

Annual Report  
of  
Accomplishments and Results  
2005



**College of the Environment and Life Sciences**

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**University of Rhode Island**

Rhode Island  
Agricultural Experiment Station  
and  
Cooperative Extension

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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, 2004-September 30, 2005 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 2005. (See additional comments under Program Review Process).
- We have appended a **Portfolio of Current Projects** for the Station, providing brief outlines for all projects approved for FY2005.

**EXECUTIVE SUMMARY OF THE ANNUAL REPORT**  
**Annual Report of Accomplishments and Results**  
**Rhode Island Agricultural Experiment Station & Rhode Island**  
**Cooperative Extension**  
**FY2005**

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.

FY 2005 was a successful year for our Land Grant programs. We met all federal mandates with respect to commitment to integration of research and extension (established target: 25%; actual: 31% and 39%, respectively) and multistate extension (established target: 25%; actual: 28%). More importantly, our programs in each of the goal areas met critical needs of our state, region, and country. For instance, our televised "Plant Pro" segments reached 7 million households in 2005 (the population of Rhode Island is approximately 1 million). Further, we have reduced tick borne disease risk (e.g., Lyme disease) through our on-going public education efforts supported by Smith Lever funding. Likewise, we have reduced the risk of food-borne illnesses by providing GAP and HACCP training programs. Several of our station researchers have dedicated their efforts to issues of food security and the new life-threatening, pervasive disease of our time, obesity. Their efforts are paying off; we've increased fruit and vegetable consumption of elementary school children in four "at risk" towns in Rhode Island and we have collaborated with community agencies to assess and address the food needs of Rhode Islanders living in poverty. Our efforts to preserve the environment reach across state lines through the New England Water Quality Program. We have trained municipal officials, preserved riparian buffers and reduced the nitrogen burden placed on our watersheds. Our social scientists have worked on critical issues related to agricultural and environmental economics. In doing so, we have improved Rhode Island farm viability and provided policy strategies for managing renewable resources like our near- and off-shore fisheries. Last, we've invested in the wellbeing of children and families in Rhode Island. Spanning early child care to 4-H youth development programs, our scientists, staff and students are making a difference in the lives of the citizens of our state.

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.

**Annual Report of Accomplishments and Results  
Rhode Island Agricultural Experiment Station & Rhode Island  
Cooperative Extension  
FY2005**

**PLANNED PROGRAMS**

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**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. Thus we directly impact 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 and Integrated Pest Management.

**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.
- A study has been initiated to evaluate the rooting depths of native grass species.

**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

- RIDOT “Evaluation of Native Grasses for Highway Slope Stabilization and Salt Tolerance”
- Gifts from the turf seed production and sod production industries to the URI Foundation
- Start-up funds

**Scope of impact:** State and regional

**Knowledge Area:** KA 202. Plant Genetic Resources

**Situations:**

*Situation 1-* Lawns are an important part of the American landscape, particularly in urban/suburban areas. They reduce heat buildup, provide permeable surfaces to absorb storm runoff, absorb carbon dioxide and emit oxygen, and add aesthetic value. They can also be expensive to maintain, can strain limited water supplies, and can contribute to water pollution through runoff and leaching of fertilizers and pesticides. The negative environmental impacts of lawns can be minimized by planting grass species and varieties which are locally adapted and can thrive with few inputs of water, fertilizer, or pesticides.

**Outputs:**

- Conducted trials of new and experimental varieties of bluegrass, ryegrass, tall fescue, fineleaf fescue, and bentgrasses to determine which are best suited to the climate and conditions of Rhode Island.
- Initiated a five-year trial specifically to look at performance of selected grasses under very low input condition.

**Outcomes/Impact:**

- New information was gained on the performance of different varieties of grasses under commercial maintenance condition in Rhode Island.

- Information about variety performance and the best adapted varieties for Rhode Island and southern New England was communicated to 150 industry professionals at the URI Turfgrass Field Day.
- New information was gained on the establishment and persistence of turfgrasses under low-input conditions.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

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

**Scope of impact:** State and regional

**Situations:**

*Situation 2-* RIAES work in this area focuses on acquisition, preservation, characterization, and development of plant genetic resources for plant production. Our work focuses on the use of ex-situ preservation methods, as well as 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 2005 was to transfer, from commercial nurseries and collections, shade tree and shrub germplasm for introduction to the northeast nursery and landscape industries.

