organizational*: Development of multi-functional teaching tools and methodologies; strengthened relationships with environmental, governmental and industry organizations; improved educational curriculum materials; enhanced research relationships; increased use of web-based, television and print media; and increased use of assessment tools to evaluate program successes and progress.
- *Educational:* Change in attitudes, increased knowledge and understanding of private drinking water sources and their protection, and adoption by targeted audiences of short, mid and long-term behavioral changes that result in reduced risks to private wells. Individuals participating in programs gain an understanding of their responsibility for protecting private wells, the benefits associated with private well water protection, best management practices for private well water protection, and the voluntary actions they can take for protection and management of their private drinking water supply. Educational programs and efforts are focused on medium-term impacts whereby private well owners take actions to protect their private well through such actions as regular water testing, installing home water treatment if necessary, and adopting BMPs.
- *Environmental*: The anticipated long-term outcomes of these efforts are improved drinking water quality, increased protection of human health, and a decrease in nonpoint source pollution.
- Private Drinking Water Well Protection: We have conducted post workshop evaluations with 20% of workshop participants. One hundred thirty-three follow-up evaluations were either mailed; fifty were returned, resulting in a 37% response rate. Results indicate that participants are taking action to protect their private well as a result attending the workshop. These actions include:
    - 55% had their well water tested.

- 37% inspected their wellhead.
- 23% maintained their water treatment system.
- 15% had a water treatment system installed.
- 34% began inspecting their septic system, while 28% had already been doing so.
- 38% began pumping their septic system, while 21% had already been doing so.
- 18% stopped using fertilizers around their well, while 65% had already avoided doing so.
- 13% stopped using pesticides around the well, while 81% had already avoided doing so.
- 25% began taking their household hazardous waste to a collection facility, while 29% had already been doing so.
- 23% began using non-toxic alternatives to household hazardous waste, while 40% were already doing so.
- 13% began disposing of used motor oil in the oil igloo at the dump or transfer station, while 54% had already been doing so.
- 63% shared the information learned at the workshop with others.

- Sustainable Landscaping: Follow up program evaluations determined that more than 54% of respondents have adopted at least one "smart" landscaping practice and about 21% plan to incorporate a new practice into their landscaping. Of these individuals, 58% said their adoption of a practice is based on water quality protection.

Source of funds:

☒ Smith-Lever
☐ Hatch
☒ State
☒ Other (please list)

- Gold, A., R. Jeffrey, A. McCann, P. August. New England Regional Water Quality Program. (2004, 2005), USDA, CSREES $613,000.
- McCann, A., H. Burdett, D. Neugent. Well Water Protection Video Project: Protecting Rural Drinking Water Quality. (2005) USDA, CSREES Healthy Homes $4,000.00.
- McCann, A. Public Interactive Web Site for Private Water Well and Water Use Education. (2006) USDA, CSREES Healthy Homes $4,000.00.
- McCann, A., H. Burdett, M. Gold. Protecting Water Quality in Rural Landscapes: A Comprehensive Community Nonpoint Source Education Program. (2002 – 2006) Funding from USDA, CSREES. $278,000.00.
- Joubert, L., A. McCann, and A. Gold. (2005 - 2008) Source Water Assessment and Public Outreach: An Integrated Approach for Major Water Suppliers in Rhode Island. Funding from the RI Department of Health. $375,074.00.
- McCann, A., H. Burdett, M. Morreira, K. Petterson, F. Launer. Livestock on Small Acreages: Protecting Water Resources and Health, A Train-the-trainer Extension Education Program. (2006 – 2009). Funding from USDA, CSREES. $180,000.00

Scope of impact: The URI Home*A*Syst Program works at the local, regional, and national scales. We develop, test and refine programs with case studies at the local level that leverage other sources of support. At the regional and national scale, in cooperation with stakeholders and partner agencies, we identify needs and build upon successful local programs to create and disseminate new materials, tools and curricula for use throughout New England and the nation. One example of this is the dissemination of our private well protection fact sheet series. These fact sheets were distributed throughout New England via the New England Regional Water Quality Program and are being revised and modified for use in the other New England states.

Situations:

Situation 4- URI Watershed Watch Program: URI Watershed Watch is a nationally-recognized scientist-led volunteer water quality monitoring and education program that began in 1988. The goals of Watershed Watch have remained consistent and relevant over this time span. They are to promote active citizen participation in water quality protection, educate the public about water quality issues, and to obtain multi-year surface water quality information both to determine current conditions and to detect trends. URI Watershed Watch encourages community-level and personal stewardship of local watersheds and serves as the steppingstone for increased community involvement by the volunteers themselves. URI Watershed Watch works with over thirty local Rhode Island sponsors including the Narragansett Indian Tribe, as well as with the RI Department of Environmental Management (RIDEM) and the Narragansett Bay Estuary program, all of which financially and programmatically support the program. RIDEM considers URI Watershed Watch data on par with that collected and analyzed by professionals. URI Watershed Watch maintains its own analytical laboratory. In this past year the laboratory received State certification as an Analytical Laboratory by the Rhode Island Department of Health.

CSREES New England Regional Water Program Volunteer Water Quality Monitoring Focus Area: The Volunteer Water Quality Monitoring focus area, led by URI, provides leadership for the New England Regional Monitoring Collaborative (NERMC). Through this collaborative, the Volunteer Monitoring focus area coordinates the delivery of training and related services to volunteer watershed monitoring groups in New England. Operating as a regional focus group improves the ability to be proactive in developing sampling and action strategies, prevent redundancies of effort, increase the level of expertise of volunteers and improve program quality and effectiveness. In addition the group strives to increase the use of low cost and user-friendly watershed monitoring tools by making training and related services more accessible. Being primarily housed within universities allows the member monitoring programs to emphasize scientist-led watershed level water quality monitoring with trained volunteers. The volunteer monitoring programs within the Universities of Massachusetts, New Hampshire, Rhode Island, and Vermont are core members, as are staff from US EPA-NE region, River Network and New England Interstate Water Pollution Control Commission.

Volunteer Water Quality Monitoring: A National Facilitation Project.

In September 2000, Rhode Island and Wisconsin Extension received funding from USDA CSREES 406 National Integrate Water Quality Program for a four year project entitled National Facilitation of CRSEES Volunteer Monitoring Efforts. In September 2004 this project was one of three expanded and renewed for an additional four years, again with URI leading the project. The goals of this facilitation project are to build a comprehensive support system for Extension volunteer water quality monitoring efforts across the country and to enhance integration of volunteer monitoring into research, education, and extension activities. Original objectives included identifying and linking current Extension volunteer monitoring programs,

developing multi-media training materials, offering and conducting training programs, developing and establishing internet and web-based tools. Current objectives include enhancing networking, communication and assessment efforts, further involving the research community, enhancing stakeholder involvement by offering workshops at national and regional CSREES conferences, coordinating volunteer monitoring involvement at a national water quality conference, and strengthening CSREES regional water programs' capacity to incorporate volunteer monitoring to address their priorities.

Statewide Outputs:

URI Watershed Watch Program

- URI Watershed Watch has volunteer water quality monitors in all 14 major RI watersheds and in all aquatic ecosystems except wetlands.
- There are over 350 citizen scientists participating in this program, monitoring over 220 sites.
- All monitoring data and results are posted on-line at www.uri.edu/ce/wq/ww
- Significant local support for Watershed Watch is apparent through program sponsorship from more than 30 local organizations, including one-third of RI towns. This financial support stabilizes the program and provides funding for experiential learning by URI undergraduate and graduate students.
- URI Watershed Watch has sponsored multiple URI Coastal Fellows each year since the inception of the program. In this past year we sponsored 2 undergraduate Coastal Fellows.
- RI Department of Environmental Management is a strong supporter of the program, providing grant funding for overall program support on a five-year cycle.
- Coastal monitoring efforts expanded this year.
    - Greenwich Bay Tributary monitoring began in the summer of 2003. This allowed continuation of monitoring that would have ended due to lack of state agency funding. It provides data for implementation of the Greenwich Bay Special Area Management Plan, and RI Department of Environmental Management Total Maximum Daily Load studies. It was sponsored by the locally based Greenwich Bay Watershed Group.
    - The Narragansett Bay Estuary Program expanded funding for volunteer monitoring on 11 sites at marinas and in Greenwich Bay itself. This program is also sponsored by local marinas and the Greenwich Bay Watershed Group.
    - Monitoring in South County's Salt Ponds and Block Island's Great Salt Pond was expanded, with sponsorship assumed by the Salts Pond Coalition and the Block Island Committee for the Great Salt Pond as EPA grant support ended.
- The URIWW Analytical laboratory received State Certification as an Analytical Laboratory by the Rhode Island Department of Health. It is only the second laboratory at URI to successfully complete this rigorous certification process.
- URIWW is a member of the Rhode Island Environmental Monitoring Collaborative, charged with establishing a mechanism to coordinate and make consistent, monitoring efforts between government agencies, municipalities, nonprofit organizations and universities.

Regional Outputs:

CSREES New England Region Water Program Volunteer Water Quality Monitoring Focus Area:

- Workshops conducted under the joint New England Regional Monitoring Collaborative/ Volunteer Monitoring theme of the CSREES New England Regional Water Quality Program, provided targeted training to volunteer monitoring groups throughout New England.
- A presentation on Enhancing the Use and Availability of Volunteer Water Quality Monitoring Data in New England was made at the *Massachusetts Water Resources Research Conference*. CELS contribution #5052.
- *New England Chapter of North American Lake Management Society Annual Conference,* June 2006 in Farmington, Maine, was co-sponsored by the Volunteer Monitoring Focus area of the CSREES New England Regional Water Quality Program.
- *New England Regional Lakes Assessment Project*. Linda Green is the RI and also volunteer monitoring representative to this new and emerging multi-year project, sponsored by EPA-NE Analytical Laboratory (Chelmsford, MA) and involving all New England states. 10 RI sites were selected and monitored by EPA scientists during summer 2006.

National Outputs:

Volunteer Water Quality Monitoring: A National Facilitation Project

- The facilitation flagship website www.usawaterquality.org/volunteer showcases and strengthens the National Volunteer Monitoring Network, as well as maintains and expands links to the NIWQP National and regional websites. The project website connects the programs, expertise and products within the Extension Volunteer Monitoring Network and presents programs in a coherent, organized framework to stakeholders, decision makers and partners.
    - There are now a total of 45 Extension sponsored or affiliated volunteer monitoring programs listed and linked to on the website. These programs began as early as 1978 and as recently as 2004.
    - The website has direct links to individual program monitoring manuals, research related to volunteer monitoring, and project training materials and fact sheets.
    - An annotated bibliography of papers and studies comparing volunteer with professional monitoring, or research incorporating volunteer generated monitoring data is maintained on the website strengthening the research base of this project and also further validating the efforts of volunteer monitoring programs.
- The facilitation project listserv (CSREESvolmon-list@uwex.edu) has grown to several hundred members, rivaling EPA's volunteer monitoring listserv in size.
    - A new section on the website archives exchanges from both list-serves. There are more than 50 topics with archived exchanges.
- Presentations and workshops sponsored by the national facilitation project were held in Michigan, Kentucky and Wisconsin, at venues ranging from multi-county to regional conferences.
- A workshop was held at the 2006 USDA-CSREES National Water Quality Conference in San Antonio, TX in conjunction with the NEMO National Facilitation Project. The focus

was the incorporation of volunteer data into geospatial technologies and web and print formats that facilitate public decision making. (CELS contribution #5053.)

- National Facilitation Project PI Linda Green represented all National Facilitation projects at the Committee for Shared Leadership meeting at the CSREES-USDA National Water Conference.
- The Volunteer Monitoring National Facilitation Project co-sponsored (with EPA & USGS) and co-hosted the 2006 National Water Quality Monitoring Conference, *Monitoring Networks: Connecting for Clean Water*, May 2006 in San Jose' CA.
    - Linda Green was a co-chair of the conference, Elizabeth Herron co-chaired the volunteer monitoring component.
    - Organized a successful campaign to award *The Volunteer Monitor* editor Eleanor Ely with the prestigious Elizabeth J. Fellows Award.
    - Led the effort to develop and present a comprehensive series of workshops and sessions based on input from the volunteer monitoring community nationwide.
    - All project staff held workshops and organized multiple presentation sessions.
    - Provided travel support for select volunteer monitoring attendees and programmatic support for all volunteer monitoring attendees
    - Successfully solicited support from CSREES regions to support travel for their own representatives as well as from conference exhibitors for other volunteer monitoring coordinators.
    - Among the 900 attendees over 100 were volunteer monitoring coordinators, a significant percentage.
    - Organized an after-hours volunteer monitoring coordinator meeting.
    - Conducted a needs assessment for volunteer monitoring coordinators.

Additional National Outputs:

- Linda Green and Elizabeth Herron are both longtime editorial board members of *The Volunteer Monitor* newsletter, a topically oriented twice yearly 24 page newsletter, with an average print run of 19,000.
- Linda Green was a member of the planning committee for the April 2006 National Lakes Assessment conference, Chicago, IL.
- Linda Green continues to represent the volunteer monitoring community as a founding member of the thirty-five member National Water Quality Monitoring Council (NWQMC). She has held this position since 1997. She is also co-chair of the Collaboration and Outreach Work Group.

Publications:

- Green, Linda T., Marie E. Esten, and Elizabeth Herron. 2005. Quality Assurance Project Plan, University of Rhode Island Watershed Watch – Ambient and Marine Field Monitoring Program: Block Island and Green Hill Pond Watersheds, Rhode Island. CELS Contribution #5036, University of Rhode Island, Kingston, Rhode Island.
- Herron, Elizabeth M, Linda T. Green, and Kris Stepenuck. 2006. Volunteer Management and Support. Factsheet Module VIII, Guide for Growing CSREES Volunteer Monitoring Programs. CELS contribution #5071, University of Rhode Island, Kingston, Rhode Island.
- Stepenuck, Kristine, Elizabeth M. Herron, and Linda T. Green. 2006 . Designing an On-line Database: Considerations in planning your program's database. Factsheet Module

IX, Guide for Growing CSREES Volunteer Monitoring Programs. CELS contribution #5072, University of Rhode Island, Kingston, Rhode Island.

- Elizabeth M. Herron, Linda T. Green, and Stepenuck, Kristine. 2006 . Sharing Information Through Internet Exchanges. Factsheet Module VII, Guide for Growing CSREES Volunteer Monitoring Programs. CELS contribution #5077, University of Rhode Island, Kingston, Rhode Island.

Outcomes/Impact:

URI Watershed Watch Program

- URI Watershed Watch is the largest and most comprehensive scientist-led volunteer water quality-monitoring program in the State. These monitoring efforts were and are used to provide baseline data, detect trends, supplement existing monitoring, and track success of BMP and TMDL implementation efforts. Data produced from field monitoring and laboratory analyses are incorporated into the State's 305(b) report to EPA, and are also used to identify water bodies for the State's listing of impaired waters (303[d]) list. Few states in the country accept volunteer monitoring data as comparable to professionally collected data. Because of strict quality assurance procedures the URI Watershed Watch data is accepted and used as readily as professionally collected data in Rhode Island. In fact, the program provides the State with approximately 90% of its lake water quality data. The nineteen-plus year data records on a number of sites are the only such long-term freshwater compilation in Rhode Island, whether by professionals or volunteers. This long-term record has been utilized by graduate students, university researchers, environmental consultants, federal and state agencies for environmental research and policy development.
- The 350+ trained volunteers provided nearly 16,000 hours in volunteer water quality monitoring at more than 220 lake, stream, salt pond, estuary and Bay sites statewide. At the 2004 rate of $18.05/hr (www.independentsector.org/) this is equivalent to over $280,000 in value.
- URIWW volunteers have become educated as to the actual water quality conditions in the locations they monitor. They have learned about natural seasonal cycles and what is usual or unusual for their monitoring location.
- URIWW volunteers have learned about the causes of nonpoint source pollution and steps needed to reduce it. They have educated and involved their neighbors in monitoring.
- Select URIWW volunteers have used their monitoring activities as a springboard for further community involvement, such as joining conservation commissions, planning and zoning boards, and running for elected office.
- Watershed organizations which participate in URIWW have used their monitoring activities as a recruitment tool for own their organizations.
- Watershed organizations have used the results of their monitoring to advocate for preservation of water quality in some locations and for restoration of water quality in others.
- Watershed organizations have successfully obtained grant funding for their monitoring efforts and to develop database systems to allow them to more easily assess and present their data.

- With the completion and approval of our quality assurance project plans and receiving State Certification as an analytical laboratory, the quality of our data has been further validated, and remaining roadblocks to its use removed. This allows our laboratory to be engaged by RI DEM and EPA for analyzing water samples.

Regional

- The New England Regional Monitoring Collaborative (NERMC) improves the ability of NE volunteer monitoring program coordinators to be proactive in developing sampling and action strategies, prevent redundancies of effort, increase the level of expertise of volunteers and improve program quality and effectiveness. In addition NERMC strives to increase the use of low cost and user-friendly watershed monitoring tools by making training and related services more accessible.
- Each year our regional project co-sponsors the NE chapter of the North American Lake Management Society's annual conference.
- *New England Lake Assessment Project.* This Project has completed the first year shakedown season. A short-term outcome is the recognition that volunteer monitoring programs will be integral to the project and that EPA-NE recognizes that Extension volunteer monitoring programs are necessary partners in this project. A further expected outcome is the recognition that volunteer monitoring programs have the best capacity to provide long-term follow-up monitoring.

National:

National Facilitation of Volunteer Monitoring Efforts

- National facilitation project staff were invited to organize and conduct volunteer monitoring workshops or presentations in Kentucky at the Southern Region Biennial Conference, and in Grand Rapids, Michigan for the southwest Michigan area .
    - At these workshops watershed and other groups had a chance to network with each other and learn of each other's capacity.
    - These groups were educated as to the scope of the national facilitation project, and trained in the use of products.
    - Extension is recognized as a leader within the volunteer monitoring community.
- The project web site (www.usawaterquality.org/volunteer/) has provided a number of outcomes for this project.
    - It has provided heightened recognition of the Extension associated volunteer monitoring programs across the country.
    - It has become a resource for program coordinators to find information in factsheet modules, use its archived listserv responses to queries, and also to view and download archived Powerpoint presentations.
    - Its annotated bibliography of comparisons between volunteer and profession monitoring programs has helped support programs in challenges to the quality of their data and has provided linkages to research efforts.
    - It has provided information and direction for program coordinators considering setting up databases.
- Project co-sponsorship of the May 2006 National Water Quality Monitoring Conference, *Monitoring Networks: Connecting for Clean Water* has led to greatly enhanced recognition of the USDA-CSREES National Integrated Water Program, as well as appreciation for its support of this conference.

- This is the first (out of 5) conferences where volunteer monitoring programs shared the stage with federal and state agency programs. Professional and volunteer monitoring coordinators gained information and exposure to each other's programs and monitoring results, and forged new alliances.
- Nearly all of the CSREES regions, including New England, provided travel assistance for a volunteer monitoring coordinator to participate in this conference leading to significant education and networking experiences for participants.
- Extension gained recognition and appreciation for its ascendant role in supporting volunteer monitoring, in contrast to EPA's diminishing role.
- Invited by EPA's Watershed Academy to present "Getting Started in Volunteer Monitoring."
- Results of needs assessment set the course for further activities by this national facilitation project.

Source of funds:
☒Smith-Lever
☐Hatch
☒State
☒Other (please list)

- L. Green, E. Herron, URI Watershed Watch, 35 local sponsoring agencies and organizations, $30,000.
- L. Green, A. Gold, R. Shepard and E. Herron, Enhancing the Extension Volunteer Monitoring Network: Renewal Proposal for National Facilitation of CSREES Volunteer Monitoring Efforts, USDA-CSREES, $399,000.
- L. Green, E. Herron, A. Gold, RI Lake Water Quality Assessments: Five Years of Volunteer Monitoring RI DEM, 10/1/00 – 9/30/06, $219,932.
- L. Joubert et. al., BI & Green Hill Pond Watersheds, EPA National community Decentralized Wastewater Treatment Demonstration Project, EPA, 4/1/00 – 11/30/06, $100,438.
- L. Green, Donation to the Gloria Hurley Endowment of the URI Foundation by the Sharpe Family Foundation, 4/1/01 – 3/31/02, $2,000.
- L. Green, URI Watershed Watch Discretionary Funds - interest accrued from Gloria Hurley Endowment, Gloria Hurley Endowment, $5,200.
- A.J. Gold, R.. Jeffrey, A. McCann, P. August, The New England Regional Water Quality Program, USDA-CSREES, 9/15/05 – 9/14/08, $13,400.
- L. Green and E. Herron, Greenwich Bay Tributary Monitoring Program, New England Grassroots Environmental Fund via the Greenwich Bay Watershed Group, $2,000.
- L. Green and E. Herron, Salt Ponds Monitoring Program, Salt Ponds Coalition, $7,600.
- L. Green and E. Herron, Great Salt Pond (Block Island) Monitoring Program, committee for the Great Salt Pond and the Town of New Shoreham, $5,200.
- L. Green, R. Ribb, C. Deacutis, Greenwich Bay Volunteer Monitoring Program, Narragansett Bay National Estuary Program (US EPA) 9/15/04 – 9/14/06, $13,200.

Scope of impact: The URI Watershed Program works at the local, regional, and national scales with enhanced national efforts due to its National Facilitation Project. On a local and watershed level, we provide the means for local organizations to develop their capacity and to monitor their

waters of concern and focus their efforts on protecting or improving these waters. As state agency activities wind down, these organizations can provide long term follow up and extend continuity. Monitoring often provides a focus for watershed organizations. We educate the public on water quality issues and encourage individuals to adopt watershed-friendly behaviors and policies. We bring University science to the community, and the community to university science. Colleagues in the research community and local and state policy makers seek out and use the monitoring results. Regionally, EPA and the NE states recognize the value of volunteer monitoring data, both on its own and for the program's involving communities in recognizing and addressing water quality concerns. We provide national leadership in volunteer monitoring which has garnered increased and enhanced recognition of the roles of volunteer monitoring programs on their own, and in helping raise support for state and federal agency programs.