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. Protocols for *in vitro* regeneration of several ornamental plant species are also being developed. Once established, these protocols will be used for developing novel plants by *in vitro* mutagenesis. We are also conducting research toward understanding the molecular genetic underpinnings behind the remontant (reblooming) flowering characteristic recently discovered in some *Hydrangea macrophylla* genotypes.

**Outputs:**

- Forty-two new plant taxa were accessioned. These are being grown, in the field and in containers at the East Farm Agricultural Experiment Station.
- Accessions are propagated and evaluated for cold and environmental tolerance in the Northeast.
- More than 4,000 woody plant propagules were distributed to cooperating nurseries and arboreta, and to the public on a limited basis.
- 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* and *Clethra alnifolia* have been determined. In addition, callus induction and root organogenesis have been optimized.
  - Research is ongoing on the use of etiolation technology for propagation of difficult-to-root accessions. In particular are studies using phenylalanine 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.
  - 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.
  - Two hundred-fifty seedling *T. heterophylla*, Western Hemlock, and fifty *T. chinensis*, Chinese Hemlock, plants were obtained for evaluation and use as rootstock material to evaluate transmissible adelgid resistance.
  - 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 established 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 4,000 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 remountant 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

- Rhode Island Nursery and Landscape Association, plant sales, nursery grants-in-aid.

**Scope of impact:** State and regional

**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.
- Completed construction of a computer controlled micro-irrigation system.
- Thirty-eight taxa of succulents have been accessioned and grown in replicated mesocosms to investigate suitable growing media and cold hardiness. Five taxa did not survive the winter of 2004 and were replaced. Data were taken every two weeks during the growing season and data analysis is underway.
- Upgrades to a greenhouse research facility were completed.
- 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](http://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: (in press)

- Maynard, B. 2005. What is Your Favorite Plant? Rhode Island Nursery and Landscape Association Newsletter. 51(3):14-16.

**Outcomes/Impact:**

- All irrigation water applied in the computer controlled micro-irrigation system is recaptured and allows for water quality analysis. This facility is being used to evaluate irrigation methods and container media to optimize low-water use container culture in the northeast. The results of research on irrigation practices and modified container media requirements increased production potential and reduce production costs by 10-30%.
- Information on the propagation of *Lindera* and *Sassafras* was presented at a national-level producer conference attended by over 300 farmers.
- 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](http://www.utextension.utk.edu/hbin/greenimpact.html)) which will be published as a Southern Cooperative Series Bulletin.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- New England Nursery Association grant-in-aid to CE
- Rhode Island Nursery and Landscape Association grant-in-aid
- USDA Special Grant “Nursery Production RP”, 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 Cooperative Extension Education Center 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, the URI CE Healthy Landscapes program is a grant-funded educational endeavor which focuses on landscape management practices designed to protect water quality and to safeguard water supply. Currently being piloted in the Town of North Kingstown, the Healthy Landscapes program offers another venue for demonstrating the benefits of recycling and composting. It has also benefited from extensive press coverage during the pilot period. More information on the program is available at [www.healthylandscapes.org](http://www.healthylandscapes.org).

In addition to these targeted programs, the URI Cooperative Extension Education 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:**

- Presented paper at a national conference on Coastal Vegetative Buffer Policy.
- Initiated Coastal Landscapes Program in partnership with Rhode Island Coastal Resource Management Council.
- Developed curriculum for a new training program in the "Ecology of Managed Landscapes" designed for coastal resource managers.

- Designed and conducted Master Composter/Master Recycler Training Program.
- Revamped the Learning Landscape Environmental Education Program for elementary school children to bring the program into alignment with the Benchmarks for Science Literacy and the Rhode Island State Science Frameworks.
- Developed a Teachers Guide and a Nature Journal for the program along with a training manual for the URI Master Gardeners who serve as instructors.
- Wrote and published the Rhode Island Master Gardener Training Manual.
- Conducted a 16 week Master Gardener training program.
- Conducted an eight week Fall Gardening School.
- Conducted a six week Summer Gardening School in the URI Botanical Gardens.
- 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.
- Healthy Landscapes Program: Described in detail in (Goal 4, Program 6 of this report).
- URI Cooperative Extension's "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 CE Education Center, with periodic appearances by other URI scientists and staff and horticulturists from throughout RI.