Knowledge Area: KA 123. Management and Sustainability of Forest Resources.

Situation:

Between 2001 and 2005, while working under RI00MS970 ("Vernal Pool Hydroperiod Prediction as a Basis for Habitat Assessment and Management of Forest Amphibians"), we developed two rapid-assessment methods for estimating annual hydroperiod, or duration of inundation, for seasonal ponds—also known as vernal pools—in the Pawcatuck River watershed of southern Rhode Island. Supported by an FY 2006 Hatch Strengthening Grant ("Refinement and Integration of Seasonal Pond Hydroperiod Estimation Models"), we refined those methods for use in a 2006 project funded by the Rhode Island Department of Environmental Management (RIDEM). The objective of the RIDEM project was to identify amphibian "hotspots," or geographic areas capable of supporting unusually high productivity and diversity of pond-breeding amphibians, as a basis for prioritizing land protection efforts at the watershed scale. Through this joint RIDEM/RIAES effort, we visited 102 seasonal ponds within the Queen's River watershed, a sub-basin of the Pawcatuck, and ranked them based on pond size, estimated hydroperiod, and upland forest cover within 300 m of the pond—all characteristics that were correlated with wood frog (*Rana sylvatica*) and spotted salamander (*Ambystoma maculatum*) egg-mass counts in RI00MS970. We identified six heavily forested areas with one or more clusters of high-ranking ponds as hotspots. Ranging in size from 196 ha to 606 ha, the hotspots encompassed 24 % of the land in the watershed, but accounted for 87% of the high-ranking ponds and 54% of the ponds of intermediate rank. Using GIS to overlay the hotspots, connecting forest corridors, and areas of the watershed that had already been protected via acquisition in fee or conservation easements clearly revealed the gaps—those valuable, but unprotected, areas that should be considered for future land conservation. We are confident that our approach can be applied successfully wherever correlates of pond-breeding amphibian reproductive effort are known and both site-specific field data and GIS land cover data are available.

Outputs:

- Three scientific journal manuscripts:
  Skidds, D.E., F.C. Golet, P.W.C. Paton, and J.C. Mitchell. Habitat correlates of reproductive effort in Wood Frogs and Spotted Salamanders in an urbanizing watershed. *Journal of Herpetology*. (In revision)

Mitchell, J.C., F.C. Golet, and D.E. Skidds. Using hydroperiod to guide pond-breeding amphibian habitat assessment and management. (To be submitted to *Wetlands* in summer 2007)

Mitchell, J.C., F.C. Golet, and D.E. Skidds. Using plants as indicators of seasonal pond hydroperiod class. (To be submitted to *Wetlands* in summer 2007)

- One popular article:

  Golet, F.C. 2006. Prioritizing protection of vernal pools in the Queen. Watershed: A Newsletter of the Wood-Pawcatuck Watershed Association 23:5-6.

- $50,000 from the Rhode Island Department of Environmental Management, funded under an EPA Non-regulatory Pilot Demonstration Grant, to prioritize protection of vernal pools in the Queen's River watershed of Rhode Island (F. Golet, J. Mitchell, P. Paton, D. Skidds; Jan. 2006-Jan. 2007).
- Hatch research proposal to assess the influence of municipal groundwater withdrawal on seasonal pond hydroperiod and amphibian habitat suitability (F. Golet, A. Veeger; FY 2008-2010). *Note:* Observations of apparent pumping-induced groundwater recharge in one seasonal pond studied in RI00MS970 prompted this proposal.

Outcomes/Impact:

- A recent URI B.S. graduate, partially supported by the Hatch Strengthening Grant, worked as a summer field assistant on the RIDEM project described above and received training in vernal pool habitat assessment in preparation for his Master's research, scheduled for 2007-2009.
- We used the knowledge gained from this research to inform resource managers, wetlands regulatory personnel, and other partners regarding the importance of seasonal ponds as amphibian habitat and key variables to incorporate into habitat assessments. Our findings should help to guide land use management, open space acquisition, and maintenance of regional biodiversity. Partners with whom we have shared this knowledge include: USEPA, Region 1; USEPA Atlantic Ecology Division Laboratory; RI Department of Environmental Management, Office of Water Resources; US Geological Survey, MA-RI Office; USDA Natural Resources Conservation Service; RI Natural Heritage Program; The Nature Conservancy, RI Chapter; Audubon Society of Rhode Island; Wood-Pawcatuck Watershed Association; and RI Association of Wetland Scientists.
- Through on-site discussions, we gave landowners at our study sites an appreciation for the important role that their individual properties play in maintaining pond-breeding amphibian populations and other types of forest wildlife throughout the watershed as a whole.
- We conveyed the results of our work annually to undergraduate and graduate students enrolled in URI courses on Wetland Ecology (NRS 423) and Wetland Wildlife (NRS 406).
- We used knowledge gained from our work to frame and initiate new research efforts that will further advance the science of vernal pool ecology and management. (Note $50,000 grant from RIDEM and recent Hatch proposal listed under "Outputs" above).

Scope of impact: To date, we have shared our new knowledge with state and federal agencies, nongovernmental conservation organizations, University students, private landowners, the Rhode

Island general public, and the scientific community in this country and abroad through the channels listed above. Given the broad interest in wetland and amphibian conservation, we are confident that our findings will significantly enhance understanding of seasonal pond ecology and the effectiveness of pond-breeding amphibian management throughout the eastern United States.

Source of funds:
☐ Smith-Lever
☒ McIntyre-Stennis
X Hatch
☒ State
☐ Other (please list)

Knowledge Area: KA 131. Alternative Uses of Land; KA 608. Community Resource Planning and Development

Non-Point Education for Rural Decision Makers
Situation:

Rhode Island municipal officials play a key role in managing water quality. Through planning, zoning and land development review, community leaders routinely make land use decisions that directly affect the quality of local streams and aquifers. Yet most board and commission members are volunteers. They have varied backgrounds, often without specialized training in land use and resource management issues. Our surveys show these citizens are very concerned with making fair and sound decisions. They care about maintaining the quality of life in their communities. But they are also focused on immediate priorities such as managing growth. Given this situation, municipal officials need practical information on minimizing pollution risks that is directly applicable to local resources and relevant to current land use issues.

To address these needs, RI Nonpoint Education for Municipal Officials (NEMO) provides outreach to municipal officials on controlling effects of changing land use on local water resources. Our goal is to provide local land use decision makers with the skills and resources needed to identify pollution problems, assess impacts to local water resources, and adopt effective pollution controls. As a member of the National NEMO Network, RI NEMO focuses on the use of GIS-based watershed assessment tools to provide local decision-makers with the knowledge and educational resources to identify local water quality problems and to adopt effective pollution controls within a watershed context.

Established in 1993, RI NEMO is the only consistent source of resource-based training for Rhode Island municipal officials. Three types of assistance is offered to meet local needs and interests: Educational workshops and presentations ranging from small group work sessions to statewide conferences; Application of GIS-based watershed assessment tools with community involvement; and Technical support in implementing local pollution controls including, for example, updating local ordinances or expanding community public education programs. NEMO focus areas include the following:

Drinking Water Source Protection
Under the community-based Source Water Assessment Program (SWAP), URI NEMO partners with the Rhode Island Department of Health (RI HEALTH) to build municipal capacity for drinking water source protection through training and application of GIS-based watershed

assessment tools. RI HEALTH has committed $375,000 to the URI NEMO Program for this outreach effort. Our goal is to promote adoption of source water protection measures identified in Source Water Assessments of public water supplies completed by RI NEMO and RI HEALTH. The GIS-based assessment method developed and applied in these assessments enabled communities to analyze risks to public health and environmental quality associated with various land use/land management strategies and to evaluate alternative control measures. Workshops for local council, boards and commissions, focus on these site-specific results and discussion of locally acceptable management options. We offer follow up assistance by request, including work sessions on specific topics and technical support in updating local ordinances to enhance source water protection.

Community Wastewater Management

An estimated 30% of Rhode Islanders rely on onsite wastewater treatment systems for wastewater treatment and small communities are entirely unsewered. The proportion of homes and businesses dependent on onsite systems is not likely to decline as sprawl-type growth patterns drive new construction beyond existing sewer service. No longer considered a temporary fix until sewers are installed, properly managed onsite wastewater treatment systems are now considered a permanent community wastewater treatment option, and often the most economical and environmentally sound choice. However, the need for regular system inspection, repair and upgrading has never been greater. Much new development is occurring in environmentally sensitive areas and on highly marginal soils. And up to 50% of existing systems are estimated to pre-date State minimum design standards and are likely to be either cesspools or substandard. To address this need, RI NEMO works with the NE OWTP to provide training, and educational materials to assist communities establish or expand a local wastewater management program. RI NEMO outreach is partially supported by EPA under the National Decentralized Wastewater Demonstration project.

Stormwater Management

In 2006 RI NEMO formed a partnership with the RI Department of Environmental Management and the RI Department of Transportation to assist RI municipalities and state agencies in meeting Phase II storm water permit requirements. Under this unique agreement, URI will develop educational materials and outreach methods for municipalities; train government staff in updated storm water management practices, and develop model ordinances for local storm water management. The URI Cooperative Extension Education Center, a partner in this project, will assist in developing a statewide media campaign to promote awareness of storm water impacts and local control actions. The RI Department of Transportation has awarded $671,500 to URI Cooperative Extension for this outreach program.

Tools for GIS-Based Watershed Assessment
RI NEMO applies geographic information systems (GIS) to assess pollution risks to local water resources and to promote natural-resource based land use decisions. For example, the MANAGE pollution risk assessment method (Method for Assessment, Nutrient loading And Geographic Evaluation) is applied by RI NEMO staff in cooperation with community participation and involvement. Other basic methods for site assessment and mapping are available on the RI NEMO website. Specialized assistance available by request based on URI staff resources and funding.

Outputs

- RI NEMO Program hosted the workshop "Dealing with Density – Drinking water, wastewater and stormwater solutions." This workshop gathered nearly 60 people from the three southern New England states, including representatives from at least 17 RI municipalities. November 1, 2005, Kingston RI
- RI NEMO working co-developed a regional workshop "Establishing a local wastewater management program – Starting it, running it and clearing the hurdles". This one-day workshop targeted local, county and state regulatory decision makers. It provided attendees with the tools needed to develop and sustain a wastewater management program, identify stumbling blocks that may arise, and how to effectively deal with them. This workshop drew 86 attendees – approximately a quarter of which were from MA, CT, NH, MD, and WI; the remaining participants were from Rhode Island. March 14, 2006, Narragansett RI
- RI NEMO organized a new two-session workshop for local officials: "Evaluating the Impacts of New Development on Groundwater", in conjunction with Fuss & O'Neill, Inc. Several municipal staff, planning board and conservation commission members from four municipalities participated. May 11 and 25, 2006, Kingston RI.
- Worked with the URI Geospatial Extension program to co-sponsor and organize a set of GIS workshops for municipal officials: "Introduction to GPS for Stormwater Managers" (June 2006) and "Pictures, Points, and Places" (July 2006).
- RI NEMO conducted 7 workshops for local officials in cooperation with the towns of North Kingstown, Hopkinton and Tiverton, the RI Rivers Council Watershed Stewards Program and the RI Rivers Council Land and Water Summit, the Blackstone River Coalition, and for non-profit community development corporations and state agency staff through the Local Initiatives Support Corporation (LISC). Topics centered on source water protection, with emphasis on stormwater and wastewater management tools in some areas. Workshops were tailored interests of participating communities using GIS mapping and pollution risk indicators generated through Source Water Assessment Plans.
- Developed poster displays on training and educational resources available through the Source Water Assessment Program for the RI Land and Water Summit (400 attendees) and the RI League of Cities and Towns annual meeting 1/26/06 (350 attendees).
- RINEMO conducted outreach to Cooperative Extension and state agency partners though participation in regional and national conferences. Staff delivered presentations, prepared poster displays, or co-authored papers and presentations at 7 regional and national conferences, including: the 4th National Conference Nonpoint Source and Stormwater Education Programs, Chicago, IL; the National NEMO Low-Impact In-

service Training program, New Hampshire,; the New Hampshire Drinking Water Source Protection Workshop, Concord NH; the National Onsite Wastewater Recycling Association Annual Conference; the Massachusetts Health Officers Association, Hyannis MA; and Pathogens in Drinking Water Sources – Groundwater Foundation Attleboro MA.

- In conjunction with the Onsite Wastewater Training Center, RINEMO coordinated with a private sector company that provides data management software to develop the Rhode Island Wastewater Information System (RIWIS). RINEMO worked with local partners to solicit local support for and participation in the program.
- RINEMO provided focused assistance to several communities in evaluating development impacts, identifying alternative lands use control practices, and updating local development standards:
  - **Tiverton**: Continued to work with the Conservation Commission and Wastewater Management Commissions in establishing a wastewater management ordinance by providing training and educational materials, reviewing ordinance revisions, participating in public workshops and hearings, and assisting town staff to implement a wastewater management program, to include initial outreach to residents, maintenance providers and use of the RIWIS software.
  - **Charlestown and the Salt Ponds Coalition**: Responded to requests for information on potential impacts of land use and best management practices to minimize impacts of new development. Worked with the members of the Salt Ponds Coalition to apply GIS-based assessment tools to evaluate pollution risks of alternative land use options.
  - **Cumberland**: Continued to work with Cumberland staff and boards in drafting a Water Resource Protection and participated in the first Planning Board hearing on the proposed Water Resources Overlay District to address need for the ordinance and technical questions.
  - **Hopkinton**: Participated in several meetings of the Conservation Commission and Planning Board to discuss groundwater protection and wastewater management issues related to with compact residential development and industrial development. Cooperated with Atlantic States Rural Water Association meeting in development of a groundwater protection plan.
  - In partnership with the New England Onsite Wastewater Training, continued to provide training and technical support in developing local wastewater management program for the Rhode Island towns of **South Kingstown, Charlestown and New Shoreham** under the Block Island/Green Hill Pond Watershed National Wastewater Treatment Demonstration Project, and provided regional and national outreach on project accomplishments.
  - Worked with the **Foster** planning board to begin exploring options for strengthening land development performance standards to better protect groundwater supplies, particularly from new development on marginal high water table sites.
- Conducted an extensive review of national stormwater outreach efforts "RI NEMO Review of National Stormwater/NPS Outreach Efforts." Findings of this review were used to support development of a Request for Proposal for consulting services to assist in a statewide media campaign on stormwater impacts and control measures.
- RINEMO developed a Guide to Updating Source Water Assessment/Protection Plans, with summary factsheet and excel spreadsheets for reporting results. This guide was developed in coordination with RI HEALTH, RI Water Resources Board, RI DEM, and

RI Statewide Planning. RINEMO presented an overview of the draft method at water suppliers, finalized the method based on input from agency staff and water suppliers, and provided technical assistance to community water suppliers in applying the method.

- RINEMO Continued to coordinate with state partners, working with DEM on development of GIS mapping tools for municipalities, and coordinating outreach to municipalities through various groups, including the RI Land Use Training Collaborative, a diverse group of non-profit organizations, state planning and regulatory agencies.
- In this reporting period RI NEMO spearheaded a major reorganization and enhancement of the Water quality program website shared by NEMO, HomeASyst, Watershed Watch, the Onsite Wastewater Training Center, and the Water Resources lab. Lisa Philo of the RI NEMO program assumed responsibility for managing all elements of the project, including coordinating with Water Quality Group partners, developing a scope of services for web design professionals, soliciting bids, selecting a consultant, overseeing management of the project, and working closely with the consultant on reorganization of the site. The revised site will include resource centers on topics that involve two or more programs, such as a drinking water resource page and onsite wastewater management center.

Impacts

- Rhode Island NEMO accomplishments were highlighted and gained broad national distribution through the National NEMO Network 2005 Progress Report "Charting a Course for Better Land Use". RI NEMO activities were singled out in three chapters focusing on local land use ordinances, installation of stormwater and wastewater management practices, and publications distributed nationally.
- URI Cooperative Extension outreach resulting in five feature articles published in two national magazines: Onsite Water Treatment*,* a bi-monthly journal on decentralized wastewater treatment solutions with a circulation of 23,000; and Small Flows Quarterly, a publication of the National Small Flows Clearinghouse on community wastewater issues reaching 42,800 water treatment professionals, government officials and community leaders. These articles highlighted the role of decentralized wastewater management as a tool for better municipal land use, showcased accomplishments of the Block Island and Green Hill Pond Wastewater Demonstration Project, and two focused exclusively on the New England OWT program.
- URI training and educational support provided **Tiverton** town staff and board/ commission members with the capacity to spearhead adoption of an ordinance that will result in enhanced protection of the Stafford Pond drinking water supply. Board members were able to effectively respond to town council questions and concerns about the need for improved wastewater management and to describe options for implementing the mandatory inspection and repair program.
- **Tiverton** adopted a Wastewater Management Ordinance in July 2006 as a mandatory program, to be phased in town-wide beginning in the Stafford Pond watershed. The ordinance will result in public education, regular septic system inspections, maintenance, and repair; town registration of maintenance providers; oversight by town staff to include tracking results, reminders and enforcement action. This ordinance will also enable the town to enforce removal of cesspools within the Stafford Pond watershed, enhancing protection of this water supply.

- **The Salt Ponds Coalition** used NEMO results, with URI Watershed Watch data and other sources to prepare and submit written testimony to the RI Coastal Resources Management Council in March, 2006 on a proposed high density development project, and also presented testimony in Charlestown and Westerly public meetings on impacts of alternative development scenarios and need for groundwater protection measures.
- **Charlestown** adopted a change to the Zoning ordinance to restrict maximum building height, from 35 feet to 30 feet, on lots less than 1 acre, in an effort to reduce number of bedrooms and thus wastewater flow to coastal ponds.
- **Cumberland's** Planning Board made a decision to move forward with a Water Resource Protection Overlay District. Adoption has been slowed by high turnover among planning staff and elected officials.
- **Hopkinton** drafted Conservation Development amendments to their Zoning ordinance, using information obtained at URI groundwater protection workshops, and also agreed to work with the Atlantic States Rural Water Association to assist in development of a wellhead protection program with assistance from RI NEMO. In several cases, Conservation Commission incorporated NEMO information on nonpoint pollution control practices in recommendations to the Planning Board on pending development projects.
- Following participation in RI NEMO groundwater protection workshops, the town of **Coventry** adopted a Well Protection Ordinance (September, 2006) requiring well certification and testing for all new wells before issuance of building permits, patterned after a West Greenwich ordinance highlighted at the workshop. Coventry is the second town in the state to adopt such an ordinance.
- As a result of a unique public-private sector effort, the **RI Wastewater Information System (RIWIS)**, an onsite wastewater treatment system inventory and tracking program is now offered to Rhode Island communities free of charge.
- The towns of **New Shoreham, Jamestown, and Charlestown** are now using the RIWIS software. The towns of **North Kingstown, Tiverton** and **Portsmouth** are planning to adopt the system, and others have expressed interest for the future. For Charlestown alone, this represents a cost saving of $6,600 per year in software maintenance costs. For the Town of North Kingstown, the cost savings is more than $10,000 for database set up alone, and at least another $10,000 in annual maintenance costs. The reduced cost and increased efficiency in using this web-based system overcomes a major barrier in adoption of local wastewater management programs.
- The **Source Water Assessment update method** developed by RI NEMO will be used by all major water suppliers in Rhode Island to update Water Supply Management Plans every five years. This establishes a consistent method for identifying and evaluating pollution risks to drinking water sources using the original (2003) source water assessment. This will allow water suppliers, planners and regulators to track source water risk factors over time for enhanced source water protection. This standardized method promises to minimize time and effort in updating water supply management plan, thereby freeing staff resources to focus on progress in implementing management practices. In addition, water suppliers that have initiated updates are choosing to use the GIS-based method, increasing use of GIS for source water management.
- Attendees at the Dealing with Density-Drinking Water, Wastewater, and Stormwater Solutions, which included representatives from at least 17 Rhode Island municipalities, reported that the workshop was relevant and practical for their town work and that they

planned to share the information with others (4.48 out of 5). In a follow-up survey conducted three months after the workshop, Forty-one percent of respondents had used the information to answer technical questions. Seventy-one percent of respondents also had shared the information with others.

- A resident of Martha's Vineyard, MA created a video about Block Island's experience in implementing a wastewater management program and also attended URI's "Local Wastewater Management" workshop. Following the URI workshop, attendees from Martha's Vineyard shared this video with local officials and associations, in an effort to share what they learned at the workshop. Since the workshop, they have formed an "Island Plan," working towards island-wide water management.
- Following participation in NEMO workshops on groundwater protection, the **Foster** planning board began working with NEMO to consider updating development standards to address groundwater protection issues.
- The town of **South Kingstown** drafted zoning standards for town council approval that strengthen protection of wetland buffers to maintain water quality function of riparian areas and minimize risk of impact from disturbance and onsite wastewater treatment systems. The proposed ordinance also enhances protection of drinking water wells by requiring use of advanced wastewater treatment systems providing both nitrogen and pathogen reduction for lots where the distance between the drainfield and private well is less than 100 feet.

Source of funds:
☒Smith-Lever
☐Hatch
☒State
☒Other (please list)

- L. Joubert, M. Gold, A. Gold, and L.D. Philo. Storm Water Phase II Public Outreach, Education, Involvement and Participation Project. RI Department of Transportation, 2005-2009, $671,500.
- L. Joubert, A. McCann, and A.. Gold., Source Water Assessment Program, Municipal Capacity Training and Public Outreach. RI Dept of Health, 2005-2008, $375,000.
- L. Joubert, G. Loomis, and A.. Gold., Decentralized Wastewater Demonstration Project. US EPA., 2001-2006, $1,150,000.
- 406 project $4,500

Scope of impact: Due to the participation of almost 30 states in the National NEMO Network, URI NEMO has been able to share its research-based materials and programs with a wide audience. Our presentations at national conferences have garnered attention by other outreach programs as far reaching as Hawaii and as close as neighboring Connecticut. Specifically, URI NEMO's community-based techniques for assessment and management of pollution risks have proven transferable to the local resource protection issues faced by other states across the country.

URI NEMO's participation in regional programs has allowed us to engage municipal officials throughout the northeast, who often face problems very similar to those of Rhode Island communities: issues centering upon managing the impacts of rapid growth and the protection of

local water supplies. Municipal officials in two Connecticut towns are continuing to adopt new approaches to wastewater treatment due to our involvement.

Our involvement with communities across Rhode Island unites town officials, local organizations, as well as state agencies, in the effort not only to better understand the linkages between land use decisions and water quality impacts but also to incorporate that research into improved decision-making processes. A highlight of our local work involves the reduction of an estimated 200 pounds of nitrogen per year from a local watershed due to an updated wastewater management program, offering not only a new way for officials to deal with this critical issue but also providing a direct effect to watershed residents.

Geospatial Technologies for Natural Resource Management
(Rhode Island RREA Program)

Situation:

Rhode Island is a unique state in that it is the smallest in the nation and yet is the second most densely populated. Its natural features are diverse, including 600 miles of coastline, over 16,000 acres of wetlands, 91,000 acres of bays and estuaries, and over 43,000 acres of publicly-owned forests. To date, approximately 100,000 acres of the State's 671,000 acres are protected as open space. Rhode Island voters continue to support the highest per capita spending on open space in the nation. Awareness of the State's uniqueness continues to grow at both the state and local levels. A wide range of organizations need technical information and training to assist them with the protection, management, and preservation of open space. Policy makers and professionals alike need information on which to base land use decisions, including options for sustaining forest ecosystems and identifying of sensitive areas.

The URI RREA Program seeks to continue providing technical information and training opportunities through which the best available natural resource data are made accessible to environmental professionals in municipal, state, and private organizations. As the educational outreach arm of the University of Rhode Island, Cooperative Extension provides the link between University-based research, the Rhode Island Geographic Information System consortium (RIGIS), and community decision-makers. The URI Cooperative Extension RREA and Geospatial Extension Programs work to train land use managers in the value and use of geospatial technologies for natural resource management, and to provide guidance for the appropriate integration of these technologies into the decision making framework for public policy affecting forest resources and their watersheds.

The URI RREA Program has three components: 1) Training in the use of geospatial technology to enhance the use of these tools for natural resource management, particularly forest ecosystems. The Program assists resource managers with effectively using a wide variety of data and applications. 2) Providing Internet-based resources that serve geospatial data to users, including Rhode Island's Geo-data Gateway, the Rhode Island Geographic Information System database, and Global Positioning System base station reference files. 3) Demonstrate the use of both geospatial technology and data to resource managers through pilot projects.

Outputs – Forest Management:

- Two workshops (50 total participants) on Woodscaping featuring the Small Acreage Woodland Owners fact sheet series, were implemented by partner agency Southern New England Forest Consortium, Inc. during the reporting period.

Outputs- Public Policy Related to Forest and Range Land:

- Provided infrastructural and programmatic staff support to USDA CSREES, NASA Earth Science Enterprise, and NOAA Sea Grant funded Geospatial Extension Specialist (GES) for Rhode Island.
- RREA supports the development of the GES-led Rhode Island's Geodata Gateway. This metadata clearinghouse will dramatically improve the ease by which users will locate geographic data and resources in the State. This clearinghouse, the first for Rhode Island, will include both RIGIS and non-RIGIS data. Public debut is anticipated for Spring 2007.
- The RIGIS website that is maintained in part by RREA was updated to simplify navigation to geospatial data for Rhode Island.
- Facilitate in-state communication in partnership with the GES by maintaining the RIGIS email listserv and RSS feed.
- Within the suite of geospatial data servers overseen by RREA (RIGIS vector data, GPS Base Station correction file server, orthophotography image server) over 765 GB of data were distributed during FY2006.
- RREA staff continued to participate in the RIGIS Executive Committee quarterly meetings.
- Introduction to ArcGIS 1 course was held two times for a total of 30 participants: January & March, 2006.
- Sponsored the establishment of the URI Geospatial Extension Program's new Global Positioning System (GPS) unit loan program for educational and non-profit organizations in Rhode Island.
- Expanded GIS training courses offered at URI by enhancing partnership with ESRI, Inc. ESRI taught 2 advanced training programs in the CELS computer lab during this reporting period. For our audiences, we offered an advanced cartography course and a parcel editing course in June 2006. A total of 17 people attended these courses. We plan to continue this training relationship in 2007 in partnership with the URI Geospatial Extension Program.

Outcomes/Impact – Forest Management

- Knowledge used to inform decision makers or public: Landowners to implement sustainable forestry practices that they learned from Woodscaping programming (workshops, factsheets, web resources), and that these adopted practices serve the objectives of the landowners.

Outcomes/Impact –Public Policy Related to Forest and Range Land

- Organizational: Greater accessibility and use of community based geospatial tools and databases for local water quality management and natural resource protection. Enhanced coverage of a range of water quality-related education and research topics, through regional sharing of new state program tools and products.
- Educational: Increased knowledge of the use of geospatial technologies for resource management and protection. The increased use of geospatial technologies for resource management.

- Knowledge used to inform decision makers or public: Enrollments in the RREA GIS courses offered in partnership with the URI Geospatial Extension Program have been at maximum capacity; there continues to be a significant interest in our training, especially by resource managers working for municipalities and state government.
- Knowledge used to inform decision makers or public: Every user of digital map information for Rhode Island depends on RIGIS data access system managed by RREA in partnership with the URI Geospatial Extension Program. Our training programs are the most effective and affordable means for decision-makers to keep current with GIS software used for natural resource management.
- Integrated project: The URI RREA program, through the Environmental Data Center, is a participant in and contributor to the RI Environmental Monitoring Collaborative established by the RI General Assembly Comprehensive Watershed and Marine Monitoring Act of 2004.
- Integrated project: We teamed with the Rhode Island Geospatial Extension Specialist, Geographic Information System (RIGIS), Environmental Monitoring Collaborative (RIEMC), RI Department of Environmental Management (RIDEM), and Transportation (RIDOT) in completing a successful project sponsored by the USGS Federal Geographic Data Committee for developing a more efficient method for the RI Geospatial Community efficiently download online data depicting various data themes using a Framework Web Feature Service.
- Integrated project: We teamed with the URI Environmental Data Center and National Park Service to train 5 graduate students in the use of GPS in natural resources management whereby the students participated in a natural resource data development exercise at Saratoga National Historic Park in New York.
- Integrated project: Our RREA project has enabled us to continue assisting the Rhode Island Army National Guard's Environmental Compliance Unit to develop online intranet mapping applications using ArcSDE and ArcIMS to assist in natural resource protection on its 20 state-based training facilities.
- Integrated project: RREA has provided a foundation of RIGIS data to assist municipalities in mapping critical facilities and hazards for the Rhode Island Emergency Management Agency Hazard Mitigation Plan.
- Integrated project: Through the Environmental Data Center, our RREA program provides a geospatial technical foundation to the MapCoast Partnership whose charge is to map shallow and coastal water soils and sediments to support management and conservation of coastal ecosystems in Rhode Island.
- Integrated project: The Rhode Island Natural History Survey benefits directly from access to Spatial Database Engine (ArcSDE) vector and image data resources made available through the RREA spatial data distribution program.
- Integrated Project: The RREA is leading a statewide initiative to develop a stewardship and monitoring program for protected lands owned by land trusts and NGOs. Our partners are The Nature Conservancy, The Audubon Society, US Fish and Wildlife Service, the Land Trust Council, and the RI Natural History Survey. Elements of the Stewardship program include forest management, pest and pathogen monitoring, invasive species monitoring and providing public access to conservation lands.

Source of funds:
☒Smith-Lever
☐Hatch
☒State
☒Other (please list)

- CSREES, RREA

Scope of impact: Our RREA programming affects decision-makers and resource managers at the federal, state, municipal, non-profit, public, and private enterprise sectors. Through the RI Environmental Monitoring Collaborative, established by the RI General Assembly Comprehensive Watershed and Marine Monitoring Act of 2004, the RREA Geospatial Program is working to provide a central database, via the Internet, to store monitoring data and disseminate the analysis of these data to decision-makers and the public. The result will be to establish a mechanism to coordinate monitoring efforts among government agencies, municipalities, nonprofit organizations and universities.

Geospatial Extension Program
Situation:

Citizens, scientists, resource managers, and decision-makers in Rhode Island require ready access to accurate and current geospatial data. These data and the technology required to use them are constantly changing. The Rhode Island Geospatial Extension Specialist (GES) is creating an effective and efficient system of Internet-based access to geospatial data, technology, and resources for Rhode Island. The GES administers training activities to educate citizens, scientists, resource managers, and decision-makers on the availability and application of contemporary geospatial data and tools.

Outputs:
The Rhode Island Geospatial Extension Specialist (GES) is pursuing three major objectives toward achieving a goal of making geospatial data and information readily available to citizens, resource managers, scientists, and decision-makers:

Objective 1 - Develop and coordinate a Rhode Island Geographic Information System (RIGIS) data and information access system that is consistent with national standards and provides simple and intuitive access to all forms of geospatial data and information for Rhode Island. Program outputs related to this objective consist of:

- Continued development of Rhode Island's Geodata Gateway. This metadata clearinghouse will dramatically improve the ease by which users will locate geographic data and resources in the State. This clearinghouse, the first for Rhode Island, will include both RIGIS and non-RIGIS data. Beta testing is nearly complete and its public debut is anticipated for Spring 2007.
- Continued maintenance of the RIGIS data distribution system by loading new data, removing outdated resources, and notifying the user community of these changes via email, RSS, and the website itself. Website redesign is underway in order improve look and feel of site, as well as to comply with International Standards Organization published standards for geodata.
- Processed and reviewed data prior to their incorporation into the RIGIS data catalog.
- Maintained node on the FGDC metadata clearinghouse network on behalf of RIGIS.

- In support of the National Spatial Data Infrastructure (NSDI), RIGIS data holdings were published to the National Geospatial One-Stop for the first time.
- Lead a successful 2006 NSDI Cooperative Agreement Program project to create and host three web feature services that serve Framework-compliant data for Transportation, Governmental Units, and Hydrography. These Framework services are the first of their kind in Rhode Island and have been published to the National Geospatial One-Stop.

Objective 2 -- Develop a comprehensive portfolio of Internet Map Server applications that provide ready-access to RIGIS information to users who do not have GIS software and the technical knowledge on how to use it. Program outputs related to this objective consist of:

- Beta version of new online Rhode Island Atlas created. It will serve as the base map for the Rhode Island Geodata Gateway and as the flagship for the RIMAP network. Cutting-edge software is being implemented to serve the Atlas in a variety of formats to the general public, to be released in Summer 2007.
- Exploring easier methods of sharing recent acquisitions of RIGIS digital orthophotography via Internet Map Server applications.
- *Rhode Island's Changing Landscape* website development begun in partnership with the URI Laboratory for Terrestrial for Remote Sensing and the University of Connecticut Center for Land Use Education and Resarch (CLEAR). Public release scheduled for Summer 2007.

Objective 3 -- Expand the portfolio of training programs for geospatial data and information in Rhode Island. Program outputs related to this objective consist of:
Training activities:

- Introduction to ArcGIS 1 course was held 2 times for a total of 30 participants: January & March, 2006.
- Expanded GIS training courses offered at URI by enhancing partnership with ESRI. ESRI taught 2 advanced training programs in the CELS computer lab during this reporting period. For our audiences, we offered an advanced cartography course and a parcel editing course in June 2006. A total of 17 people attended these courses. We plan to continue this training relationship in 2007.
- Designed and lead *Digital Imagery for Rhode Island: The State of the State* seminar. University of Rhode Island Coastal Institute, March 15, 2005.
- Designed and hosted the *Introduction to GPS for Stormwater Managers* seminar in partnership with the URI Nonpoint Education for Municipal Officials (NEMO) Program and the Rhode Island Department of Environmental Management. June 15, 2006.
- Hosted and assisted with the instruction of *Pictures, Points, and Places*, and innovative new course designed by the University of New Hampshire Geospatial Technologies Training Center. This highly acclaimed class was taught by UNH Extension staff in partnership with the URI Geospatial Extension Program and the UConn Geospatial Technology Program. July 25, 2006.
- Began a new Global Positioning System (GPS) unit loan program for educational and non-profit organizations in Rhode Island.
- Shared ideas and knowledge of geospatial technology and data with clients from Rhode Island state government, municipalities, conservation groups, and private industry on an *ad hoc* basis via in-person, telephone, and email communication.

- Successfully applied to the Institute for the Application of Geospatial Technology at Cayuga Community College for funds to run an introductory remote sensing workshop in Fall 2007.
- Guest speaker for the URI Coastal Institute IGERT Project.

Support of programmatic outputs:
Coordination, communication, and facilitation activities:

- Hosted ESRI-sponsored and taught *Introducing ArcGIS 9.2* seminar. Sept 27, 2006.
- Continued participation in quarterly RIGIS executive committee meetings.
- Continued support of the National Geospatial Technology Extension Network (NGTEN). Member of the NGTEN website development committee. Member of the Map@Syst leadership committee, an innovative new eXtension Community of Practice funded in 2006. Website debut scheduled for Fall 2007.
- Continued administration of RIGIS-L, a statewide email listserv for geospatial technology users.
- Continued administration of the RIGIS RSS feed.
- Attended *Introduction to Geospatial Metadata* and *Remote Sensing for Spatial Analysts* classes hosted and taught by the NOAA Coastal Services Center. March 20-24, 2006.

Professional Conferences and Workshops:

- Northeast Arc Users Group (NEARC)
- National Nonpoint Education for Municipal Officials (NEMO) Network's Fifth NEMO University Conference
- ESRI International Users Conference
- Rhode Island League of Cities and Towns Convention
- New England GIS Conference

Outcomes/Impact:

- Geospatial data are more easily accessible to Rhode Islanders. New data have been made available. Consumers of geodata in Rhode Island are more attuned to when new data are added to the RIGIS catalog due to enhanced avenues for communication implemented by the GES.
- Geospatial technology and training are more accessible to Rhode Islanders. The number and diversity of geospatial training programs in Rhode Island has increased. More than 250 individuals participated in educational activities arranged by the RI GES. Through creating and facilitating several training opportunities in FY2006, the RI Geospatial Extension Program is helping build the community of those savvy in geospatial technology in Rhode Island.

Source of funds:
Smith-Lever
State
Other (please list)

- P.V. August, A.J. Gold, C. LaBash, Y.Q. Wang and A. McCann. Geospatial Information in Rhode Island: Making a Difference in Sustainable Resource Management, CSREES, 2004 – 2007, $285,000.

Scope of impact: A large number of organizations in the public, private, and non-profit sectors have been affected by the work of the RI GES to date. Representatives from RI state government, local government, conservation organizations, and higher education has sought the RI GES' counsel with regard to issues such as access to data, techniques for using data, and implementing geospatial technologies within their own organization. The impact of the RI GES has crossed state boundaries to both Connecticut and New Hampshire in partnership with the UConn Geospatial Technology Program and the UNH Geospatial Technologies Training Center. Individuals from across the New England region traveled to participate in training opportunities facilitated by the RI GES. We anticipate this scope of impact will grow stronger with the release of the Rhode Island Geodata Gateway in the coming year and further increases in educational opportunities

Situation:

Increasing Urban Impervious Surface in Rhode Island and the Environmental Impacts

Impervious surface area (ISA) is defined as any impenetrable material that prevents infiltration of water into the soil. Urban pavements, such as rooftops, roads, sidewalks, parking lots, driveways and other manmade concrete surfaces, are among impervious surface types that featured the urban and suburban landscape. Urban runoff, mostly through ISA, is the leading source of pollution in the Nation's estuaries, lakes, and rivers. Impervious surface has been identified as a key environmental indicator due to its impacts on water systems and its role in transportation and concentration of pollutants. A large body of research consistently has found that impact begins to occur at very low levels of overall watershed imperviousness. When less than 10% of a watershed is impervious, impervious are measurable but slight, at between 10% and 25% water quality is impacted and at above 25% water quality is degraded. Therefore, quantification of the percentage of ISA in landscape has become increasingly important with growing concern over water quality in this country.

Effective impervious area (EIA) is the directly connected impervious surface to the storm drain system and contributes to increased watershed volumes and runoff rates. There are documented case studies that conclusively link urbanization and increased watershed imperviousness to hydrologic impacts on streams. Existing reports and case studies provide strong evidence that urbanization negatively affects streams and results in water quality problems such as loss of habitat, increased temperatures, sedimentation and loss of fish population. ISA is widely accepted as a reliable indicator of urbanization.

As Rhode Island has no high spatial resolution ISA and EIA information available, we proposed this project to conduct the investigation. This project is to integrate space-borne and airborne remote sensing data and spatial information extraction modeling to accomplish the following objectives.

1. To obtain information on spatial coverage and distribution of ISA and effective impervious area (EIA) for the state of Rhode Island using the most recent 2003/2004 true-color 1:5,000 orthorectified digital aerial photograph data.
2. To extract EIA information by integration of GIS modeling techniques and remote

sensing derived ISA.

3. To identify sensitive areas through change detection of pre-development and post-development ISA and EIA using GIS modeling.
4. To examine the impacts from changing ISA and EIA on the water quality and receiving water hydrology.

Outputs:

Publications

Zhou, Y. and Y. Wang. Extraction of Impervious Surface Areas from High Spatial Resolution Imageries by Multiple Agent Segmentation and Classification, *Photogrammetric Engineering & Remote Sensing*, 73: xxxx-xxxx (accepted and in press).

Wang, Y., Y. Zhou, and X. Zhang. The SPLIT and MASC Models for Extraction of Impervious Surface Areas from Multiple Remote Sensing Data. *In Remote Sensing of Impervious Surface* (Weng, Editor), CRC Press, New York. (Accepted, in press)

Zhou, Y. and Y. Wang. The state of impervious surface in the state of Rhode Island, *Northeastern Naturalist* (submitted, in review).

Conference Paper and Presentation

Zhou, Y. and Y. Wang, 2006. Extraction of Impervious Surface Areas from High Spatial Resolution Imageries, in Proceedings of ASPRS 2006 Annual Conference, Many 5-9, 2006, Reno, Nevada.

Outcomes/Impact:

In year 2006 and under this project, we have extracted the impervious surface areas (ISA) for the state of Rhode Island using 1-meter spatial resolution true-color digital Orthophoto. This is the first ever high spatial resolution coverage of ISA for the state. The results indicate that the state has 10.3% of the land covered by ISA. Twenty two towns have over 10% ISA percentage, 10 towns have over 20% ISA percentage, and 5 towns have over 30% ISA percentage. The distribution patterns indicate that ISA are mainly concentrated along the coastal lines in the southern and the eastern sections of the state.

The ISA data provide the most updated and precise information for the state in coastal and watershed management, as well as for environmental monitoring, modeling, and planning.

- Student training. Y.Q. Wang: One Ph.D. student (Mr. Yuyu Zhou) is currently funded by this project.

Source of funds:

Hatch

Situation:

Valuation of Forested Land Conservation Alternatives: Tools to Evaluate Validity of Willingness-to-Pay

Public policy officials seek methods to evaluate the validity of measures of economic value for forest land conservation. The project will develop methods to test whether survey respondents accurately state their real willingness to pay for land conservation alternatives.

Outputs:

- During the reporting period, the project has supported and extended a number of projects developing tools for valuation of non-market amenities provided by forestlands. Chief among these is a USDA Managed Ecosystem project in which we are developing, and testing in the lab, incentive compatible mechanisms for eliciting willingness to pay for ecosystem benefits associated with changes in forest harvesting guidelines around vernal pools. The project has supported development of an incentive compatible mechanism for use in valuation surveys. Valuation surveys typically ask hypothetical questions, which is often thought to lead people to state valuations higher than they would actually be willing to pay because they do not need to trade off the stated alternatives and other goods. However, when valuation surveys solicit real money to pay for real public goods, each respondent has an incentive to understate their true values, strategically hoping the other respondents will state enough to provide the public good without his/her contribution. Thus, conventionally formatted survey questions, with or without real money and goods on the line, cannot provide accurate measures of value.
- During this year, we extended to the multiple alternative case the proof of incentive compatibility for our adaptation of pivotal mechanism for use in discrete choice questions of the type frequently used in valuation surveys.
- We developed laboratory tests of the modification of the pivotal mechanism for use in discrete choice questions of the type frequently used in valuation surveys. With binary questions, in which subjects were asked whether they are willing to pay a stated fee for a stated level of forest amenities, we have shown that subjects largely answer yes or no questions about their willingness to pay truthfully, at a rate that is slightly higher than the best-performing mechanism used in the field. We conducted a second set of experiments to test the version of the mechanism for question formats that ask respondents to choose from among multiple alternatives, a format commonly used because it improves the statistical power of the models. This task proved challenging for subjects, but ongoing data analysis suggests that our implementation of the pivotal mechanism elicits the truth more frequently than other commonly used mechanisms. These experimental results are informing our field trial, under the USDA conservation innovation grant discussed below.
- The project supported completion of an econometric manuscript introducing a new way to normalize the utility functions estimated from contingent valuation survey data that dramatically simplifies the task of estimating distributions of willingness to pay using random parameters models. While it has long been known that the coefficient on an alternatives cost could be set to 1 and the scale parameter of the error term estimated, yielding an expenditure function, we extended this to now-fashionable random parameters models, and demonstrated that it gives distributions of willingness to pay more easily than the standard approach.
- We are extending use of this method with a new USDA Conservation Innovation Grant that will use incentive compatible mechanisms to determine the maximum willingness to

pay for changes in farm haying practices that enhance breeding success of grassland nesting birds, and the potential for operating a for-profit business brokering farm practice contracts between farmers and residents. In addition, the project has supported data entry on a survey to evaluate whether rural residents prefer to support land conservation emphasizing forest rather than farms (or vice versa), and how that preference relates to a community's dominant land-cover and the residents background exposure to other land cover types and interest in aesthetics related to solitude, historical culture, and environmental quality. We conducted a hypothetical survey in fall 2006, and learned that residents expressed a willingness to pay of about $12 per household for practices that enhance grassland bird management, and another $12 if there are guided bird tours of farms.