### **Outcomes/Impact:**

- Through the Coastal Buffer Zone Project, the Landscape Horticulture Program has formed a partnership with a state regulatory agency that will protect water quality and create economic opportunities for the green industry.
- Through the Master Composter Program, 25 individuals were trained in the fundamentals of composting and recycling and have donated over 250 hours of volunteer time to public service programs.
- Over 130 new Master Gardeners were trained. They join a cadre of over 400 active Master Gardeners who donate over 20,000 hours of time working closely with URI faculty and staff on a range of horticultural and environmental research and outreach programs.
- 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.
- Through the delivery of educational programs (workshops, talks, public exhibits and open houses) by highly trained URI Master Gardener volunteers, over 10,000 RI homeowners increased their awareness of sustainability issues and knowledge of how to implement environmentally sound home and garden practices.
- Over 200 members of the green industries attended URI GreenShare WinterSchool training programs.

- Over 400 people attended the URI CE Summer and Fall Gardening Schools.
- A Spring Gardening Seminar hosted by URI CE 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.
- URI Cooperative Extension Master Gardener volunteers answered over 12,000 calls from Rhode Island citizens through the toll-free URI CE Gardening Hotline and the Master Gardener and Plant Pro email hotlines.
- 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 factsheets are on the web at: [www.uri.edu/ce/factsheets/sheets/](http://www.uri.edu/ce/factsheets/sheets/).
- In 2005, 62 “Ask a Master Gardener” booths, staffed by URI Master Gardener volunteers, answered over 3,500 of the RI gardening public’s questions through participation at fairs, the RI Flower Show and other public events around the state throughout the year. During these events, the booth promotes environmentally sound gardening practices and increases the public’s knowledge regarding the use of sustainable, non-invasive plants in the home landscape.
- *Green Source*, a URI Master Gardener monthly column in several weekly papers reached over 200,000 households with our sustainable practices message.
- The Learning Landscape Environmental Education school enrichment program was attended by over 2,800 elementary children and numerous educational tours were held for the public.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- USDA Special Grant, “RI-Nursery Industry”, 2003-2006

**Scope of impact:** State and regional. The CE 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

**Situation:**

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.

**Outputs:**

- Visited 23 orchards in Rhode Island from April through September, with an average of 3 visits per orchard.
- Delivered IPM techniques and recommendations through weekly-recorded phone messages and the URI Apple IPM website ([www.uri.edu/research/ipm](http://www.uri.edu/research/ipm)).
- 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.
- Educated apple growers on IPM techniques at 5 Rhode Island Fruit Growers Association meetings. Each meeting attended by an average of 25 growers.
- Recorded 15 weekly telephone messages that were accessed by fruit growers.
- Through the Apple IPM website, provided scouting reports and daily pest alert updates through the degree day and weather program called Orchard Radar.
- Provided 285 pest identifications and control recommendations for samples submitted to the URI Plant Clinic. Individual reports were sent to each client.

**Outcomes/Impact:**

- Rhode Island apple growers applied 9% fewer fungicides, 35% fewer insecticides and 60% fewer miticides than is recommended in the New England Apple Pest Management Guide.
- The 285 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.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- Legislative Grant: RI-Nursery Industry

**Scope of impact: State and regional.** This work impacts Rhode Island and Massachusetts apple growers. The existence of the URI Plant Clinic affects all gardeners and commercial growers in Rhode Island.

**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.

**Outcomes/Impact:**

- New information was gained on the relative tolerance of 100 Kentucky Bluegrass cultivars to leaf rust caused by *Puccinia poa-sudetica*. This information was communicated in a report to the 25 sod producers who belong to the New England Sod Producers Association.

**Source of funds:**

- Smith-Lever
- Hatch (pending)
- State
- Other

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

**Scope of impact:** State and regional

**Situations:**

*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.



### **Outputs:**

- A survey of the distribution, frequency and population levels over time of plant-parasitic nematodes were surveyed 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. 2006. Soil characteristics and management practices associated with population levels of plant-parasitic nematodes on golf course greens in southern New England. *Agronomy Journal* (submitted).
- 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* (in press)

### **Outcomes/Impact:**

- Our research demonstrates that a large number of factors can influence the levels of plant-parasitic nematodes on golf courses.
- *Poa annua* is the most important factor contributing to large nematode populations. It is the most suitable golf course host for plant-parasitic nematodes and diligent removal of this pest may be a potential strategy towards reducing plant-parasitic nematode populations.
- 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

**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 determining 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.