- The survey and mechanism experiments are feeding into actual solicitations for money from residents that will occur in March 2007. This will provide us an opportunity to validity test our hypothetical survey and laboratory results, but also to actually evaluate the potential for using these techniques to establish brokered markets for public good ecosystem services.
- While manuscripts are still in development, this project has directly supported three papers, one currently in the second round of review, and a dissertation.

Outcomes/Impact:

- When applied in the future, the incentive compatible mechanism will provide accurate measurements of public values for changes in forestry practices around vernal pools linked to enhanced amphibian survival. In addition to measuring specific values, the tools developed can be used to validate, or calibrate, widely-used hypothetical instruments, and can be used to obtain better estimates in future valuation studies on which policy decisions are based. The survey on preferences for forest versus farmland cover is expected to contribute to an understanding of the likelihood that state or regional land conservation programs generate incentives that push rural communities toward land conservation that is or is not compatible with their own preferences.

Source of funds:
☐ Smith-Lever
☒ McIntire-Stennis
☐ Hatch
☒ State
☐ Other (please list)

Scope of impact: State, regional and national

Knowledge Area: KA 133. Pollution Prevention and Mitigation

Situation:

New England Onsite Wastewater Training Program

Approximately 30% of all Rhode Islanders and 25% of the rest of the nation rely on onsite wastewater treatment systems to treat human wastes. Public health and water quality can be impacted by poorly functioning and failed septic systems. Knowledge about conventional septic systems and existing and emerging innovative and alternative onsite wastewater treatment systems needs to be transferred to homeowners, real estate professionals, and the many professional clientele practitioner groups engaged in onsite wastewater design, installation, operation and maintenance, and regulations. Providing research-based outreach education to our clientele will facilitate informed decision making at all levels.

The goal of the NE Onsite Wastewater Training Program is to develop, demonstrate, and disseminate research-based, comprehensive, cost-effective approaches for rural communities that protect public health and reduce water quality risks from onsite wastewater treatment systems.

The NE Onsite Wastewater Training Program, a program focusing on research and outreach education utilizing over 55 alternative and innovative onsite wastewater demonstration system best management practices, targets homeowners, real estate agents, septic system designers, site evaluators, installers, operation and maintenance service providers, municipal officials, and regulators. This program also provides many of the licensed private sector practitioners with continuing education credit classes needed to renew their professional licenses. The physical field-training Center, established in 1994, is located on the URI Kingston campus, and consists of twenty-one innovative and alternative full-scale systems constructed above ground for hands-on learning.

Outputs:

- The NEOWT Program staff, with State regulatory and private sector partners, ran a series of twenty-four professional development classes. These one and two-day classes provided continuing education opportunities for Southern New England onsite wastewater practitioners who need to maintain professional licenses.
- NEOWT program staff created and presented five new classes during this period designed to help meet the continuing education credit needs for our licensed wastewater practitioners.
- During this reporting period, NEOWT Program staff delivered 14 talks at national and regional conferences involving ongoing URI onsite wastewater research and outreach education.
- NEOWT Program staff co-authored a homeowner's guide to onsite wastewater treatment systems with fellow colleagues of the Consortium of Institutes for Decentralized Wastewater Treatment (a largely Land Grant university based network of researchers and educators working in onsite wastewater treatment.
- NEOWT staff provided technical assistance to Old Lyme, CT and several neighboring communities. The purpose of this outreach effort was to help establish local wastewater management programs that incorporate innovative and alternative treatment systems. NEOWT Program staff utilized our successes working with Rhode Island communities as an example of how to maintain sustainable development in coastal communities and protect public and environmental health utilizing decentralized wastewater treatment systems, and avoiding costly municipal sewer projects.

- Staff participated in cesspool phase-out legislation meetings with Rhode Island Department of Environmental Management and NGO stakeholders.
- Six alternative and innovative nitrogen removing wastewater treatment systems installed in the Wickford Harbor watershed in the Town of North Kingstown, RI under the auspices of a URI and USEPA Supplemental Environmental Project aimed at improving water quality in the Wickford Harbor. Priority locations for advanced nitrogen treatment systems were based on priority assessments provided by URI NEMO Pollution Risk Assessment. NEOWT Program staff provided technical assistance to the town on establishing the program and reviewing all system designs.
- NEOWT Program staff delivered a presentation to Lake Mishnock Association on onsite wastewater treatment and lake water quality.
- URI NEMO and NEOWTC Program hosted a workshop dealing with housing density, drinking water, wastewater and stormwater solutions. This workshop gathered nearly 60 people from the three southern New England states.
- NEOWT Program working in conjunction with URI NEMO co-developed a workshop on establishing a local wastewater management program – how to start it, run it and solve problems. This one-day workshop was geared towards local, county and state regulatory decision makers. This workshop provided attendees with the tools needed to develop and sustain a wastewater management program and what issues may develop and how to effectively cope and deal with them. This workshop drew 86 attendees – approximately a quarter of which were from MA, CT, NH, MD, and WI; the remaining people were from Rhode Island.
- A NEOWT Program staff member is an appointed member of the RI DEM Onsite Wastewater Technical Review Committee (TRC) which makes decisions on all new and emerging alternative wastewater treatment technologies for Rhode Island. The TRC and RIDEM have benefited from NEOWT Center research-based recommendations.

Outcomes/Impact:

- The NEOWT Program operates in partnership with state and federal agencies, municipalities, and over 40 private sector and industry partners. Since 1996, the OWT Program has established a network of 56 alternative and innovative research and demonstration systems. These systems were installed under the auspices of several state and federally funded projects to replace failed septic systems at actual homes in priority watersheds, and these systems form the foundation for the NEOWT Center's research-based outreach education efforts. Each of the research and demonstration septic systems is based upon proven technologies that minimize nutrient and/or microbial loading to ground and surface waters. This long-term research information has also helped support important regulatory policy changes concerning the design and use of alternative and innovative septic system technologies in Rhode Island. The NEOWT Program is also a major information resource for Extension programs throughout New England, and works regionally in the Northeast, and nationally with sister Extension programs.
- Over 470 Southern New England onsite wastewater practitioners attended one- and two-day NEOWT Program classes during this reporting period. These professional development classes provided continuing education opportunities for many of these practitioners who needed to maintain their professional licenses.

- Onsite Wastewater Training Center staff reached an estimated 2000 wastewater professionals while delivering 14 talks at national and regional conferences.
- As a direct result of the publication of the 4 booklets/manuals relating to creative community decentralized (onsite) wastewater treatment and management the following outcomes occurred:
    - URI NEMO and NEOWT Program wastewater outreach and research reached a broad audience through feature stories describing the manuals in *Small Flows Quarterly* (Winter 2006) and *Onsite Water Treatment* (March/April 2006).
    - The articles mentioned above led to manual orders from across the country, including: Massachusetts; West Virginia; Kentucky; Vermont; Delaware; Pennsylvania; Colorado; and Kansas.
    - Of particular note, the Nantucket Department of Public Health placed an order for 200 copies of the series, to be distributed throughout the town as a method of promoting onsite wastewater awareness.
    - We were able to provide easy access to many of the informational highlights of a wastewater management conference that we held in March 2006, through the use of the manuals as take-home "handouts." We received a wealth of positive feedback about these handouts, in terms of their ability to support conference attendees' efforts to encourage wastewater management in their towns.
    - General distribution of the manuals enhanced awareness among homeowners, land developers, wastewater practitioners, and communities of alternative wastewater treatment system options to promote compact development, control sprawl, revitalize village centers, and avoid costly and unnecessary centralized sewer projects.
    - As a direct result of the Chepachet Village Demonstration Project, RI Department of Environmental Management received a USEPA wastewater demonstration grant to integrate alternative and innovative decentralized wastewater treatment systems with stormwater control measures to demonstrate revitalization of historic mill villages in the Blackstone River Valley National Heritage Corridor Demo. This project, done in conjunction with Massachusetts, selected Chepachet Village in Glocester, RI based upon a competitive selection process, as the Rhode Island case study site largely because of town's interest in expanding the groundwork established in the initial Chepachet Village Project. URI NEMO and NEOWTC have provided technical advice on this new federal project.
    - URI NEMO and NEOWT Program staff coordinated with RI Department of Environmental Management as a project partner on the Blackstone River Valley National Heritage Corridor Demonstration Project providing assistance in developing a scope of work for the project. The overall grant objective is to integrate alternative and innovative decentralized wastewater treatment systems with stormwater control measures to demonstrate revitalization of historic mill villages in Rhode Island and Massachusetts and serving as an example for villages elsewhere in the United States.
- Conducted Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) National Train-the-Trainer Academy with fellow trainers from NCSU, TAMU, UMN, and UTN. This academy prepared 24 prospective trainers from Land Grant universities and state wastewater associations to deliver the CIDWT Residential Onsite Wastewater

Treatment Systems: An Operational and Maintenance Service Provider Program training materials to other audiences throughout the United States. Raleigh, NC. April 26 – 28, 2006

- Developed and delivered CIDWT High Strength Wastewater Curriculum. URI CELS NEOWT Program staff, working in cooperation with the Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) partners from UMN, TAMU, and William Stuth from AquaTest, Inc. (the leading private sector authority on high strength wastewater treatment) produced a draft curriculum (written manual and associated PowerPoint slides) for training wastewater practitioners to effectively deal with high strength waste streams. Training curriculum materials received their first pilot testing in Rhode Island at a NEOWT Program 2-day workshop in October 2006.
- Participated in planning the Consortium of Institutes for Decentralized Wastewater Treatment National Train-the-Trainer Academy II with fellow trainers from UAZ, UMO, NCSU, TAMU, UMN, and UTN. This academy will help prepare prospective Land Grant university and state wastewater association trainers to develop training courses and assist instructors in sharpening their training skills. Academy II will be held in Nashville, TN on February 9-10, 2007.
- NEOWT Program staff participated in a joint effort to produce the CIDWT Glossary of Decentralized Wastewater Terminology – Draft. This 80 plus page document (9 MB electronic copy) is the collective effort of the Consortium of Institutes for Decentralized Wastewater Treatment writers from UAZ, UMO, UMN, NCSU, TAMU, and URI. Phase II of this glossary project requires the document now receive peer review and comment. This effort is the result of sixteen 2-hour long conference calls and a 1 day face-to-face meeting.
- Delivered a half-day indoor lecture style workshop, entitled Onsite Wastewater System Basics for Real Estate Professionals, to real estate professionals licensed in Rhode Island and nearby Massachusetts. This class is approved for Rhode Island real estate agent continuing education unit credit towards professional license renewal. Offered in partnership with Rhode Island Association of Realtors and Rhode Island DEM. January 10, 2006.
- Presented "Onsite Wastewater Technology success stories in Rhode Island". Invited presentation by David Kalen OWT Program Manager at the 5th Annual Southwest Onsite Wastewater Conference, Feb. 1-2, 2006 in Laughlin, NV. Approximately 340 people in attendance.
- Delivered a half-day outdoor hands-on training workshop, entitled Hands-on Onsite Wastewater System Training for Real Estate Professionals, conducted at the URI CELS New England Onsite Wastewater Training Center for real estate professionals licensed in Rhode Island. This class is approved for Rhode Island real estate agent continuing education unit credit towards professional license renewal. Offered in partnership with Rhode Island Association of Realtors and Rhode Island DEM. April 10, 2006.
- NEOWT and NEMO Program staff provided technical support to Old Saybrook, CT and Westport, CT alternative wastewater treatment systems and wastewater management.
- Avoidance of groundwater and surface water contamination by cesspools that were removed as a result of passage of a cesspool phase-out amendment to the Town of Charlestown, RI wastewater management ordinance. URI technical support and educational materials from the NEOWT and NEMO Programs were used to support this local action.

- The Town of North Kingstown, RI implemented a septic system upgrade program for homeowners in critical locations of the Wickford Harbor watershed, providing partial grants for upgrading of conventional systems to advanced nitrogen reducing technologies. URI NEMO and NEOWTC staff provided technical assistance to the town on establishing the program and reviewing 6 actual system designs during this reporting period. As an outcome from this effort an estimated 120 pounds of nitrogen will be removed from this watershed by these nitrogen reduction systems on an annual basis.
- Coordinated with a private sector company that provides data management software to develop the Rhode Island Wastewater Information System (RIWIS). As a result of this unique public-private sector effort this onsite wastewater treatment system inventory and tracking program is now offered to Rhode Island communities free of charge. This will result in thousands of dollars saved in initial capital cost for data program purchase and in staff time cost savings for participating communities.

Source of funds:
☒Smith-Lever
☐Hatch
☒State
☒Other (please list)
- 406 Program

Scope of impact: As the main provider of continuing education credits for wastewater professionals in Rhode Island, nearly all licensed designers and installers of onsite wastewater treatment technologies in Rhode Island have been affected by OTW Center training. Nearly 30% of all onsite wastewater system applications to RI DEM during the reporting period were for innovative and alternative systems. This is in sharp contrast to the number of alternative system applications just 7 years ago which amounted to about 2-3 percent. Rhode Island municipal staff has collectively benefited by attending NEOWT wastewater training classes, and classes co-taught by URI NEMO, and learning new ideas about wastewater management. Changes in Rhode Island DEM onsite wastewater regulations are being drafted that directly reflect findings from NEOWT Program research-based onsite demonstration project systems. New draft regulations are proposed for public hearing in spring 2007. As a result of our efforts, several Connecticut communities have established decentralized alternative wastewater treatment programs to help address their wastewater needs, thus avoid costly and unnecessary sewer projects. Curricula co-developed by NEOWT Program staff in cooperation with Consortium of Institutes for Decentralized Wastewater Treatment partners at other Land Grant institutions received a Blue Ribbon Award for Outreach Education Materials from the Am. Soc. of Agricultural and Biological Engineers. These materials have been adopted nation-wide as the standard training materials for all practitioners doing operation and maintenance of onsite wastewater treatment systems. The OWT Program staff is actively engaged in a similar effort to develop training materials to troubleshoot high strength wastewater treatment systems, which once developed will fill a huge knowledge gap and provide a huge cost savings to systems owners, safeguard water quality, and protect public health. All these materials and the training needed to effectively deliver them are readily available to all wastewater professionals, Land grant educators, and local and state government agencies.

Fate and Effects of Antibiotics in Onsite Wastewater Treatment Systems.

Situation:

Consumption of pharmaceutical products, either by humans or animals, is not going to stop. Rather, it is likely to increase in the future, given current demographic trends that include large increases in the elderly population and of individuals with chronic diseases. One approach to the problem of contamination of freshwater bodies with bioactive compounds is the development of wastewater treatment processes that remove them from the effluent.

Of specific interest in the context of the priorities of the Station are OWTS. About 23% of U.S. households rely on OWTS for disposal of domestic wastewater, and this value has remained steady for the past three decades. This value is higher in rural areas, where low population densities make sewers an unattractive alternative for domestic wastewater disposal. In the northeastern U.S. the sandy, well-stratified soils of glacial origin and high water tables pose special problems with respect to surface and groundwater contamination by OWTS. In Rhode Island OWTS account for an estimated 50% of the nitrogen contamination that finds its way into Narragansett Bay. Nitrogen and other contaminants are generally transported in ground and surface water before reaching coastal areas. The potential for freshwater contamination by biologically active compounds originating in OWTS may thus be high.

We evaluated the fate and effects of an antibiotic (tetracycline) in conventional and aerated OWTS leachfield soil at the pilot scale. There are no data available on either the fate (e.g. adsorption, binding, biodegradation) or effects (e.g. interference with contaminant removal, shifts in microbial community structure, development of antibiotic resistance in pathogenic bacteria) of antibiotics in leachfield soil. Similarly, there is little information on alternative treatment processes that may enhance antibiotic removal from effluents. An industry-sponsored evaluation of a novel, patented process to aerate OWTS leachfields conducted by our laboratory indicates that aeration of leachfield soil enhances the removal of biodegradable organic C (measured as biological oxygen demand, or BOD_5), total nitrogen, and fecal coliform bacteria. The effects of aeration on nutrient and organic C removal in leachfield soil suggest that this technology is a good candidate for removal of antibiotics in leachfield soil.

We chose tetracycline as the test compound for the propose study for a number of reasons: (1) it is a broad-spectrum antibiotic, affecting both Gram-positive and Gram-negative bacteria); (2) it is used in human and veterinary medicine for the treatment of bacterial infections, and (3) it has been found to resist microbial attack.

Objectives and Hypotheses:

Objective 1: Determine the degree to which tetracycline present in septic tank effluent at an environmentally relevant concentration (5 mg/L) is removed in aerated and unaerated leachfield soil. Hypothesis 1: We expect that the rate of tetracycline removal will be higher in aerated than in unaerated leachfield soil. Biodegradation of organic compounds is generally slower under anaerobic conditions and at low concentrations. Specifically, the biodegradation of a number of antibiotics was significantly slower in the absence of oxygen.

Objective 2: Evaluate the effects of low levels of tetracycline on: Removal of nutrients (N and P), biological oxygen demand (BOD), and fecal coliform bacteria in aerated and unaerated leachfield soil. Hypothesis 2A: Because we anticipate that tetracycline will be biodegraded to a greater extent in aerated than unaerated leachfield soil, we expect that the water quality functions of leachfield soil will be less impacted by tetracycline under aerated than under unaerated conditions. Hypothesis 2B: The lower levels of tetracycline (resulting from presumed greater biodegradation) may lead to higher levels of antibiotic resistance in *E. coli* in drainage water from aerated leachfield soil. This is because bacterial populations are more likely to develop antibiotic resistance when exposed to low concentrations of the chemical.

The research was conducted at a laboratory facility built adjacent to a two-family home in southeastern Connecticut. All effluent from the septic tank was diverted to a pump station located above the laboratory, and dosed to a series of six lysimeters. The lysimeters were dosed four times a day for ten days with wastewater containing 5 mg tetracycline/L. Three of these lysimeters were vented to the home's leachfield (LEACH), while the headspace of the other three was pumped with ambient air to maintain an oxygen level of approximately 21% (AIR).

Outputs:

- Amador, J. A., D. A. Potts, M. C. Savin, P. Tomlinson, J. H. Görres, and E. L. Nicosia. 2006. Mesocosm-scale evaluation of faunal and microbial communities of aerated and conventional septic system leachfield soils. Journal of Environmental Quality 35:1160-1169.
- Amador, J. A., D. A. Potts, E. L. Patenaude, and J. H. Görres. 2007. Effects of depth on domestic wastewater renovation in intermittently aerated leachfield mesocosms. ASCE Journal of Hydrologic Engineering (Accepted pending revision)
- Amador, J. A. "Cleaning up dirty water with dirt" Presentation at the W. Alton Jones Earth Camp, W. Alton Jones Campus, University of Rhode Island, West Greenwich, RI. (July 2006)
- Atoyan, J. A., E. L. Patenaude, D. A. Potts, J. A. Amador. 2007. Effects of tetracycline on antibiotic resistance and removal of fecal indicator bacteria in aerated and unaerated leachfield mesocosms. Journal of Environmental Science and Health, Part B (Submitted)
- Atoyan, J. A. 2006. Effects of tetracycline on fecal indicator bacteria and microbial community structure in conventional and aerated septic system leachfield soils. M.S. Thesis, University of Rhode Island, Kingston, RI. 69 pages.
- Patenaude, E. L. 2006. Effects of tetracycline on water quality in conventional and aerated septic system leachfields. M.S. Thesis, University of Rhode Island, Kingston, RI. 80 pages.

Outcomes/Impact:

- *Results.* Addition of tetracycline to leachfield soil at environmentally relevant concentrations had no significant effect on pH, dissolved oxygen, dissolved organic C removal or removal of P in either aerated or unaerated leachfield soils. Tetracycline had a short-term negative impact on the removal of N in aerated soil, and a positive effect in unaerated soil. However, these parameters returned to pre-dosing values with 3 weeks. We were unable to detect tetracycline in water that had passed through either aerated or unaerated leachfield soil. Tetracycline dosing had no significant effect on either removal of fecal coliform bacteria or tetracycline resistance in *E. coli* or fecal streptococci in soil or water under aerated or unaerated conditions. Our results suggest that inputs of tetracycline into OWTS are not likely to affect water quality functions, with aerated and unaerated leachfield soils apparently responding in a similar manner to the introduction of the antibiotic.
- *Student training.* Two M.S. students (E. Patenaude and J. Atoyan) worked on different aspects of this project. They both defended their thesis successfully in 2006. One undergraduate student (N. Schwarz) worked as lab assistant for the duration of this project.

- Two M.S. theses have resulted from this work, and two research articles based on this work have been submitted for review. In addition, we expect to disseminate the data to practitioners and regulators through inclusion of our results in workshops conducted by the URI On-site Wastewater Training Center, as we have done in the past.
- The project has resulted in a collaborative research study between Jose Amador (NRS) and David Nelson, Andrew Staroscik, and Janet Atoyan (CMB) using molecular techniques to identify the microorganisms present in aerated and conventional leachfield soil and the effects of tetracycline exposure on the structure of the microbial community in these soils. We are in the process of writing a research paper based on this work. The resulting data will be used to develop a proposal to the Microbial Observatories Program of the National Science Foundation in the near future.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ State
☐ Other (please list)

Scope of impact: The results of this project should have national impact, given that nearly a quarter of households in the US rely on OWTS for disposal and treatment of domestic wastewater, and the use of antibiotics is widespread. Decision makers are likely to take note of this study as one of the first to evaluate the effects of an antibiotic leachfield soils. Similarly, this information will be of use in evaluating the response of aeration technologies for the improvement of leachfield functioning to challenges with antibiotics. At the local level, our results provide practitioners and regulators with a measure of confidence in the robustness of existing OWTS.

Knowledge Area: KA 135. Aquatic and Terrestrial Wildlife

Management of Southern New England Forests for Ruffed Grouse and Associated Wildlife

Situation:

Conservation of early successional forests within the eastern United States is a primary contemporary management concern because today these forests and their associated wildlife species are relatively rare and they require active management. We focus on ruffed grouse in this research because (a) forest management that enhances ruffed grouse populations will also positively influence populations of many other wildlife species so in this sense grouse are an excellent "sentinel species" for early successional forests, (b) ruffed grouse are of particular conservation concern in southern New England because they are a native gamebird species that is currently too rare to sustain a hunting season, and (c) much recent research effort has focused on why populations of ruffed grouse in eastern forests have declined. The primary goal of the proposed research is to assess how habitat quality and forest management practices affect home range and survival of grouse in southern New England. Results from previous related CRIS-supported research were reported in publications during 2005-06 (see list below). These results establish how home range size of grouse in southern New England changes with forest composition in this region. As part of this second year of the project, one M.S. graduate student,

Erik Bloomberg, has completed his last field season during fall 2006. He trapped grouse in state management areas in Rhode Island, fitted captured grouse with 11-12 g necklace-type radio transmitters. He is now tracking the grouse and recording their locations and movements. He will use this information to estimate home range and survival of grouse. We are also developing a Geographic Information Systems (GIS) map containing data on forest types, vegetation, management activities, roads, and natural features (lakes, streams, etc.) for the study site. Types of management activities include: silvicultural treatments (e.g. clearcut, shelterwood, and deferment), areas mowed to maintain road edges or open fields, prescribed burns, and openings created for wildlife. Radiolocations of grouse are overlaid on these base maps and their home ranges estimated. The mapped data will then be used to develop a spatially-explicit population viability analysis model that will be used to determine the effect of forest type and management activities on population dynamics of grouse. Results from this research will provide information that will enhance our ability to effectively manage southern New England forests for ruffed grouse and associated wildlife. Given that forest management in the eastern U.S. involves mostly privately-owned forests, there is a great need for research on key wildlife species that demonstrates how best to manage forests on a relatively small scale so that certain portions of the forest are at an early successional stage. In addition, the information can be used to test current ecological hypotheses about habitat/bird associations in early successional forests.

Outputs:

Publications

- Endrulat, E.G., S.R. McWilliams, and B.C. Tefft. 2005. Habitat selection and home range size of ruffed grouse in Rhode Island. Northeastern Naturalist 12:411-424.
- B.C. Tefft "Importance of early successional forests for wildlife." Rhode Island Natural History Survey, Kingston, RI.

Outcomes/Impact:

- This research involved the training of one M.S. student (Erik Bloomberg) and one undergraduate student (Amy Wynia) in both field biology skills and computer-intensive analysis of spatial data. Mr. Blomberg will complete his MSc thesis during the next fiscal year. Ms. Wynia will successfully defend her undergraduate honor's thesis in May 2006 that is the product of her research on this project.
- Knowledge gained from this research directly influenced forest management plans and the identification of key conservation reserves in Rhode Island.
- New insights obtained from this research included the need to develop Population Viability Analysis models that integrate realistic information about how successional changes in forest vegetation affect key wildlife species.

Source of funds:

☐ Smith-Lever
☒ Hatch
☒ McIntire-Stennis
☒ State
☐ Other (please list)

Scope of impact: In this second year of the project, new insights gained from this research directly affected (a) state wildlife biologists and managers who are responsible for land

acquisitions and conservation planning, (b) private landowners who are interested in managing their lands to benefit wildlife, and (c) scientific colleagues who are interested in determining how best to study the effect of forest management on key wildlife.

Knowledge Area: KA 136. Conservation of Biological Diversity

The Importance of Coastal Environments for Migrating Songbirds: Implications for Management of Natural Resources.

Situation:

The primary goal of the proposed research is to use changes in body composition and blood metabolites of representative songbird species to evaluate the quality of available habitats and foods for migrating songbirds while they are using stopover sites in coastal southern New England. The field research is conducted on Block Island, Rhode Island, an important stopover site for migrating songbirds as indicated by past research including some of our own, and by its designation by The Nature Conservancy as one of ten last great places on earth because of its unique conservation importance. Results from previous related CRIS-supported research were reported in publications during 2006 (see list below). These results suggested that migratory birds switch from eating mostly insects to eating mostly fruits during migration through southern New England, and that these fruits contain types of fatty acids that may be important for the birds' successful migration. One Ph.D. graduate student, Susan Smith, was hired in Sept. 2003 to work on this project, and a new MSc graduate student, Lillie Langlois, was hired in Sept. 2005. During fall 2006, Ms. Smith successfully completed her last field season and Ms. Langlois her first field season on Block Island, RI. Ms. Smith conducted field experiments designed to determine (a) whether variation in refueling rates (measured by concentrations of blood lipids) of omnivorous migratory birds during stopover at different coastal New England sites is related to fruit resource abundance, (b) whether daytime lipid deposition (measured by plasma triglyceride and B-hydroxybutyrate) in free-living migratory songbirds at stopover sites depends on foraging mode (i.e., insectivory versus frugivory), and (c) how blood lipids vary within species foraging at the same stopover site in relation to air temperature, body mass, and date. She also conducted an experiment with captive white-crowned sparrows to further explore how diet quality and composition affect certain blood metabolites (e.g., FFA, glycerol, ß-OHB, uric acid, triglycerides) that are used as indicators of fat and protein deposition or catabolism. Ms. Smith is completing the laboratory analysis of blood samples taken as part of this experiment and her fieldwork. She will defend her dissertation and graduate this May (2007). Ms Langlois conducted field and captive bird experiments designed to determine the protein and specific amino acid requirements of frugivorous songbirds. Results from this research will provide information that will enhance our ability to effectively manage coastal ecosystems for migratory birds. In addition, the information can be used to test current ecological hypotheses relevant to songbirds during migration.

Outputs:

Publications

- Podlesak, D. and S.R. McWilliams. 2006. Metabolic routing of dietary nutrients in birds: effects of diet quality and macronutrient composition revealed using stable isotopes. PHYSIOLOGICAL AND BIOCHEMICAL ZOOLOGY 79:534-549.

- Podlesak, D. and S.R. McWilliams. 2006. Birds metabolically route exogenous nutrients to rebuild digestive organs after fasting. Integrative and Comparative Biology, in press.
- Smith, S.B., S.R. McWilliams, and C. Guglielmo. 2006. Effect of diet on plasma metabolites in a migratory songbird. Integrative and Comparative Biology, in press.
- Podlesak, D. and S.R. McWilliams. 2007. Metabolic routing of dietary nutrients in birds: effects of dietary lipid composition on d13C of depot fat. AUK, in press.
- Smith, S.B., S.R. McWilliams, and C. Guglielmo. 2007. Effect of diet composition on plasma metabolite profiles in a migratory songbird. CONDOR, in press.
- Smith, S.B., K.H. McPherson, J. Backer, B.J. Pierce, D. Podlesak, S.R. McWilliams. 2007. Fruit quality and consumption by songbirds during autumn migration. WILSON JOURNAL OF ORNITHOLOGY, in press.
- Muller, M., S.R. McWilliams, D. Podlesak, J. Donaldson, and R. Lindroth. 2006. Tri-trophic direct and indirect effects of plant defenses: Black-capped chickadees choose to eat gypsy moth caterpillars based on host leaf chemistry. OIKOS 114:507-517.

Presentations

- Annual meeting of the American Physiological Society (Virginia Beach, VA) "Effects of dietary lipids and antioxidants on exercise performance in birds." (w/ B. J. Pierce)
- Fourth meeting of the North American Ornithological Congress (Veracruz, Mexico) "Diet quality and metabolic routing of dietary nutrients in migratory birds: novel applications of stable isotopes" (w/ D. Podlesak)
- 24th International Ornithological Congress (Hamburg, Germany). "Seasonal changes in composition of lipid stores in migratory birds: causes and consequences" (w/ B. J. Pierce)
- 24th International Ornithological Congress (Hamburg, Germany). "Tri-trophic effects of plant defenses: Black-capped chickadees consume caterpillars based on host leaf chemistry" (w/ M. Muller)
- Annual meeting of the Rhode Island Natural History Survey (Cranston, RI) "Fruit quality and consumption by songbirds during autumn migration" (w/ S.B. Smith)
- Annual meeting of the Society for Integrative and Comparative Biology (Orlando, FL). "Birds metabolically route exogenous nutrients to rebuild digestive organs after fasting." (w/ D. Podlesak)
- January 2006 Annual meeting of the Society of Integrative & Comparative Biology (Orlando, FL) "Effect of diet on plasma metabolites in a migratory songbird" (w/ S.B. Smith and C.G. Guglielmo)

Outcomes/Impact:

- This research involved the training of one Ph.D. student (Susan Smith) and one MSc student (Lillie Langlois) in field biology skills, laboratory analysis skills, and computer-intensive analysis of data. In addition, six undergraduate students participated in this research during 2006 and they were trained in various aspects of field biology and husbandry of captive birds.
- New insights obtained from this research include determining how body composition and blood metabolites of representative songbird species can be used to evaluate the quality of habitats and foods for migrating birds while they use stopover sites in southern New England.

- New insights obtained from this research allowed us to test current ecological hypotheses relevant to songbirds during migration. This knowledge of stopover sites for migratory birds enhances our ability to effectively manage coastal ecosystems for migratory species.

Source of funds:
☐ Smith-Lever
☒ Hatch
☒ McIntire-Stennis
☒ State
☒ Other (please list)

- The Nature Conservancy
- National Science Foundation

Scope of impact: New insights obtained from this research affected the following constituencies: (a) regional, state, and local non-profit conservation organizations, government agencies, and advisory groups interested in coastal zone management (e.g., The Nature Conservancy, RI Dept. Environmental Management, Coastal Resources Management Council, U.S. National Park Service, U.S. National Wildlife Refuges), and (b) scientific colleagues in the U.S. and abroad who are interested in blood indices of animal health that can be used to assess the quality of wildlife habitat.

GOAL 5: ENHANCED ECONOMIC OPPORTUNITY AND QUALITY OF LIFE FOR AMERICANS

PROGRAM 7. SUSTAINABLE AND NURTURING COMMUNITIES

Situation and Priorities:
The RI Sustainable and Nurturing Communities Program brings together outstanding natural resource and environmental economics research targeting the fishing/aquaculture industry, major CE outreach programs in sustainable agriculture/farm viability and the programming of the Children, 4-H and Families (CFF) Program Area targeting Rhode Island youth and their families. The CFF program continues to maintain a viable educational delivery system that meets critical client needs while moving through an in-depth review and strategic planning process to clarify our mission and vision with an integrated, sustainable business plan. Special attention is being focused on reconnecting the CFF programs to the academic and research expertise of the College of the Environment and Life Sciences while determining the appropriate scope and target audiences for this new, revitalized CE program area. During this process, program priorities continue to be addressed in the following areas: Human Development and Family Well Being and 4-H Youth Development.

Knowledge Areas: KA 601. Economics of Agricultural Production and Farm Management (Farm Management, Sustainable Agriculture and Agricultural Profitability); KA 602. Business Management Finance and Taxation (Financial Risk Management)

Situation:

Our Cooperative Extension Sustainable Communities program area addresses the need to strengthen the capacity of state and local organizations, municipalities and citizens, to make informed decisions and plan sustainable communities and farms, and manage resources and community assets wisely. Program delivery methods include, providing educational programs, information, organizational development support, technical assistance/consulting services, training and development opportunities for extension and agricultural service providers, farmers, community organizations and agricultural groups. The program priorities over the period of this report have been in the area of *sustainable agriculture/farm viability* with a focus on small-scale farms, and rural economic development with a focus on sustainable tourism – the state's second largest industry.

Outputs:

- *RI Small-Scale Farms Technical Support Project:* URI Extension was awarded (4/05) a $150,000 grant from the Northeast Regional Sustainable Agriculture Research and Education Program (SARE) for a 2 year program to provide small-scale farmers with the

technical assistance and timely information they need to increase production and adopt new sustainable agriculture practices.

- *Sustainable Tourism Initiatives:* Tourism is the second largest industry in RI. Agricultural and rural tourism is the fastest growing tourism sector. URI has worked with agriculture and tourism interests to provide information on sustainable development and management of tourism businesses and the natural and cultural assets on which they depend.
- *RI Partnership for Farm Viability*: URI Cooperative Extension entered into an ongoing strategic partnership with, the RI Center for Agricultural Promotion and Education (RICAPE), and the RI Division of Agriculture to develop and deliver educational programming and support services for RI farmers and growers that enhance the productivity, economic vitality and sustainability of agriculture in RI. We have also supported RICAPE's program organizational development goals through board and staff consulting, development of grant proposals, and programming partnerships.
- *Northeast Regional Collaborative Initiatives*: URI Cooperative Extension has established sustainable agriculture and rural development research and outreach collaborations with organizations in the Northeast Region including: Northeast Regional Sustainable Agriculture Research and Education Program, Farm Transfer Network of New England, and Northeast Regional Center for Rural Development/Land Use Network

Outcomes/Impact:

RI Small-Scale Farms Technical Support Project:
In January 2006, URI Cooperative Extension, with USDA/SARE, funding of $150,000, launched a two year project to develop and implement a system of technical support for small-scale RI farmers and growers engaged in the production of food, fiber and other non-ornamental agricultural crops. The project is also testing farmer preferences for information access. Consulting services, in-depth case management, and information resources are intended to foster the adoption of new sustainable agricultural practices and/or farm viability enterprises, improve decision making and problem solving.

Notable outcomes to date include:

- Project launch with the hiring of a program manager/sustainable ag specialist in February 2006; A representative program advisory committee has been formed composed of extension faculty, state and USDA agricultural service providers, farmers and farmer educators;
- Our project has been widely publicized and enthusiastically received by the RI agricultural community. To date, program information has been delivered at twenty-five farmer meetings, workshops and state forums, reaching an estimated 1,800 farmers and agriculturalists;
- A call-in information and referral system has been established, and the an interactive URI Sustainable Agriculture internet site has been launched in February 2007;
- A total of 75 farms have received on-farm consultations (multiple visits) regarding sustainable production methods and problem solving. The majority of farm visits have resulted in submissions of samples to the URI plant clinic and disease diagnostic laboratory. Plant clinic and University staff have worked together to identify these agricultural production pests and problems. The insight gained from this cooperative detective work has allowed RI extension staff to develop recommendations for growers

that incorporate sustainable practices that are economically feasible, work well within the grower's production philosophy, and are environmentally sound.
- We have instituted a clientele contact/data collection system to aggregate farm profiles and support services requested/provided. Data collection supports project research into farmer technical support needs and program/information delivery preferences.

RI Tourism Initiative

Sustainable Tourism Project

- Sustainable Communities Program Area staffs have collaborated with
- RI's Blackstone Valley Tourism Council (BVTC) to develop a position paper on sustainable tourism practices. The paper was presented/circulated to key legislators, the state Economic Development Corp.'s Tourism Division, and RI area tourism organizations and businesses and resulted in the formation of the RI Sustainable Tourism Network.
- In June 2006, Extension joined with BVTC to co-sponsor a workshop on "Voluntourism" – community centered tourism offering meaningful service learning experiences for visitors which provides local economic development, while addressing community needs.
- On November 15, 2006, the RI Tourism Network conducted the Sustainable Tourism Summit. Eighty-five tourism professionals, and government and business representatives attended this day-long forum featuring presentations by state and national tourism development experts, and which engaged attendees in workshops to create a blueprint for sustainable development and management of tourism assets in RI.

RI Agricultural Tourism, Research and Education Project:

- URI Cooperative Extension worked in association with RI Center for Agricultural Promotion and Education (RCAPE and RI DEM Division of Agriculture, to secure $85,000 USDA/SARE (via RICAPE) for a two year (2004-9/06) program to provide training and development opportunities in agricultural tourism and direct marketing to RI farms.
- Under RICAPE's leadership and in close association with Extension, this program has been providing a variety of professional services and support activities to educate inform and facilitate the development of agricultural tourism in RI. More than 250 individuals have benefited from this project, including through 10 workshops and a state conference reaching 100 farmers and 50 tourism and agriculture service professionals, and a state/regional conference. Critical connections with RI tourism professionals have been established.
- Eight farms were awarded mini-grants for projects innovation in education programming, farm site, farm access/amenities and physical plant upgrades, marketing materials, and new products and visitor activities.

Farm Assessments for Agricultural Tourism

- URI Extension also worked with RICAPE to consult with individual farmers in identifying on-farm assets that could be developed for ag tourism attractions and alternative enterprises, and products and/or services.

- Extension provided in-depth, on-site consulting services to 16 RI farms regarding, school field tour programming/curriculum development.

RICAPE Capacity Building:

- URI Cooperative Extension provided active support over the period of this report to the RI Center for Agricultural Promotion and Education (RICAPE) in the areas of strategic planning, program and organizational development, membership and governance, volunteer management and training, and public information.
- Extension assisted RICAPE with resource/sponsor identification and proposal and grant writing for K-16 educational programs, farm viability initiatives, and technical assistance for farmers and agricultural professionals, and for organizational development/capacity building of RICAPE and the RI agricultural community.
- Extension participated in the formation of the Agriculture Education Network and was instrumental in helping RICAPE (via URI) receive a $280,000 federal appropriation for "Campaign 2010- A Garden at Every School."

Sustainable Agriculture Outreach Education Planning and Site Assessment for URI Peckham Farm

- URI Extension, in association with URI's Landscape Architecture Program, Senior Design Studio and funded by a USDA/SARE grant, conducted a site assessment of URI's 300 acre Peckham Farm – a major research and teaching site and home to the RI 4-H program.
- An estimated 75 faculty, staff, extension clientele, agency partners and community stakeholders were engaged in an in-depth survey, and facilitated community forums designed to elicit opinions and suggestions for the future of the farm and extension sustainable agriculture programs. The process culminated in a report and recommendation to College/CE administration on the feasibility and design for site development of these important physical assets.

Northeast Regional Collaborative Initiatives:

Northeast Regional Sustainable Agriculture Research and Education Program;

- The USDA SARE program is a major funding source and primary support and coordinating body for the USDA Cooperative Extension Sustainable Agriculture national initiative via state land-grant universities. URI Extension is actively engaged in the regional SARE consortium and through this delivers the following programs: Staff training program development and delivery; promotion, networking and coordination for SARE staff and farmer/grower professional development opportunities, publications and grant programs. Over the period of this report three RI farmers received SARE Farmer/Grower Grants.

Farm Transfer Network of New England (FTNNE)

- URI Extension has worked with land-grant universities and affiliate organizations throughout New England to establish FTNNE - a regional collaborative to develop and deliver information resources and education programs about farm transition/transfer and related estate planning issues. In RI, an introductory "Transferring the Farm" workshop

was held 3/16/06 at URI. A total of 60 farmers and 10 agricultural service providers attended. Two more RI farm transfer workshops are scheduled for March 2007.

Source of Funds:
Smith-Lever
State
Other (please list)
- SARE

Scope of Impact: State and regional

Knowledge Area: KA 605. Natural Resource and Environmental Economics

Situation:
There exist alternative marketing approaches and approaches to negative publicity regarding seafood which have not yet been identified. This Multistate Hatch Project RI00W1004, *Marketing, Trade, And Management Of Fisheries And Aquaculture Resourc*es, will develop marketing strategies that will maximize the value of seafood products to both the consumer and the producer. This project has three major areas of : expand and develop seafood markets by developing new marketing ideas, identifying market niches, and developing alternative seafood products: improve fishery and aquaculture management by developing decision support tools to integrate management and marketing and increase the efficiency of fishery governance by developing ideas and knowledge supporting transition to market-based fishery management.

Outputs:
- Research on the impacts of ecolabeling on consumer demand for frozen seafood progressed in the past year with completion of two M.S. theses; demand analysis for salmon and a hedonic analysis of frozen seafood, both in the UK market.
- Progress was made on a M.S. thesis on the impacts of consumer concerns regarding PCB contamination of farmed salmon.
- 500 consumer surveys were collected in Rhode Island to assess consumers' preferences for ecolabeled and locally produced agriculture and seafood products
- On-going work is focusing on the impact of farmed shrimp on the US market and how shrimp aquaculture is changing prices.
- Conducted research to evaluate the aquaculture sector's degree of dependence on fishmeal supply.

Publications:
- Kristofersson, D. and J.L. Anderson. "Is There a Relationship between Fisheries and Farming? Interdependence of Fisheries, Animal Production and Aquaculture," *Marine Policy*, Vol. 30, No. 6 (2006):721-725.
- Baskaran, R. and J.L. Anderson. "Atlantic Sea Scallop Management: An Alternative Rights-based Cooperative Approach to Resource Sustainability," *Marine Policy,* 29 (2005):357-369.