**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:**

- We found in 2005 that the parasitoid *Tetrastichus setifer* is established in RI, MA, ME, and NH as a result of our releases and LLB populations have declined substantially at the two oldest release sites.
- We located 25 lily gardens near our release site in Cumberland, RI. We found *T. setifer* in 6 of those sites with the most distant recovery over 5 miles from the release plot and 4 of the 6 located at least 0.5 miles distant. *Lemophagus errabundus* was found in a lily garden 0.75 miles from our Plainville, MA release site in 2005, indicating that it is not only established from releases in 2003 and 2004, but it has spread a considerable distance.
- We also released *Lemophagus errabundus* in our Kingston, RI plot where we found good parasitism in the weeks following release.
- We released LLB larvae parasitized by *D. jucunda* into our lily plots to determine if this is a better way to establish this species.
- We reared additional Galerucella beetles for release against purple loosestrife throughout Rhode Island with the cooperation of the RI Dept. of Transportation, and the Wood/Pawcatuck Association in 2005.
- We have tracked density and parasitism rates of birch leafminer since releasing the European parasitoid *Lathrolestes nigrivittatus* against this pest in 1994. This year continued the trend of reduced pest densities and increased parasitism rates that we have observed over the past decade. As in 2004, we observed and had reports of no economic damage from this pest in Rhode Island this season.
- In comparing native and exotic populations of *Phragmites australis*, we find the native subspecies to be more susceptible to several introduced herbivores including the aphid *Hyalopterus pruni*, and the flies *Lipara similis* and *L. rufitarsis*.

### **Publications**

- Tewksbury, L., M. Gold, R. Casagrande, and M. Kenis. 2005. Establishment in North America of *Tetrastichus setifer* Thomson (Hymenoptera: Eulophidae), a parasitoid of *Lilioceris lili* (Coleoptera: Chrysomelidae). Pgs. 142-143. IN: Hoddle, M. Second International Symposium on Biological Control of Arthropods. USDA Forest Service Publ. FHTET-205-08.

### **Outcomes/Impact:**

- We have established the lily leaf beetle parasitoid *Tetrastichus setifer* in 4 New England states where it seems capable of spreading and locally reducing pest populations. We have also established the lily leaf beetle parasitoid *Lemophagus errabundus* in RI where it has spread at least 0.75 miles.

- Purple loosestrife and cypress spurge populations continue to decline state-wide and birch leafminers have been reduced to non-pest status as a result of our biological control releases.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- North American Lily Society

**Scope of impact:** State and regional

**Situations:**

*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:**

- Two commercially available strains of *Heterorhabditis bacteriophora* were obtained from Becker-Underwood and applied to fine fescue infested with oriental beetle larvae. Strain #1 provided 95% control of larvae, strain #2 provided 83% control of larvae. The nematodes were as good as or better than two standard insecticides (Merit 83% control; Dylox 53%).
- 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. 42,763 beetles were captured over the flight period in 2005. 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 4' X 4' plots received an "effective" dose of bacteria. Evaluation of plots one year after establishment showed no statistically significant difference between treated and control plots (Fig. 2). This experiment was conducted in an area with soil temperatures that are supposed to be conducive to milky disease infectivity (i.e. > 21°C).

**Outcomes/Impact:**

- Individuals managing extensive acreage or intensive turfgrass areas have an affordable system for monitoring nitrogen application efficiency. Use of this system will result in more efficient use of fertilizer and improve environmental quality. Several new golf courses will be using the monitoring protocols we developed.

**Source of Funds:**

Smith-Lever

Hatch

State

Other

- 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:**

- Developed an infrastructure for implementing community-based tick control programs. The program called "Do You Hate Ticks As Much As We Do?" attempts a "bottom-up" approach for delivering public health information.
- In 2005, we held 8 tick control awareness workshops for 240 people.
- Used newly available Bayesian statistical techniques in WinBUGS software to re-analyze Lyme disease case epidemiology from 1993 to 2003.
- Created informative and accurate risk maps by comparing known Rhode Island incidence rates (range: 250-800 cases per year) with posterior means from the Bayesian method.
- Added another year to our continuous deer tick statewide surveillance data from 1993.
- Developed a basic web system to be launched in spring, 2006. Rhode Island residents, or other interested users, can register and the site will contact them when important tick-bite prevention information should be disseminated, as well as remind them of the tick-bite prevention information on the website

- Completed field experiments to assess the rate of questing ticks at different soil moisture levels
- Developed RNAi as a useful tool in identifying functionally important tick salivary gland genes, and this tool is being used to aid studies of intracellular pathogen trafficking in tick salivary glands.