- Anderson, J.L., "Economic Analysis: Shrimp Outlook 2006." In *Proceedings of the Global Shrimp Outlook: 2006*, Global Aquaculture Alliance, Key Biscayne, FL Nov. 5-8, 2006.
- Valderrama, D. and J.L. Anderson, "Improving Management of Atlantic Sea Scallops through Optimal Rotation of Fishing Grounds," *IIFET 2004 Proceeding: Rebuilding Fisheries in an Uncertain Environment*. July 11-14, 2006.
- Johnston, R.J. and C. Roheim. 2006. "A Battle of Taste and Environmental Convictions for Ecolabeled Seafood: A Contingent Ranking Experiment," *Journal of Agricultural and Resource Economics*. 31(2): 283-300
- Johnston, R.J., C. Roheim, D. Joglekar, and R. Pomeroy. 2006. "Estimating Preferences for Non-Market Attributes of Aquaculture and Sustainable Seafood Production: Methods and Empirical Applications." *International Journal of Environment and Pollution.*
- Roheim, C.A. and J.G. Sutinen. 2006. *Trade and Market-Related Instruments to Reinforce Fisheries Management Measures to Promote Sustainable Fishing Practices.* International Centre for Trade and Sustainable Development, Geneva, Switzerland, and the Organization for Economic Cooperation and Development – High Seas Task Force, Paris, France. www.high-seas.org.

M.S. Theses

- Greer, Jessica. M.S. 2006. "Estimation of Market-based Benefits of Marine Stewardship Council's Ecolabels on Frozen Salmon in the U.K."
- Gardiner, Lacey. M.S. 2006. "A Hedonic Analysis of the Retail Market for Frozen Fish in the United Kingdom and the Role of the Marine Stewardship Council Ecolabel"

Outcomes/Impact:

- The work on property rights, aquaculture and the future evaluated how the design of property rights institutions influences the success of the fisheries and aquaculture industries.
- The paper on tuna conservation links harvest timing and methods to tuna quality and, therefore prices for US-caught bluefin tuna in Japan. This information has been incorporated into an optimization model to illustrate how changes in fisheries management could improve net return in the East Coast tuna fishery.
- The work evaluating the global shrimp market is being actively used by producers, traders and buyers for supermarkets and restaurants throughout the US and abroad.
- The assessment of market benefits of ecolabeled seafood is being actively used by the entire supply chain and policy makers to determine if the benefits of environmental stewardship outweigh the costs.

Source of Funds:

☐ Smith-Lever
☒ Hatch
☐ McIntire-Stennis
☒ State
☒ Other (please list)

- USDA/NRI Markets and Trade program

Scope of impact: Local, multistate, national and international

Knowledge Area: KA 605. Natural Resource and Environmental Economics (30%); and KA 607. Economic Theory and Methods (70%)

Situation:

Hatch project, RI00H328 – *Spatial Modeling of Location Within a Fishery*, addresses the lack of spatial and dynamic structure in the current econometric models used to analyze location choice modeling in fisheries economics. The efficient management of marine resources relies on developing policies that synthesize the biological structure of the resource with the decision heuristics employed by harvesting agents. Previous studies conducted on decision heuristics have assumed that there doesn't exist any spatial structure to the data being analyzed. The purpose of this project is to expand the current fisheries literature focusing on location choice modeling by incorporating the potential for spatial interactions and spillovers. The model developed is a spatially explicit harvest decision model. FY06 project progress and impact to date listed below.

Outputs:

- Investigated the impact of homogeneous resource modeling in a heterogeneous fishery by synthesizing a stochastic production frontier model with the estimation classification algorithm. Resulted in a paper under review at the *Canadian Journal of Agricultural Economics*.
- Utilized minimal subset theory to illustrate the impacts of ignoring the second moment of a vessel' technical efficiency score on their overall ranking within a fishery. Resulted in a publication in the *Journal of Applied Econometrics*.
- Investigated the impacts of heterogeneous production and minimal subset theory on fishery capacity estimates. Resulted in a paper under review at the *Journal of Environmental Economics and Management*.
- Developed a spatial panel data estimator for highly mobile production processes. Resulted in a paper under review at the *Journal of Business and Economic Statistics*.
- Developed a spatially dynamic discrete choice estimator used to analyze spatial location choice modeling. Resulted in a publication in the *American Journal of Agricultural Economics* and another paper that is under review at the *Journal of Environmental Economics and Management*.

Publications:

- Flores-Lagunes, A., Horrace, W. C. and K. E. Schnier. "Identifying Technically Efficient Fishing Vessels: A Non-Empty, Minimal Subset Approach," forthcoming, *Journal of Applied Econometrics*.
- Hicks, R.L. and K.E. Schnier. 2006. "Dynamic Random Utility Modeling: A Monte Carlo Analysis," *American Journal of Agricultural Economics* 88(4): 816-835.

Outcomes/Impact:

- The spatial discrete choice modeling expands the random utility modeling literature and illustrates the conditions under which dynamic behavior should be accounted for in empirical analysis.
- The spatial discrete choice model illustrates the impacts of dolphin-safe tuna labeling on the spatial production practices of the Eastern Tropical Pacific Ocean tuna fleet during the time period 1979-1992.

- The heterogeneity modeling helps us refine our estimates of fishery capacity and capacity utilization as well a vessel's relative ranking within the fishery.
- The spatial panel estimator provides a new econometric method to estimate individual and time varying measures of technical efficiency.
- Papers under review at the following journals: *Canadian Journal of Agricultural Economics, Journal of Environmental Economics and Management (2 papers), Journal of Business and Economic Statistics.*

Source of Funds:
☐ Smith-Lever
☒ Hatch
☐ McIntire-Stennis
☒ State
☐ Other (please list)

Scope of impact: State, regional and national

Knowledge Areas: KA 605. Natural Resource and Environmental Economics (60%); and KA 610. Domestic Policy Analysis (40%)

Situation:

Effective management of our fisheries resources is critical to maintaining the health of our oceans and sustaining our recreational and commercial fishing communities. However, the current system of overlapping federal, state and local bureaucracies is not producing effective policies. The absence of management reform, many of our fisheries may enter ecological and economic crises. At present, there is little agreement on whether and how to reform fisheries governance institutions. We believe that the lack of agreement and lack of substantive ideas for reforming our fishery management institutions are rooted in the lack of understanding of how fishery management policies are produced. We propose to develop a comprehensive model of fisheries policy making and to subject selected hypotheses to extensive testing thus resulting in a new political-economic tool that will provide techniques for improving the design of fishery management institutions. FY06 Hatch Project RI00H105, *Experimental Analysis Of The Political Economics Of Fishery Governance* progress and impact to date listed below.

Outputs:
- Experienced subject experiments: Experiments with once and twice-experienced subjects show that contributions to lobbying fall to zero when the initial regulation is inefficiently strict. This suggests that among homogeneous agents, free riding is especially powerful when the benefits of public goods are allocated competitively.
- Experimental data analysis: we have determined that data are not consistent with our game theoretic model, instead showing more free riding.
- Manuscript: Sam Bwalya, the student who has developed the basic model and designed and ran the experiments, has completed his dissertation and has prepared a manuscript presenting the model and main aggregate experimental results. We are in the final stages of editing it for submission to a top general interest economics journal.

- Fellowship: A new student, Matt Freeman has successfully competed for a Sea Grant fellowship proposal to integrate into the base model heterogeneous agents. This has allowed us to continue this work beyond the final year of Hatch funding. In this environment, our current results might explain why large numbers of small agents have difficulty lobbying against efforts by one or a small number of large agents--who do not have the free rider problem--leading to regulations that favor a subset of agents. Matt is integrating heterogeneity into the model, and will run additional experiments to test its hypotheses once his model is complete.

Outcomes/Impact:

- We have shown that it is difficult for large groups to coordinate lobbying activity because free ridership is even stronger than game theory predicts when benefits from the public good are allocated competitively. This likely implies lobbying activity, and thus final regulations, will reflect the preferences of small groups of users which are better able to overcome the free rider problem. If so, this means that competitively appropriated resources are going to be better managed by apolitical means.
- Paper will shortly be submitted to the *Journal of Political Economy*.

Source of Funds:

☐ Smith-Lever
☒ Hatch
☐ McIntire-Stennis
☒ State
☐ Other (please list)

Scope of impact: State, regional and national

Knowledge Area: KA 802. Human Development and Family Well Being

Situation:

URI Cooperative Extension Children, Youth & Families staff (Bocage, Martin, Ogando) continued to focus on the human communities as prescribed in the plan of work. Program development focuses on human development and family studies as critical to family well being. Areas of emphasis include programs and research based information presented at the community level to address family structures stressed by poverty, creating weakened environments for child rearing; parenting skills, and programs to support community based shrinking resources utilizing educational information and referrals. The goal of these programs is to increase the number of individuals, families and community organizations trained in skills and competencies to cope with stressed environments. The Children, Youth and Families unit continues to monitor effectiveness of outreach efforts utilizing a variety of tested evaluative measures. Based on an annual needs assessment and RI demographic data, priority areas of work include:

1. Human Development throughout the life cycle
2. Parenting, parent child relationships
3. Child Care, dependent care and after school programs
4. Children, Youth and Families at Risk
5. Training and Development of Youth Workers

Evaluative Efforts:
Evaluations were conducted on workshops, with 5 questions assessing the quality of the workshop and information provided, and 4 questions assessing the quality of the presenter. For the 2005-2006 project year, 295 workshop participants completed the evaluation form.

- 97% of workshop participants rated the workshop quality as *Excellent*
- 98% of workshop participants rated the presenter quality as *Excellent*.

A neighborhood survey was developed to assess and determine the relationship between:

- Perceptions of the community
- Parenting style
- Levels of instrumental and emotional support
- Usage of community resources
- Attendance at FACE IT Workshops

Effects of Workshops on Parenting: Compared to parents who have not attended parenting workshops, those who have engage more significantly in nurturing parenting and less harsh parenting.

Outputs:

- Recruitment and sustaining of children, youth and community based agencies.
- Annual development of educational information based on community based needs.
- Translation of educational information into Spanish.
- Workshops develop included; Balancing Work & Families, Parenting Strategies, Providing Structure and Nurturance Across the life Span, Building Family Strengths, Parenting Children Birth – Age 6, Parenting School Age Children, Understanding Normal Changes in Adolescents, Childhood Aggression: Where does it Come From and How can it Be Managed? Psychosocial Development, Math, Math, Math,
- Updated and maintained web based Professional Staff Development and Life Skills Training curricula for early child care and school age providers.
- Development and maintenance of Web CT course in English and Spanish.
- RFP renewal for Face it Providence year 5 submitted to CSREES Children, Youth and Families at Risk Initiative.
- Recruitment of High School Seniors enrolled via their Family Consumer Science Teacher in the Children, Youth and Families Internship opportunity utilizing the CE Professional Staff Development and Life Skills curricula as part of their child development course for college credit through the URI Special Programs office.
- TrY CAPS leaders and youth continued their leadership and community service program efforts in the 3 at risk FACE IT Providence communities.
- Providence community Advisory Board (CAB) continued to serve as a resource to community based organizations.
- Continued development and implementation of evaluative assessment tools.

Outcomes/Impact:

- Community based organization membership was maintained.
- 50 educational workshops were marketed, developed and implemented at the community level.

- Educational information is offered in English and Spanish.
- 12 Home Day Care providers (underrepresented group) are enrolled in the College Credit Options.
- 773 participants enrolled and participated in We Come to You Workshop Series.
- Face It Providence funded by CSREES CYFAR, provided $134,000 to implement and expand program opportunities in the 3 highest risk communities in Providence.
- 73 high school seniors completed their internship in child development reaching a total of 1,858 children in early child care and school age community based settings.
- 162 TrY CAPS youth participated in neighborhood service, collecting and distributing toys, food and information.
- TrY CAPS youth program received non profit status and implemented 4-H curricula in its summer program for over 60 neighborhood youth.
- All workshop materials, evaluative instruments, web ct course information is available in English and Spanish
- Pre and Post Summative evaluation: Building Family Strengths appears to be the strongest workshop
- The Providence CAB (Community Advisory Board), as a self sustaining entity, continues to meet and address youth & family issues.
- The staffing pattern continues and provides a cohesive ecological report.
- A new two year collaborative math science project linking FACE IT Providence partners with 4-H was successfully funded by the URI College of Environment and Life Sciences via the CELS CARES Initiative.

Source of Funds:
☒Smith-Lever
☐Hatch
☐McIntire-Stennis
☒State
☒Other (please list)
- Children, Youth & Families at Risk Initiative (CSREES CYFAR)

Scope of impact: Local and State

Knowledge Area: KA 806. Youth Development

Situation:

The CELS 4-H Youth Development program continues to thrive while still in transition mode as the review and planning process for a new CFF program nears completion. The State 4-H Transition team (which consists of approximately 2.0 FTEs) continues to maintain ongoing educational programs. New efforts have been focused on building partnerships with other youth serving agencies, community organizations and school systems and reconnecting the program to its academic and research base. Increased emphasis has also been placed on partnering for external funding and program support. It has been recognized that the 4-H program must institute measures for better assessing the actual impacts/outcomes of the URI 4-H program. Major areas of program emphasis for FY05 include:

1. Youth initiatives in non-formal science, technology and healthy lifestyles

2. Life skills development in communication, problem solving and leadership
3. Self confidence, self esteem and a sense of belonging
4. Interaction and relationships with adults and peers through 4-H clubs and learning opportunities
5. Volunteerism and community service for youth

Outputs:

- State 4-H Staff and 324 4-H volunteers provided 849 4-H youth with research-based, educational experiences through various delivery methods including 4-H club meetings, workshops, clinics, field days, fairs, conferences and newsletters
- Recruitment and training of new 4-H volunteers continued as a priority to expand the delivery capability of state 4-H education mission.
- Strengthening programmatic connections within the College of the Environment and Life Sciences resulted in new partnerships with the college's Office of Student Affairs and the CE Water Quality Team. Each collaboration resulted in a funded proposal to further the CELS and CE Outreach mission through utilizing 4-H as the key delivery mechanism
- Continued to update and expand the information base of the state 4-H website as the major communication tool with 4-H teens and volunteers. Held two web classes to train 4-Hers and Volunteers how to create club websites, increasing their technology and communication skills. Thirty nine people participated.
- Recognized the achievement of outstanding 4-H members and volunteers - RI 4-H Awards Program and Banquet – Nineteen clubs submitted record books for county medal awards. In partnership with the RI 4-H Foundation and the 4-H All Stars, 233 4-H volunteers, members and parents attending a State 4-H Awards Banquet in their honor.
- Training programs for public presentations continued as 4-Hers and volunteers from 4-H clubs across the state participated in "Speak Up and Speak Out."
- Major educational programs and events for FY06 included District and State 4-H Public Presentations Contests, 4-H Teen Leadership Camp, State 4-H Photo Fine Arts Show, 4-H Conservation Field Day, 4-H Fitness Days, 4-H Horse Shows, Livestock Clinics and Judging Events, 4-H Fairs, New England Teen Conference, State 4-H Junior Conference for 9-12 year olds, Eastern States Exposition.
- The FY06 4-H State Conservation Field day focused on wetlands and waterways as 4-H members and volunteers spent the day at Sachuest Point National Wildlife Refuge in Middletown, RI learning about coastal habitats and resources. The program featured workshops on aquatic life, barrier beaches, birds, wildlife, plants, ecosystems and the US Fish and Wildlife Service. Program evaluations completed by the participants revealed a need for more programming in the area of wildlife and aquatics.
- Created 2 new non-competitive public presentation opportunities for 4-H members through new partnerships. "4-H Goes to the Zoo", a new partnership with the Roger Williams Park Zoo and the "4-H Farm School" in cooperation with the Washington County (state) Fair both provide 4-Hers with the opportunity to teach the public through demonstrations and illustrated talks about their 4-H projects and the life skills they have acquired.
-

Outcomes/Impact:

- Through 4-H project work, children demonstrated increased skills and knowledge with and about animals, and improved social and leadership skills through 4-H club activities, quiz bowl, hippology, judging, general knowledge tests, and putting together public presentations, exhibits, and learning stations. FY06 participations levels were: 160 4-H members enrolled in leadership, 172 in environmental education, 233 in public presentations, 302 in photography and visual arts, 271 in community service, 177 in the horse and pony projects, 98 with rabbits/cavies, 54 with dog care and training, 82 with dairy cattle, 60 with birds and poultry, 30 with sheep, 45 with goats and 32 with beef.
- Participation at the State 4-H Public Presentation contest in FY06 reflected an increase in the number of 4-Hers who achieved a score of 90% or better at the district events.
- Twenty three outstanding teens, who participated in the RI 4-H Teen Leadership Camp enhanced their leadership skills and then applied this new knowledge by running workshops and serving as mentors at the State 4-H Junior Conference. . The conference focused on introducing youth to various science based programs in our College of the Environment and Life Sciences.
- As documented through 4-H record books submitted to the state office for county medal awards, 104 URI 4-Hers carried out 2,264 hours of community service during FY06.
- Seven 4-H Clubs statewide were selected for Club Excellence Awards based on a combination of promoting 4-H in their community, demonstrating leadership expertise within the club structure, participating in multiple state learning opportunities, submitting record books for county medals and carry out a major community service project and a major 4-H leadership project during the current 4-H year. This was more than double the qualifying clubs for FY05.
- Over 97 4-Hers displayed 197 pieces of art work at the 22nd Annual Photo Fine Arts Show was held at the Warwick Mall. Over 175 mall goers stopped to vote on the "Viewers Choice Award" making the exhibit much more interactive and at the same time educating the public about the diverse opportunities available through 4-H.

Source of Funds: (check all that apply and add additional funding sources)

☒ Smith-Lever
☐ Hatch
☐ McIntire-Stennis
☒ State
☒ Other (please list)

- Rhode Island 4-H Club Foundation, Inc.
- District Cooperative Extension Associations
- Southern Rhode Island 4-H All Stars

Scope of impact: Primarily state specific, New England multistate collaboration

Stakeholder Input Process

Stakeholder input is secured in a variety of different ways. Our original Plan of Work classified these under eight categories. In general, we rely on existing statewide organizations to provide input on our research initiatives, outreach approaches and educational priorities.

We communicate with, seek input from, and coordinate with a host of state agencies, federal agencies and local groups, committees and commissions. At the state level we seek input from: the RI Department of Administration, RI Department of Education, RI Department of Environmental Management, RI Department of Transportation, RI Department of Health, RI Department of Human Services, RI Department of Elderly Affairs, RI Coastal Resources Management Council, Water Resources Board, RI State Conservation Commission, RI Rural Development Council, RI Farm Service Agency, RI Natural Resource Conservation Commission, RI Food and Agriculture Council, and RI DEM-Division of Agriculture. At the Federal level we work closely with EPA Region I, the Department of the Interior, USGS, USDA, and local federal NRCS office. At the local level, we rely on focus groups, watershed councils, project-specific committees of town officials, Soil Conservation Districts and citizen groups for stakeholder input. Local organizations include: RI Food and Agricultural Council, RI Farm Service Agency, RI Farm Viability Committee, RI Chapter of the Nature Conservancy, Audubon Society of RI, local land trusts, Save the Bay, Environment Council of Rhode Island, RI Council for Agriculture Promotion and Education, RI Partners for Resource Protection, RI Grow Smart, the RI Chapter of the American Planning Committee, Source Water Assessment Committee, RI Natural History Survey, RI Builders Association, Soil Scientists of Southern New England, RI Independent Contractors Association, the RI Chapter of the American Water Works Association, Progreso Latino, Crossroads RI and the RI Community Food Bank.

Within the programs that use volunteers (e.g., Home-A-Syst, Watershed Watch, 4-H) we host listening post gatherings throughout the year to seek stakeholder needs and to receive feedback on our programs. All of our outreach/research programs have steering committees that consist of representatives from the private sector, local and state government, citizen groups, research scientists from the RI AES and educators from RI CE.

We continue to work closely with industry-based organizations like the RI Nurserymen and Landscape Architecture Association, the RI Golf Superintendents Association, the New England Golf Superintendents Association, Ocean State Aquaculture, the RI Seafood Council, RI Shellfisherman's Association, RI Veterinary Medicine Association and the RI Apple Growers Association.

Program Review Process

Program review, including project merit and peer review, are the responsibility of the Director, Associate Director and six Program Leaders.

Projects are awarded through a competitive, outcome-oriented annual request for proposals. Project proposals are peer reviewed by scientists external to URI and by the program leaders. They are prioritized based on anticipated outcome (merit), as well as goodness of fit to the program areas, quality of science, integration with extension, and multistate collaboration. Projects normally run 3 years, and funding typically includes support for graduate students, a small operating budget, and travel. Station funds also support a limited number of support staff for research and outreach operations as well as partial support for other research associates and assistants.

We have included the request for proposals for projects funded in FY 2006 (Appendix A) to provide details of the entire process, including statements of priority research areas (based on the Plan of Work Programs), and the specific instructions on target audience and outcome orientation. The RFP also includes complete documentation of procedures used for project review in the Station.

In addition to federal formula funds, all of our programs depend on external funds. We submit proposals to competitive grant programs primarily through the CSREES, EPA, NIH, NSF, DOC, and the State of Rhode Island. These proposals are peer reviewed and funding is merit based. We gain insights into the merit of our work from the feedback and assessment we obtain from the proposal reviews, along with the reviews that we receive from annual and final reports that are required by the granting agencies.

While we have moved far in changing the funding strategies used by the Station—from a near entitlement, curiosity-driven research approach with an annual disbursement of research funds to academic departments to a program and project based, outcome-oriented competitive process—we have not made commensurate progress on the Extension side. This is due largely to the high percentage of Extension funds devoted to long-term personnel. Nevertheless, we are committed to reorienting our Land Grant portfolio toward outcomes-based endeavors. We look forward to the challenges of meeting our target audience's needs.

Evaluation of the Success of Multistate, Multi-institutional, and Multidisciplinary Activities, and Joint Research and Extension Activities

Did the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

For activities that we conducted in FY 2006, yes we addressed issues of strategic importance. As we have indicated, AES funding is predicated on outcome-based proposals, with a clear focus on target audiences. We now require further management refinements to follow-up on this commitment, to verify that intended milestones are addressed on a project-by-project basis, to clearly document impact of our work and ensure that our identified target constituencies remain involved in all aspects of our programming process.

Did the planned programs address the needs of under-served and under-represented populations of the state?

Yes. We have attempted to develop a full range of programs that serve all segments of society, without regard to community, economy, or scale. Food safety and nutrition continues to be aimed at populations in greatest need, particularly in economically challenged communities and among the elderly. Our nutrition programs reach a wide spectrum of lower-income populations residing in metropolitan and rural areas of the state. This also includes adults, children and older adults who are minorities. Our agricultural programs provide benefits to all through the success of new biological control releases, the development of improved plant strains, advancement of plant management strategies and progress in new technologies that advance animal production. Aquaculture research and outreach efforts meet the needs of industry leaders, as well respond to small-scale producers with equal intensity. Water quality and natural resource management affect all Rhode Islanders. Our sustainable community's initiatives are particularly sensitive to addressing the needs of many of our rural towns.

Did the planned programs describe the expected outcomes and impacts?

We believe that we have made substantial progress in doing this. Each of the projects described in this report articulate both outcomes and impacts. We will continue to refine impact reporting, the most critical of elements in defining the success of a program.

Did the planned programs result in improved program effectiveness and/or efficiency?

The outputs, outcomes, and impacts described in this report suggests that we are productive and on track with CSREES objectives and the intent of the RI POW and RI POW Update. Further, by orienting our Land Grant programs to an outcome-based program we now have the means to self assess our effectiveness and efficiencies. Identifying priority areas, seeking extensive stakeholder input and carefully documenting the impact of our work have been key elements in improving our Land Grant program effectiveness.

Multistate Extension Activities

Many of our extension programs are developed, coordinated, and operated in collaboration with sister institutions in other northeastern states.

The presence of a USDA-APHIS approved insect quarantine facility on campus serves as a regional focal point for biological control efforts involving new species, with particular and nationally unique emphasis on invasive plants and pests of ornamental plants. Programs in horticulture, turfgrass management, and aquaculture are all increasingly multistate, with focus on regional annual meetings, as highlighted under the Knowledge Areas described herein.

URI Watershed Watch cooperates with Extension Programs from the University of New Hampshire and the University of Maine through the New England Regional Monitoring Collaborative. Watershed Watch also works closely with the UNH CE in the coordination of regional lakes conferences and regional and national volunteer monitoring conferences. The URI Municipal Watershed Management Program coordinates with the NEMO (Nonpoint Education for Municipal Officials) program from Cooperative Extension of the University of Connecticut. The URI Home-A-Syst program develops training materials in conjunction with CE programs from across the Northeast**.** In addition, the URI Onsite Wastewater Training Center participates in the Consortium of Institutes for Decentralized Wastewater Treatment. The Consortium has twenty-two member institutions throughout the US and Canada, these are listed in Section A: Multi State Extension section. In August, 2004, URI was again identified as the lead institution for the regional "406" multistate, 4-year project which unifies water quality research and outreach programs at the six New England land grants.

Our outreach efforts in food safety, nutrition, and youth programs all benefit from annual conferences, presentations made across state lines, and multistate USDA 406 projects.

Integrated Research & Extension Activities

To the fullest extent possible, all RIAES research projects are committed to full integration with extension. That is, all projects are funded on the basis of outcomes, which are expected to occur when specified target audiences use the outputs of research to accomplish specific performance goals. We have attached the project guidelines for FY06, which were adapted with minor changes from those established in January 2000, to document the commitment to integration of research and extension. We have also attached the FY06 RIAES project portfolio (continuing or new projects that have completed RI review and approved by CRIS.) Last, the expenditure data for Integrated Activities is attached in the Appendix. As we complete the implementation of outcomes-based projects focused on the needs of the target audiences, we believe the portfolio of Station projects will reflect extensive integration of our research and extension efforts.

The integration of AES and CE projects would be advanced by greater cooperation on research-related multistate projects in areas of strength such as water quality, IPM, land-use planning, aquaculture, apples, turfgrass, etc. Rhode Island is providing regional leadership in this area of integration and will continue to do so.

Administrative Accomplishments and Results

An advisory management team consisting of six program leaders, the Director and Associate Director has been established consistent with the recommendations and requirements of AREERA. The advisory team has continued to refine guidelines for AES projects, incorporating all aspects of the AREERA requirements. Below we list the program leaders and the Goal and Program for which they provide oversight.

Program Leader in Sustainable Agriculture-Dr. Brian Maynard: Oversees the implementation of Goal 1-An agricultural system that is highly competitive in the global economy Program 1-Landscape horticulture and technology for sustainable agriculture.

Program Leader in Animal Health and Aquaculture-Dr. David Bengtson: Oversees the implementation of Goal 1, An agricultural system that is highly competitive in the global economy, Program 2 Aquaculture biotechnology and fishing and Goal 2-A safe and secure food and fiber system, Program 3-Health and well-being of fish and animals.

Program Leader in Food Safety and Nutrition-Ms. Linda Sebelia: Oversees the implementation of Goal 2-A safe and secure food and fiber system, Program 4-Food Safety and Goal 3-A healthy, well nourished population, Program 5-Nutrition

Program Leader in Natural Resources-Dr. Arthur Gold: Oversees Goal 4-Greater harmony between agriculture and the environment, Program 6-Natural resource and the environment

Program Leader in Program Leader in Children, Youth and Families /Sustainable Communities- Ms. Marcia Morreira: Oversees Goal 5-Enhanced economic opportunity and quality of life for Americans, Program 7 Sustainable and nurturing communities

These Program Leaders serve as a very important role as an advisory body to the Director and Associate Director regarding every facet of the Land Grant Programs at URI. The RIAES web site is currently under revision and now has on-line description of current research programs and projects (see http://riaes.cels.uri.edu/).

We have diversified our Land Grant funding portfolio and advanced our endeavors to integrate research and extension activities. Indeed, we are preparing to implement a new, university-wide integrated research and extension, competitive grants program. Last, we have shifted resources in RI CE, but face significant personnel challenges as a result of the great percentage of statutory CE personnel on the federal budget. However, we are committed to change. To this end, we are currently in the process in revising our programs that are dedicated to Children, 4H and Families.

APPENDIX

RIAES Call for Proposals FY 2006
CELS CARES Integrated FY 2006
CELS CARES Innovative FY 2006
RIAES Portfolio of Current Projects
FY 2007 Funded CELS CARES Initiative Proposals

College of the Environment and Life Sciences and the Rhode Island Agricultural Experiment Station FY2006

CALL FOR PROPOSALS

The Rhode Island Agricultural Experiment Station (RIAES) is dedicated to supporting relevant, outcome-oriented and hypothesis-based research.

SCHEDULE. The Rhode Island Agricultural Experiment Station requests proposals for fiscal year 2006.[1] This solicitation is for multistate, integrated Hatch research projects. (An integrated project is one that has an extension component.)

If you are interested in submitting a proposal, please provide Rick Rhodes with a statement indicating the multistate project that you expect to join, the title of the project and a list of 5 possible external reviewers by November 15, 2004.

External Reviewers List: List 5 reviewers who have professional expertise in the area of your proposal. Provide the mailing address, telephone number and email address. Do **not** contact reviewers to obtain their prior agreement. The RIAES Director may also seek other reviewers. Reviewers will be asked to assess the proposal (the review form is available from the RIAES office) and to recommend acceptance, rejection, or improvements. Include with the external reviewer list, a conflict-of-interest list. The conflict of interest list should include all people with whom you have been a co-author, co-PI, or major professor, during the last 5 years.

Proposals are due December 15, 2004. All proposals will be externally peer-reviewed and internally reviewed by the Program Area Leaders for RIAES and the Associate Director and Director of RIAES. Decisions for funding will be completed by February 15, 2005. Projects typically run for 3 years. The RIAES expects that the average allocation for a standard project will be approximately $20,000 plus a graduate student tuition waiver, if appropriate. A larger budget will be available for multi-investigator projects. No overhead is charged to RIAES projects.

ELIGIBILITY FOR FUNDING. All tenure-track faculty, Appendix F faculty, Research Associates and Educators may apply. **PIs may not receive funding for more than one ongoing Hatch project – investigators with an approved individual or multistate Hatch Project for FY 2006 are not eligible for this year's competition.** .

PRIORITIES FOR STATION FUNDING (as described in the RIAES/CE *Plan of Work* and *Plan of Work Update* available at www.riaes.org).

- Aquaculture and fisheries
- Biotechnology
- Animal health

[1] Begins October 1, 2005.

- Coastal environments
- Food safety
- Nutrition
- Natural resources
- Nurturing and sustainable communities
- Sustainable agriculture

OTHER AES OPPORTUNITIES FOR FY 2006:

The RI AES will send out a second request for FY 2006 project proposals that will provide faculty release time and up to several thousand of dollars for operating, travel or student payroll for projects relevant to the mission of the RIAES. These "strengthening" projects are intended to bolster the research capacity of faculty who can benefit from release time to generate outputs and outcomes on their own, through leveraged resources.

GUIDELINES FOR PROPOSALS

TITLE PAGE:

Title *(maximum 100 characters)*

PI Name(s) and Departmental Affiliation(s)

Type of Proposal: MULTISTATE HATCH

- **Multistate Hatch Projects**: These proposals must support the goals and objectives of an approved or pending multistate project and have an extension component. (A list of multistate projects is available from the Associate Director and Program Leaders.) The proposal could be a "seed" grant for new ideas, an "umbrella" that ties together several existing lines of hypothesis-based research or a complementary proposal that strengthens and supports an existing, externally-funded project. The PI needs to be able to articulate the long-term goals and benefits of this line of research.

I. NARRATIVE: LIMIT TO 7 SINGLE-SPACED PAGES. (12 POINT, 1" MARGINS)

I. A. ISSUE(S) TO BE ADDRESSED AND JUSTIFICATION:
Include a clear statement of what the project will address, the long-range importance of the project, the type of project, objectives and hypotheses. What are overarching scientific or societal problems that your work will address? How does this project fit into the multistate objectives? As appropriate, consider the likely economic, environmental, or social benefits from this research.

I. B. STATE SPECIFIC OBJECTIVES AND HYPOTHESES:
All projects must explicitly state the hypotheses or questions being asked and the research objectives.

I. C. PREVIOUS AND PRESENT WORK: Describe the current status of research in this field. S*ummarize* previous and current research on the problem. All work cited should be referenced.

I. D. EXPERIMENTAL PLAN: ***Explain the methodology to be used, and how tasks will be divided amongst PIs if appropriate. Include a tentative schedule for conducting major steps involved in these investigations and/or experiments.***

I.E. INTEGRATION WITH EXTENSION EFFORTS: ***Proposals should link to ongoing extension efforts at URI (or other institution.) Identify the extension outcomes (i.e., how will the knowledge derived from this research enhance the public's capacity to address and solve a particular issue), outputs (i.e., what specific training activities or training materials will emerge from this project) and the***

extension professionals and programs at URI (or elsewhere) who will cooperate with this project.

I. F. LEVERAGING: Proposals are expected to as magnets for additional outside funding. A description of the details on outside funding sources and the relevance of this proposal to the priorities of external funding sources is recommended. How will this project strengthen and complement your existing research? How will this research lead to further studies supported by external grants?

II. APPENDICES: (over and above the 7 page limit)

II. A. EXTERNAL LINKAGES: List colleagues from local, state, or federal agencies (include institution); or from the private sector (include company), with a brief annotation of how they are essential to or enhance this project.

II. B. RELATED PROJECTS: Clarify relationships to other projects and the enhancements made possible by AES support.
Extension and Outreach: List related outreach projects (Cooperative Extension or other) and collaborators—internal and external to URI—and note how these projects will benefit from results of this research.
Research: List major research projects you are involved in that complement this proposal including current or pending projects.

II. C. CURRICULUM VITA: Include a 1-page CV for each PI on the proposed project, plus:

- A separate section listing all AES projects, peer-reviewed publications, extension projects, external grants, and graduate students trained in the past five years.

Budget

Provide a completed budget. **A budget justification must be included**. The RIAES expects that the average allocation per funded project will be approximately $20,000 plus a graduate student tuition waiver if appropriate. A larger budget may be available for multi-investigator projects. No overhead is charged to RIAES projects. **Seed projects will normally be funded for either a shorter time period or receive less annual funding than other types of projects.**

Budgets will be reviewed and renegotiated annually, and funds will be contingent upon productivity, effort and success in attracting related external funds, availability of AES funds, and on AES priorities. *RIAES reserves the right to terminate a project and discontinue funding for lack of activity or productivity, or to deal with fiscal emergencies should federal funds decline.*

Budget Justification:

Personnel: Tenure-track PIs may not request summer salary. *Non-tenure track faculty and research associates may request up to two months of salary; however,* Specify research associates or technicians, by name if appropriate, and their role in the project.

Graduate students: RI AES seeks to encourage graduate student education in its research mission and views with favor, projects with graduate student involvement. Specify MS or Ph.D. students. The awarding of AES assistantships will be done in consultation with the academic departments. Assistantships are for the academic year only.

Undergraduate students: Specify number of hours per week.

Equipment, Travel and Other costs: Needs for supplies, travel, equipment, and other operating.

Matching Funds: The Station must match federal formula funds with non-Federal funds. It uses salaries of scientists, based on time identified via URI's workload processes. **Third-party match** is defined as non-Federal and non-URI match funding, such as funding from other state agencies, non-governmental organizations, private business, or individuals.

RFP APPENDIX
PROCEDURES FOR APPLICATION REVIEW, INITIAL APPROVAL, ANNUAL REVIEW, AND FUNDING

REVIEW AND APPROVAL PROCESS. Proposals will be first reviewed for required content, outlined in the *Instructions for Project Proposals*, using the following checklist ☑:

☐ Issue: Is the project congruent with a Program in the RIAES *Plan of Work* and *Plan of Work Update*?
☐ Justification: Is there strong justification for priority funding?
☐ Objectives: Are objectives clear, posed as scientific questions?
☐ Background: Is there a summary of previous and present work?
☐ Methods: Are methods clearly summarized?
☐ Performance Targets (Outputs): Is there a plan for producing tangible results including how this will serve both research and extension?
☐ Milestones: Are critical points of achievement that are necessary for progress toward the performance targets clearly annotated?

Complete proposals will be forwarded for external review. Review and evaluation will be based on the following criteria:

☐ Science and Technology: Does this proposal use top quality science and technology? Relevant questions include:

- Is the PI familiar with relevant contemporary investigations?
- Are the objectives clear?
- Is the approach to the investigation clear and appropriate to meet the objectives?
- Are the principal investigator(s) and specified members of the research team qualified to conduct the research?
- Are the facilities and equipment (existing or proposed) of the Rhode Island Agricultural Experiment Station adequate for the PI to perform the proposed research?

☐ Relevance to RIAES Plan of Work: Will this proposal lead to significant outcomes related to the issues outlined in the Plan of Work?

☐ Capacity: Will this project increase our capacity to compete for external funds to support research or outreach?

☐ Previous AES and Externally Funded Research Record: The Station will conduct a review of performance over the past 5 years of Station involvement, or will otherwise seek evidence that the researcher has an established record indicating a high probability of tangible outputs.

☐ Integration: Does this project propose meaningful linkages with RI Cooperative Extension or a similar outreach avenues?

☐ Continuity: Will this project complement and provide stability to an on-going successful line of research or outreach that is otherwise sustained on external funding?

Approved proposals will be sorted against other proposals, again using the above criteria, and funded by priority until funds are exhausted. Peer reviews and comments by the Program Leader or the Director will be returned to the PI along with the approval and funding decisions.

ANNUAL REVIEW AND APPROVAL FOR CONTINUATION. Once each year, the PI is expected to provide a brief progress report via CRIS form AD-421, and to respond to any specific requests from the Director or Associate Director regarding progress. Response to this request in a timely fashion is a prerequisite to continued funding and time/effort release. The annual reporting will involve an update on progress toward proposal milestones, a listing of specific outputs (publications, patents), and a brief narrative of how results are being translated into project outcomes when used by target audiences. This report will be reviewed by the Program Leaders, the Director and Associate Director. It is intended for inclusion in the Annual Report of Progress filed by the Station, and the project will be authorized for continued support. Alternatively, insufficiencies will be explained and a schedule for their remedy will be developed jointly by the PI and the Program Leader. Subsequent failure to bring the work of the project to a satisfactory level of progress will result in termination of the project.

University of Rhode Island
College of the Environment and Life Sciences
Rhode Island Agricultural Experiment Station and
Rhode Island Cooperative Extension

Call for Proposals that Integrate Research with Extension
Anticipate funding 2-4 projects for a duration of two years with project awards averaging $50,000 per year

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Mission

CELS CARES (College of the Environment and Life Sciences' Community Access to Research and Extension Services) is a new, inclusive initiative meant to foster on-going or new innovative programs that fully integrate research with Extension. This campus-wide opportunity will enhance community access to an array of integrated resources, including cutting edge research, new knowledge, contemporary information and applications, technology, curricula and strategies - directly improving the lives of Rhode Islanders.

Description

As part of the ***CELS CARES*** (**C**ommunity **A**ccess to **R**esearch and **E**xtension **S**ervices) initiative, the URI College of the Environment and Life Sciences requests proposals for fiscal year 2006 that **fully integrate research with extension activities.** This is a new initiative meant to stimulate innovative collaborations and cultivate partnerships around the Land Grant priority areas, including aquaculture and fisheries, biotechnology, animal health, coastal environments, food safety, nutrition, natural resources, nurturing and sustainable communities and sustainable agriculture.

Of primary importance will be: 1) a clear articulation of how proposed projects will directly link URI departments with extension; 2) a plan for how the funding of projects will stimulate the leveraging of additional external funds, resources and partnerships; 3) what matching funds (salary and/or third party match, e.g. non-federal, state or municipal funds) will be brought to support the project; and 4) the potential impact and plan for the evaluation of findings and programs on expanding the research knowledge base and directly improving the lives of people or the environment in which they live (relevance to the Land Grant Mission).

REQUIREMENTS for SUBMISSION

Due date for Integrated Proposals: December 15, 2005 (external review process)

Notification of Awards: March 1, 2006

Duration of Projects: 2 years (time horizon with justification are required in the proposal)

Eligibility for Funding: All tenure track faculty, Appendix F faculty, Research Associates and Extension Educators may apply.

External Reviewers List: List 5 reviewers who have professional expertise in the area of your proposal. Provide the mailing address, telephone number and email address. Do not contact reviewers to obtain their prior agreement. The RIAES Director may seek other reviewers. Reviewers will be asked to assess the proposal and to recommend acceptance, rejection or improvements (please see *Review Process and Evaluation Criteria*, attached). Include with the external reviewer list, a conflict of interest list. This conflict of interest list should include all people with whom you have been a co-author, co-PI, or major professor, during the last 5 years.

Logic Model: The Logic Model is cyclical and can be used for planning, evaluating and reporting. All progress and impacts will be reported at the end of Year 1 and upon project completion using the Logic Model (*reference here or web site address for access*). The Logic Model depicts a broad continuum of strategies and activities at the individual/household, community/institution, and social structures/policy levels. Use of the Logic Model will be a required component of the proposal.

Please submit 1 hard copy and 1 electronic copy to:

College of the Environment and Life Sciences
CELS CARES Integrated Projects
Office of the Associate Dean/Director of Research and Extension
113 Woodward Hall
University of Rhode Island
Kingston, RI 02881

GUIDELINES for PROPOSALS **(12 point, single spaced, 1" margins)**

I. Title Page (1 page)

Title of Project
PI Names and Departmental and Extension Affiliations
Contact Information
Type of Proposal: Integrated Research and Extension

II. Narrative (10 pages, maximum)

A. Introduction

Issues to be addressed, justification and description of previous work.
Include a clear statement of what the project will address, the long-range social, economic, or environmental importance of the project; how the project is a fully integrated research/Extension effort; how findings will serve to leverage additional or new opportunities, partnerships or community programs and which of the Land Grant priority areas it will address. Briefly summarize the body of knowledge or past activities which substantiate the need for this integrated effort.

B. Objectives and Hypotheses

Explicitly state the hypotheses or questions being asked; the aims of the proposed work; articulation of research/extension integration and collaboration; expected outcomes, deliverables and impacts.

C. Methods **(this should include a time/event horizon)**

Detailed and explicit explanation of research and extension activities, methodology or techniques related to the proposed effort; description of baseline assessments and stakeholder involvement.

D. Evaluation Plan

Use of Logic Model to track and report inputs, activities, outputs (activities and participation) and outcomes (short-term, intermediate and long-term impacts); discipline or project specific methods of evaluation; data management, analysis and interpretation.

E. Dissemination Plan

Details of plan to disseminate findings to colleagues, stakeholders and the public.

III. Budget (1-2 pages)

The Integrated CELS CARES initiative expects that the average allocation per funded project will be $50,000.00 per year, for a maximum of two years. A fully articulated budget supported by a budget justification/explanation, must include a description of personnel and their role in the proposed project, equipment, travel, operating/supplies or sub-contracts; and, the type and amount of matching funds brought to this effort, including third party match (non-Federal, such as URI faculty time, or match from other state agencies, non-governmental organizations, private business, or individuals). A brief, but detailed plan for the sustaining the integrated effort by securing outside funds once the two-year phase of the project is completed should also be presented here.