#### *Publications*

- Zolnik, C. P. 2005. Effect of soil moisture on host seeking activity of nymphal *Ixodes scapularis*, pp. 78, Masters Thesis. Plant Sciences and Entomology. University of Rhode Island, Kingston.
- Karim S, NJ Miller, JG Valenzuela, JR Sauer and TN Mather. 2005. RNAi-mediated gene silencing to assess the role of synaptobrevin and cystatin in tick blood feeding. *Biochemical and Biophysical Research Communications*. 334: 1336-1342.

#### **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 prevention activities in local communities.
- We have increased understanding of disease prevention behavior and a potentially more robust method for delivering the most appropriate tick-bite precautions. Our HIDDSS framework will be a useful mechanism for communicating disease risk to residents in the Lyme disease endemic northeast. We will also increase 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.
- We have identified two potential impediments to developing a highly effective anti-tick vaccine. This helps explain mediocre results to date, and sets new directions for anti-tick vaccine development research.

- Plans to model the covariance of Lyme disease with other rapidly increasing tick-transmitted diseases such as Babesiosis and human anaplasmosis using Bayesian methods.
- Significant local media coverage promoting both the work of scientists at URI, and tick awareness for disease reduction.

**Source of funds:**

Smith-Lever

Hatch

State

Other

- 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”.

**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 will also 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:**

The U.S. aquaculture industry is based primarily on freshwater fish (catfish, trout, hybrid striped bass) and saltwater shellfish (clams, oysters). In Rhode Island, the 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 the 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. Cooperative Extension efforts during 2005 identified 5 terrestrial farmers in RI who are interested in establishing an aquaculture network to integrate largemouth bass culture into ponds or greenhouses on their existing farms and construction of some of those systems has begun.

During 2005, we also entered into 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.

### **Knowledge Area: KA 302. Nutrient Utilization in Animals**

#### **Situation:**

Aquaculture of piscivorous fish has traditionally required fish meal as the major or only source of protein in pelleted feed used to grow the fish. Fish meal is relatively expensive (as well as variable in price, e.g., during El Niño years) and its use for aquaculture is criticized by environmentalists (removing fish from the ocean to grind up and feed to other fish in captivity). Hatch project RI00H86 (“Innovative aquaculture feed development for fish meal replacement”) examines the use of plant proteins and squid hydrolysate to reduce the fish meal required in diets for summer flounder. The summer flounder aquaculture industry is slow to develop due to high costs of production, including feed costs. Squid hydrolysate is a new product made from waste materials (unused squid parts) from squid processing plants. An experiment conducted last year indicates that soybean meal, corn gluten meal and canola protein concentrate can all serve equally as partial substitution for fish meal; flounder growth rates are significantly reduced compared to that with diets made without plant proteins, but the soybean meal replacement yields an 11% reduction in cost per kg of fish produced. The next step is to try to improve the plant protein diets with the addition of squid hydrolysate.

**Outputs:**

- Lian, P.Z., C.M. Lee and E. Park. 2005. Characterization of squid-processing byproduct hydrolysate and its potential as aquaculture feed ingredient. J. Agric. Food Chem. 53: 5587-5592.
- Successful USDA equipment proposal to purchase a process-controlled extruder for the fabrication of diets for further studies with summer flounder.

**Outcomes/Impact:**

- Companies in the aquaculture and aquaculture feed industries have been evaluating this product and are considering commercial arrangements to use the technology.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

**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”) is documenting the populations of juvenile fish that find shelter in oyster aquaculture gear and comparing them with populations of juvenile fish in control areas (natural reefs). Surveys were done at 3 aquaculture sites and 5 natural reef sites from July to October, in both 2004 and 2005. The basic approach is to conduct a mark-recapture study at each of the 8 sites. Based on these surveys, the densities and size distributions of black sea bass *Centropristis striata*, cunner *Tautogalabrus adspersus*, and tautog *Tautoga onitis* were similar in both habitats, whereas scup *Stenotomus chrysops* were more abundant on aquaculture sites than on natural reefs. 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.

**Outputs:**

- The results of this work were transmitted to the Rhode Island Aquaculture Coordinator at the Rhode Island Coastal Resources Management Council.

**Outcomes/Impact:**

- The Rhode Island Aquaculture Coordinator is using these results for decision making related to applications for oyster aquaculture leases.



**Source of funds:**

- Smith-Lever  
 Hatch  
 State  
 Other

**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 *E. coli* EDL933 mutants in the intestine of the mouse and 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 that is activated by proteolytic processing resulting in a 36 kDa mature enzyme. Creation of mutant strains has allowed us to conduct research that strongly suggests that activation of pro-EmpA to the mature active form of EmpA requires a processing protease. The reduced amount of mature EmpA in the MSD1 mutant suggests that the protease enzyme is responsible for processing EmpA. It is likely that further work on other mutant strains will identify more proteases that influence the virulence of *V. anguillarum*.

Another bacterial pathogen, *Vibrio harveyi*, is the causative agent of Flounder Infectious Necrotizing Enteritis (FINE). Analysis of the data from a monitoring program of two summer flounder hatchery facilities showed that risk of infection with *V. harveyi* is highest when fish are spawned in the spring and summer seasons, most probably due to the presence of this ubiquitous pathogen in warm coastal waters. Major mortalities were associated with transport stress. Other potential bacterial pathogens of summer flounder were isolated from juvenile fish at a hatchery during the summer season, including *Photobacterium damsela damsela* and *Vibrio ichthyenteri*. However, no major mortalities were associated with these two potential pathogens in the hatchery. We conclude that *V. harveyi* is an opportunistic pathogen of summer flounder, and that it could have a major impact on the development of summer flounder aquaculture.

**Outputs:**

- Knowledge about the environmental conditions that trigger disease outbreaks gained in this research has been applied towards the development of an extension

publication with recommendations for the prevention and management of FINE in summer flounder (*Paralichthys dentatus*).

**Outcomes/Impact:**

- The major summer flounder hatchery now spawns their fish only in the autumn of each year, in part to avoid mortality due to *V. harveyi*.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- NRI

**Scope of impact:** National and international

<b>Expenditure and Full-time Equivalent (FTE) Summary FY 2005</b>	
	<b>Goal 1</b>
<b>AES Federal FTE</b>	7.53
<b>AES State FTE</b>	2.83
<b>AES Formula \$</b>	\$ 161,225
<b>AES Match \$</b>	\$ 302,992
<b>CE Federal FTE</b>	3.04
<b>CE State FTE</b>	3.62
<b>CE Formula \$</b>	\$ 191,526
<b>CE Match \$</b>	\$ 356,566
<b>Total FTE's</b>	17.02
<b>Total Formula \$</b>	\$ 352,751
<b>Total Match \$</b>	\$ 659,558

## **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 Area:** KA 711. Ensure Food Products are Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

#### **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:**

- Effective July 2005, USDA required all school foodservice operations to develop and implement a HACCP. To assist RI school foodservice operators in meeting this mandate, the food safety education and the seafood/food safety specialists, in cooperation with Kids First, Inc., developed and implemented a HACCP training program for this target audience.
- HACCP and sanitation education continue to be offered to seafood, juice/cider and meat/poultry industry personnel to help them comply with FDA and USDA food safety regulations. Knowledge of these regulations and how to effectively design HACCP and sanitation programs will help keep the participants in business. HACCP courses were offered in Connecticut and Rhode Island. These classes service the New England region as well as other participants throughout the United States.

### **Outcomes/Impact:**

- Two sessions of HACCP training for school foodservice personnel were conducted in August and September 2005. Forty people representing 25 schools attended two sessions. The information was highly rated by participants.
- Six HACCP training classes were offered to seafood, juice and/or meat/poultry processors. A total of 65 industry participants from seafood, juice or meat/poultry industries attended.
- The seafood/food safety specialist was involved in one juice HACCP class offered in Detroit, MI. The target audience was FDA regulators and there were 40 in attendance.