IV. Appendix

a. Logic Model Summary (1 page)
b. Curriculum Vita (1 page each)
c. List of Community Based Partners and Letters of Support or Agreement (External Linkages)
d. References/Bibliography/Additional PI Publications or grants related to the proposed work

REVIEW PROCESS and EVALUATION CRITERIA

A. Proposals will first be reviewed for required content, as outlined in the *Guidelines for Proposals*, using the following checklist:

- ☐ Issue: is the project congruent with the Mission of the CELS CARES initiative and the Mission of the Land Grant?
- ☐ Integration: Does the project propose meaningful linkages between research and Extension?
- ☐ Justification: Is there strong justification for funding?
- ☐ Objectives: Are the objectives clear and posed as scientific questions?
- ☐ Performance Targets (Outputs): Are the targets reasonable and relevant to improving the lives of Rhode islanders or the environment in which they live, and, is the Logic Model used effectively to describe expected inputs, outputs and impacts (outcomes)?
- ☐ Is an event horizon/time line clearly articulated?
- ☐ Is there a plan for the dissemination of results to stakeholders?
- ☐ Is there a plan presented for sustained funding or support to continue/ evolve this work?
- ☐ Are the budget and budget justifications reasonable, complete and accurate?

B. Complete proposals will be forwarded for external review. Evaluation will be based on the following criteria:

1. Technical and scientific merit of all aspects of the project including research and extension outreach/education.
   - ☐ Are the investigators familiar with relevant contemporary investigations and are they qualified to conduct the proposed, integrated work?
   - ☐ Are the proposed methods based on the most current technologies and theories?
   - ☐ Are the objectives clear, adequate, appropriate and relevant?
   - ☐ Are the facilities, staffing plan, partnerships and equipment adequate to perform the proposed work?

2. Integration
   - ☐ Is the approach one that fully integrates research activities/faculty with Extension activities/faculty/staff, as well as with community partners?

- Does the approach present an equal role for research and Extension staff?

3. Relevance of the proposed project to the Land Grant Mission and immediate community issues.
   - Does the project reflect one or more priority areas, including aquaculture and fisheries, biotechnology, animal health, coastal environments, food safety, nutrition, natural resources, nurturing and sustainable communities or sustainable agriculture?
   - Does the proposed work address identified needs in the community?

4. Capacity and Continuity: Potential for the project and staff to increase capacity (further leverage funds and resources).
   - Will this project provide the basis for work that will be able to be sustained by external funds?
   - Will the results of this project increase capacity to compete for external funds to support further integrated work of this kind?

5. Articulate and appropriate plans for evaluation and the dissemination of findings, including recognition of potential pitfalls which may require retooling or methodological adjustments.
   - Appropriateness, agility and quality of monitoring and evaluation plans
   - Plan for the dissemination of findings is complete, comprehensive, culturally sensitive and inclusive.

OVERALL RATING by EXTERNAL REVIEWERS

1. The project should address issues of substantial importance to the state, region or nation (basic and applied) and be cutting edge in nature. Please rate this project on the relevance of its objectives to current scientific knowledge and contemporary investigations in this field.

_____Excellent
_____Good
_____Fair
_____Poor
_____Unacceptable Comments:

2. The project should demonstrate appropriate approaches and methods, and use of relevant contemporary technology. Please rate the project on the strength of its approach to objectives.

_____Excellent
_____Good
_____Fair
_____Poor
_____Unacceptable Comments:

3. The project is required to be a fully integrated effort creating a new, or strengthening an on-going partnership between research and extension faculty, staff and activities to improve the lives of Rhode Islanders or the environment in which they live. Please rate this project on the clarity, extent and appropriateness of its research/extension integration.

_____Excellent
_____Good
_____Fair
_____Poor
_____Unacceptable Comments:

4. The success of this project may depend on the qualifications and experiences of the integrated team, as well as on the capacities of the facilities, equipment, and existing partnerships available to support the proposed work. Please evaluate the track records of the research/extension team considering past research and outreach productivity (e.g. external grants, peer-reviewed and consumer publications, successful partnerships in the community at large). Please rank this project on the strength of the team and its capacity to accomplish stated objectives.

_____Excellent
_____Good
_____Fair
_____Poor
_____Unacceptable Comments:

5. The results of these two-year, integrated projects are expected to lead to significant impacts for clearly identifiable target audiences. Rate this project on the merits and credibility of outcomes and impacts as described in the proposal and as projected in the Logic Model.

_____High merit and high credibility
_____Satisfactory merit and credibility
_____Low merit or of dubious value
_____Unclear as to whether this project will return any significant public benefit
Comments:

6. This integrated project is expected to provide the base for continued integrated work in this area. Will this project increase faculty and staff capacity to leverage additional funding or to be better positioned or prepared to compete for external funds to support future evolutions of this work? Please rate this project on the likelihood that it will significantly advance the competitive status of the integrated team.

_____Highly likely
_____Somewhat likely
_____Somewhat unlikely
_____Unlikely
Comments:

Please attach any additional comments that you feel will be helpful to the review of this project.

CELS CARES: Innovation in Cooperative Extension
Call for Proposals
University of Rhode Island
College of the Environment and Life Sciences
Rhode Island Agricultural Experiment Station
Rhode Island Cooperative Extension

Mission

CELS CARES (College of the Environment and Life Sciences' Community Access to Research and Extension Services): ***Innovation in Cooperative Extension*** is a one-time initiative to foster innovative programs in Cooperative Extension. The goal of this RFP is to stimulate creative ideas that extend critical knowledge to stakeholders in our state, the region and the nation. We envision this program providing seed resources for efforts that are expected to be self-sustaining within two years.

Description

As part of the ***CELS CARES*** (**C**ommunity **A**ccess to **R**esearch and **E**xtension **S**ervices) initiative, the URI College of the Environment and Life Sciences requests proposals for fiscal years 2007/2008 (October 1, 2006-September 30, 2008) that meet the mission of the RFP**.** We envision funding up to two projects at $50,000/year for two years. (Innovative projects of a smaller scope will also be considered.) As part of the URI Land Grant Mission, Cooperative Extension provides outreach in a number of different areas, including aquaculture and fisheries, biotechnology, animal health, coastal environments, food safety, nutrition, natural resources, children, 4-H and family programs, and sustainable agriculture. A description of priority areas can be found in the CE/RIAES Plan of Work Update at:

http://riaes.cels.uri.edu/resources/planofwork.html

We are looking forward to funding compelling, innovative proposals. Hence, of primary importance will be: 1) a clear articulation of how proposed projects will expand the value of URI's Cooperative Extension efforts to address the needs of Rhode Island's citizens and their environment, and the relevance of the effort to URI's Land Grant Mission; 2) a plan for how the funding of projects will stimulate the leveraging of additional external funds, resources or partnerships; 3) provision of one-to-one matching funds (salary and/or third party match, e.g. non-federal, state or municipal funds) to be applied to support the project; and 4) a description of the

potential impact of the proposed program(s) and plan for the evaluation of findings and programs.

REQUIREMENTS for SUBMISSION

Letter of Intent: 4:30 PM on December 9, 2005.
The Letter of Intent will be used to select appropriate external reviewers. CSREES/USDA National Program Leaders will also be contacted to be part of the proposal review team.

Due Date for Proposals: 4:30 PM on January 20, 2006.

Notification of Awards: April 1, 2006.

Duration of Projects: up to 2 years (time horizon with justification are required in the proposal)

Eligibility for Funding: All URI tenure track faculty, Appendix F faculty, Research Associates and Extension Educators may apply. Capacity to provide matching funds (per the CELS Cares initiative), is required.

Logic Model: The Logic Model is cyclical and is used for planning, evaluating and reporting. All progress and impacts will be reported at the end of Year 1 and upon project completion using the Logic Model. For a full description of the use of the Logic Model, please access:

http://www.uwex.edu/ces/pdande/evaluation/evallogicmodel.html.

The Logic Model depicts a broad continuum of strategies and activities at the individual/household, community/institution, and social structures/policy levels. Use of the Logic Model will be a required component of the proposal.

Questions? Please Contact: Rick Rhodes (874-2468) or
Nancy Fey-Yensan (874-2978)

Please submit 1 hard copy and 1 electronic copy (as either a Word® document or .pdf file) by 4:30 PM on January 20, 2006 to:

Hard copy: College of the Environment and Life Sciences
CELS CARES Innovative Projects
Office of the Associate Dean/Director of Research and Cooperative Extension
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GUIDELINES for PROPOSALS **(12 point, single-spaced, 1" margins)**

I. Title Page (1 page)

Title of Project
PI Names and Departmental and Cooperative Extension Affiliations
Contact Information
Type of Proposal: Innovation in Cooperative Extension

II. Narrative (8 pages, maximum)

A. Introduction

Issues to be addressed, justification and description of previous work.
Clearly identify the stakeholders who are the targets of this project.

B. Objectives

Explicitly state the aims of the proposed work.

C. Methods **(this should include a time/event horizon)**

Detailed and explicit explanation of Cooperative Extension activities, methodology or techniques related to the proposed effort; description of proposed baseline assessments and stakeholder identification and input.

D. Evaluation Plan

Use of the Logic Model to track and report inputs, activities, outputs (activities and participation) and outcomes (short-term, intermediate and long-term impacts); discipline or project specific methods of evaluation; data management, analysis and interpretation.

E. Plan for sustained funding or support to continue this work

What is the plan for sustained funding or support to continue and evolve this work beyond funding provided through this RFP?

III. Budget (Not to exceed 2 pages)

The Innovative CELS CARES initiative will fund meritorious projects of various budgets for a maximum of two years. There will be no overhead related to these funds. A fully articulated budget supported by a budget justification/explanation, must include a description of personnel and their role in the proposed project, equipment, travel, operating/supplies or sub-contracts; and, the type and amount of matching funds brought to this effort, including third party match (non-Federal, such

as URI faculty time, or match from other state agencies, non-governmental organizations, private business, or individuals).

IV. Appendix

a. *Logic Model summary of this project (1 page).*
A generic example of the Logic Model (PowerPoint slide) and a Logic Model template (Excel) are available on the CELS RIAES website.

b. *Curriculum Vitae*

Maximum of 2 pages each for each project member. The vitae should include a presentation of academic and research credentials, as applicable, e.g., earned degrees, teaching experience, outreach experience, employment history, professional activities, honors and awards, and grants received. A chronological list of all publications in refereed journals during the past4 years, including those in press, must be provided for each project member for whom a curriculum vita is provided. List only those non-refereed technical publications that have relevance to the proposed project, using a full citation format for these entries.

c. List of Community Based Partners and Letters of Support or Agreement (External Linkages).

d. References/Bibliography/Additional PI Publications or grants related to the proposed work.

REVIEW PROCESS and EVALUATION CRITERIA

A. Proposals will first be reviewed for required content, as outlined in the *Guidelines for Proposals*, using the following checklist:

Y N

☐ ☐ Issue: is the project congruent with the Mission of the CELS CARES initiative and the Mission of URI's Land Grant?

Y N

☐ ☐ Innovation: Does the project propose important innovations related to Cooperative Extension?

Y N

☐ ☐ Justification: Is there strong justification for funding?

Y N

☐ ☐ Objectives: Are the objectives clear?

Y N

☐ ☐ Performance Targets (Outputs): Are the targets reasonable and relevant to improving the lives of Rhode Islanders and/or the environment in which they live, and, is the Logic Model used effectively to describe expected inputs, outputs and outcomes and impacts?

Y N

☐ ☐ Is an event horizon/time line clearly articulated?

Y N

☐ ☐ Is there a plan for the dissemination of results to stakeholders?

Y N

☐ ☐ Is there a plan presented for sustained funding or support to continue/ evolve this work?

Y N

☐ ☐ Are the budget and budget justifications reasonable, complete and accurate?

B. Complete proposals will be forwarded for external review. Evaluation will be based on the following criteria:

6. Technical and scientific merit of all aspects of the project including research and Cooperative Extension/outreach/education.

Y N

□ □ Are the investigators familiar with relevant contemporary investigations and are they qualified to conduct the proposed work?

Y N

□ □ Are the proposed methods based on the most current technologies and theories?

Y N

□ □ Are the objectives clear, adequate, appropriate and relevant?

Y N

□ □ Are the facilities, staffing plan, partnerships and equipment adequate to perform the proposed work?

7. Innovation

Y N

□ □ Is the approach innovative and cutting edge, involving community partners and stakeholders?

Y N

□ □ Does the approach present an innovative role Outreach staff and Cooperative Extension staff?

8. Relevance of the proposed project to URI's Land Grant Mission and immediate community issues.

Y N

□ □ Does the project reflect one or more priority areas (described in the Plan of Work): aquaculture and fisheries; biotechnology; animal health; coastal environments; food safety; nutrition; natural resources; children, 4-H and family programs or sustainable agriculture?

Y N

□ □ Is the project likely to address a critical gap that has impeded the outputs and outcomes of URI Cooperative Extension or outreach programs?

Y N

□ □ Does the proposed work address identified needs in the stakeholder community?

9. Capacity and Continuity: Potential for the project and staff to increase capacity (further leverage funds and resources).

Y N

☐ ☐ Will this project provide the basis for work that will be sustainable through external funds?

Y N

☐ ☐ Will the results of this project increase capacity to compete for external funds to support further innovations of this kind?

Y N

☐ ☐ Will this project enhance or leverage the value and sustainability of existing Cooperative Extension or outreach projects?

10. Articulate and appropriate plans for evaluation and the dissemination of findings, including recognition of potential pitfalls which may require retooling or methodological adjustments.

Y N

☐ ☐ Appropriateness, agility and quality of monitoring and evaluation plans.

Y N

☐ ☐ Plan for the dissemination of findings is complete, comprehensive, culturally sensitive and inclusive.

PORTFOLIO OF CURRENT AES PROJECTS FY 2006

RI AES Proj. No.	*Description*	*Responsible Person(s)*	*Goal*	*Knowledge Area*
NE-009	Conservation and Utilization of Plant Genetic Resources	B. Maynard	1	202
NE-1019	Alternative Management Systems for Plant-parasitic Nematodes in Horticultural and Field Crops	N. Mitkowski	1	212
S-1021	Managing and Marketing Environmental Plants for Improved Production, Profitability, and Efficiency	B. Maynard	1	202, 204, 205
H-668	Production and Analysis of Transgenic Lines to be Used for Functional Genomics of Rice	A. Kausch, J. Chandlee	1	202
H-667	Biological Control of Invasive Species in RI	R. Casagrande	1	211, 215
H-402	Nutrient- Based Approach to Vaccine Development for Bacterial Pathogens	P. Cohen, D. Nelson, M. Gomez-Chiarri	1	311
H-327	Assessing the Value of Shellfish Aquaculture Gear as Fish Habitat	G. Forrester	1	307
AH-882	Vaccine Development for Bacterial Pathogens: The Nutrient Approach	M. Gomez-Chiarri	2	311
NE-1023	Improving Plant Food (Fruit, Vegetable, and Whole Grain) Availability and Intake in Older Adults	N. Fey-Yensan, C. English	3	703, 704
H-324	Carbon Sequestration and Flux in Forests at the Landscape Scale	M. Stolt	4	101
H-326	The Importance of Coastal Environments for Migrating Songbirds: Implications for Management of Natural Resources	S. McWilliams	4	136
H-325	Groundwater Nitrate Removal Capacity of Riparian Zones in Mixed Use Watersheds	A. Gold	4	112
H-105	Experimental Analysis of the Political Economics of Fishery Governance	C. Anderson, J. Sutinen	4	605, 607, 610

RI AES Proj. No. (cont.)	*Description*	*Responsible Person(s)*	*Goal*	*Knowledge Area*
MS-972	Valuation of Forested Land Conservation Alternatives: Tools to Evaluate Validity of Willingness-to-Pay	C. Anderson, S. Swallow	4	131, 136
NE-1021	Hydropedology: Genesis, Properties, and Distribution of Hydromorphic Soils	M. Stolt	4	101
W-1004	Marketing, Trade and Management of Fisheries and Aquaculture Resources	J. Anderson, C. Roheim	4	605, 610
MS-973	Management of Southern New England Forests for Roughed Grouse and Associated Wildlife	S. McWillams	4	135
H-669	Identification and Modeling of Environmental Tick Mortality Factors	T. Mather	1	721
H-330	Increasing Urban Impervious Surface in Rhode Island and the Environmental Impacts	Y. Wang	4	131
H-329	Removal and Effects of Antibiotics in Conventional and Aerated Septic System Leachfield Soil	J. Amador	4	133
H-86	Innovative Aquaculture Feed Development for Fish Meal Replacement	C. Lee, D. Bengtson	1	302
H-328	Spatial Modeling of Location within a Fishery	K. Schnier	5	605, 607
H-87	Metabolic, Hormonal and Appetitive Responses to Different Carbohydrates in Lean and Obese Adults	K. Melanson	3	702, 703
W-1133	Benefits and Costs of Natural Resources Policies Affecting Public and Private Lands	S. Swallow	4, 5	131, 608
H-669	Identification and Modeling of Environmental Tick Mortality Factors	T. Mather	1	721

FY 2007 Funded CELS CARES Initiative Proposals

Agricultural Experiment Station (AES) Awards

And Hatch and McIntire-Stennis (forestry based project)

1. Jeff Adkins (PLS): *Mutagenesis of Seeds for the Development of Novel Woody Ornamental Plants:* Plans to develop new ornamental plants that have desirable characteristics for and are environmentally sound/friendly. (Funding: 1 year; $19,800).

2. Steve Alm (PLS): *Integrated Management of Annual Bluegrass Weevils on Golf Course Turf:* This project is dedicated to the control of one of the most widespread agricultural pests in the world, root knot nematode. This proposal supports the use of alternatives to environmentally toxic pesticides. (Funding: 3 years: $25,000/year plus tuition waiver valued at $16,000/year).

3. Chris Anderson/ Jon Sutinen (ENRE): *Analysis of Conservation and Allocation Decisions in Fishery Governance Systems: E*valuate the successes and failure in the conservation of the sustainable fisheries, which will have important implications in fisheries management and the fishing industry. (Funding: 3 years: $25,000/year plus tuition waiver valued at $16,000/year).

4. Terry Bradley (FAVS): *The Role of Follistatin in Muscle Growth of Salmonids;* This project will determine the physiological basis of muscle growth in fish using the cutting edge tools of biotechnology. On a practical basis Dr. Bradley is interested in improving growth of fish cultured on farms. (Funding: 3 years: $20,000/year plus tuition waiver valued at $16,000/year).

5. Rebecca Brown (PLS): *The Identification of Grasses with Improved Salt Tolerance for Roadside Use:* Identify grasses that are tolerant to the high salt conditions associated with areas adjacent to our roadways. This project seeks to identify ways to improve roadside vegetation to minimize roadway runoff, erosion and beauty. (Funding: 1 year: $20,250/year plus tuition waiver valued at $16,000/year).

6. Art Gold (McIntire-Stennis) (NRS): *Targeting Riparian Management to Enhance In-Stream Nitrogen Removal*: Dr. Gold intends to identify attributes of streams that relate to nitrate removal. Stream denitification is important because it reduces the nitrogen that enters our waterways. Nitrogen causes unwanted bloom of algae which diminishes the health and uses of Narrangansett Bay. (Funding: 3 years: $24,500/year plus tuition waiver valued at $16,000/year).

7. Laura Meyerson (NRS): *Does Hybridization of Exotic <u>Phragmites australis</u> with Native <u>Phragmites australis</u> Result in Increased Hybrid Vigor?* This project will investigate an aggressive plant invader, <u>*Phragmites australis.*</u> This work could lead to strategies to control this invasive species to preserve and conserve our wetland resources. (Funding: 1 year: $20,000/year plus tuition waiver valued at $16,000/year).

8. Katherine Petersson (FAVS): *Influence of Vitamin E Supplementation on Immune Function in Pregnant Sheep and Their Offspring:* This project will study vitamin E and immunity in sheep. This will serve as a model for other domestic ruminants (like cattle) and the basis for improving the health and well being of farm animals. (Funding: 3 years: $25,000/year plus tuition waiver valued at $16,000/year).

Integrated Awards

1. Tom Mather (PLS), Sarah Rodgers (PLS), Nathan Miller (PLS), Colleen Redding (CPRC), Joseph Rossi (CPRC), Timothy Henry (Computer Science and Statistics; URI 3-D Group for Interactive Visualization), Brian Mullen (Computer Science and Statistics; URI 3-D Group for Interactive Visualization), Brandon Edens (Computer Science and Statistics; URI 3-D Group for Interactive Visualization) and Jean-Yves Herve (Computer Science and Statistics; URI 3-D Group for Interactive Visualization): I*nternet-based Health Information Delivery and Support System for Preventing Tick Bites and Disease:* This project creates an internet based health information system for preventing tick bites in Rhode Island and reduce diseases caused by tick bites. (Funding: 2 years; $50,000/year).

2. Geoffrey Greene and Linda Sebelia (NFS): *Healthy Weight Management in the Latino Population:* This research will investigate the factors that influence food behavior and issues of overweight in the Latino population. (Funding: 2 years; $50,000/year).

Innovative Awards

1. Kim Anderson, Phyllis Bocage, Deborah Grossman-Garber, Marcia Morreira and Barbara Nowicki (CE and CELS Student Affairs): *4-H Pathways for Success in the Food & Agricultural Sciences: Building a Diverse STEM Pipeline for Rhode Island.* This project will serve to develop an after-school science enrichment program targeting youth in urban areas. (Funding: 2 years; $49,714/year).