### **Knowledge Area: KA 712. Protect Food from Contamination by Pathogenic Microorganisms, Parasites and Naturally Occurring Toxins**

#### **Outputs:**

- Established the Rhode Island Food Safety Task Force. The major accomplishment of was the annual conference (12<sup>th</sup> Annual Food Safety Conference: “Food Safety: Bridging the Ethnic Divide”). The goal of this workshop is to increase participants’ understanding of the skills needed to communicate correct food safety behaviors to workers from other countries and cultural backgrounds.
- Produced the “Seafood Savvy” newsletter (URI and UConn) that is distributed to all participants in CT and RI HACCP courses. The newsletter provides industry with current information regulations. The project is ongoing.
- 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 2003 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 ending in September 2004 will continue. A CD ROM containing the all the educational resources developed for the project including pamphlets, fact sheets and power point presentations was developed.
  - With RI DEM’s Division of Agriculture and RIDOH, conducted an informational training session on the 2002 Farm Food Manufacture legislation.
  - 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.

*Publications:*

- Pivarnik, LF, Patnoad, MS, Leydon, NL and Gable, RK. Food Safety Knowledge of Fresh Fruits and Vegetables by New England Home Gardeners. Food Protection Trends. Accepted for Publication, 2005, and Presented at IFT (2005).
- 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. 25(4): 256-266.

**Outcomes/Impact:**

- The joint publication “Seafood Savvy: A HACCP Newsletter Update” was distributed to over 600 people in RI and CT.
- With Chief of the RI Department of Health, Division of Food Protection presented “The Process of Developing Successful School Food Safety Policies” at the National Environmental Health Association Annual Educational Conference, Providence, RI.
  - Thirty-six Rhode Island elementary, middle and high schools participated in food safety educational classroom activities and food safety policies. Thirteen hundred copies of the school food safe action guide kit have been distributed nationwide (130 in Rhode Island). There are now also active food safe schools in Connecticut, Michigan, Arkansas and Florida.

- The specialists presented a session entitled, “Using the Community Service Model to Teach Youth Food Safety” at the Family and Consumer Sciences Northeast Regional Conference. Curriculum was distributed to 30 session participants; six copies of the Food Safety House and 3 copies of the Detective Mike Robe curriculums were requested and sent to elementary schools and cooperative extension personnel in other states.
- As part of the USDA home gardening project, project directors in the 5 participating New England states completed the design of on-site structured questions, guide and script to interview process and Master Gardener volunteer interview training. The goal of the on-site interview was as a follow-up, in-depth probe to the regional survey of home gardeners that assessed food safety knowledge and attitudes from garden to table done in the previous year. Of 94 interviews done in the region, 20 RI Master Gardener volunteers were trained and conducted 18 on-site interviews with RI home gardeners. A PowerPoint presentation was developed along with role-playing scenarios for use during the training of Master Gardeners in each of the participating states.
- In the spring of 2005, during year two of the Food Safety Training and Certification for Under-educated and Limited English Proficient Food Handlers Project 65 individuals employed in school foodservice and child nutrition programs participated in 4, 15- hour food safety manager certification courses held at various locations in the state. The majority (89.9%) of participants in the food safety certification courses for school foodservice personnel were food workers. The pass rate was 88%, the second highest of the three states. Teaching resources used during year one of the project were revised based on the results of surveys administered during courses taught during year one of the project and were incorporated into year 2 courses.
- Six instructors taught multiple sections of the mandated 15-hour Food Safety Manager Certification and 6 hour Recertification courses offered through URI. Two sections of the Certification course and one section of the Recertification course were taught in Spanish. The pass rate on the required national examination continues to be 95% for English and 50% for Spanish. One hundred individuals participated in the six-hour Food Safety Manager Recertification courses.
- The Narragansett District Health and Safety Committee was formed as part of a state mandate. This committee successfully drafted and received school committee approval on a district-wide health and physical activity policy that includes food safety.

**Source of funds:**

Smith-Lever

Hatch

State

Other

- CDC School Food Safety Program
- USDA CSREES Grant

**Scope of impact:** Local, state, national

**Expenditure and Full-time Equivalent (FTE) Summary  
FY 2005**

**Goal 2**

<b>AES Federal FTE</b>		-
<b>AES State FTE</b>		-
<b>AES Formula \$</b>	\$	-
<b>AES Match \$</b>	\$	-
<b>CE Federal FTE</b>		0.84
<b>CE State FTE</b>		-
<b>CE Formula \$</b>	\$	80,019
<b>CE Match \$</b>	\$	100,066
<b>Total FTE's</b>		0.84
<b>Total Formula \$</b>	\$	80,019
<b>Total Match \$</b>	\$	100,066

## **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 or 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 1/4 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 4<sup>th</sup> 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 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 different metabolic and hormonal mechanisms in people prone to obesity may impact their responses to different carbohydrate types, and thus their appetite regulation.

#### **Outputs:**

- Data collection is complete in 12 lean males and is near completion in 12 overweight and obese males. After a preliminary visit for fitness testing, body composition analyses and questionnaires, subjects came to the lab on two randomized test visits,



in the morning after an overnight fast. Baseline metabolism and appetite were measured, and blood was collected before feeding the test meal with responses measured for three hours. (“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.

**Outcomes/Impact:**

- Data on the health effects of sugars is of great research interest. This current project provides such data, and considers the possibility that carbohydrates may exert different effects in different individuals. Findings in lean males suggest significant differences in metabolism after the different test carbohydrates, without differential impacts on appetite. Future data from tests in overweight and obese males will be critical to compare to these findings.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

**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 2.8% 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:**

- 345 low-income families and 1985 youth were reached through participation in EFNEP. Of those participants, 40% were minorities.

- 21 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 1220 patrons.
- 820 middle-school aged children participated in after-school programming at urban Boys and Girls Clubs/Kids Café's and 21<sup>st</sup> Century Community Learning Centers.
- A new social marketing campaign "Make Half your Grains Whole" (three-month) was launched and appeared as exterior panels on 60 buses and as interior posters on 110 buses which 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.
- 57 food demonstrations focusing on a plant based diet and increasing fruit and vegetables while maintaining weight were presented to 2015 food stamp eligibles at food stamp offices throughout the state.
- 2 video productions, 3 issues of the newsletter the *Good News Café*, 12 issues of *Nutrition to Go* and 8 feature news articles reached 418,400 seniors in RI and CT.
- 229 workshops focusing on Diet Quality, Food Safety and Food Resource Management were presented to 4781 seniors in RI and CT.
- 100 Head Start and EFNEP women were enrolled in a five week fruit and vegetable intervention using adapted materials from NC219R Multistate Project – *Fruit and Vegetable Connection to feeling good* and looking hot.
- 50 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) has developed an organizational structure with subcommittees focusing on curriculum development, instrument selection, web intervention development and qualitative assessment of the target population's interests and concerns about weight.
- NE-1023 Regional Research Project on Aging launched a multi-state research effort to investigate whole grain intake in older populations (RI one of the Lead Stations).
- Melanson K, Carpenter C, Balestracci K, Kresge D, Wei W, Greene G. Relationships among dietary behaviors, appetite and subjects characteristics in young adults. *Obesity Research* 2005; 13 Suppl: A68.

### **Outcomes/Impact:**

- Direct assessment data from 531 early elementary children from four core RI cities who participated in a four-week EFNEP program revealed a 70% increase in breakfast consumption, a 64% and 74% increase in the consumption of fruit and vegetables respectively.
- At program exit, 92.1% of adult EFNEP participants showed positive change in at least one food group; 21% had a diet that provided at least half the recommended number of servings from each of the food groups.
- A sampling of 179 children participating in after-school programming at Boys and Girls Clubs/Kids Café's showed a 75% increase in their ability to choose healthy snacks and a 54% in their ability to consume recommended levels of fruits and vegetables on a daily basis.

- As a result of a “Make Half Your Grains Whole” survey of 200 RIPTA riders, 7.5% increased whole grain consumption as a result of the campaign; 80% of the sample resided in zip codes identified as high food stamp neighborhoods; 75% of the sample reported seeing the posters on the inside rather than the outside of the bus; most frequently eaten whole grains are cereal, oatmeal, popcorn and crackers.
- 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 Head Start/EFNEP Fruit and Vegetable Connection study, the number of servings usually eaten by the participant increased by  $\frac{3}{4}$  serving from 2.9 to 3.6 servings ( $p < .01$ ) The number of servings estimated from the NCI Screener increased from 5.1 to 6.4 servings ( $p < .01$ ). There was an increase in self-efficacy but not decisional balance. There was no change in body weight.
- A preliminary study (Behavior Change for Obesity Prevention in Young Adults) randomized 71 students stratified by gender from an introductory nutrition class to a non-diet or fruit and vegetable intervention. Both groups completed a 10-week program consisting of weekly home-based lessons and interactive activities. There were no differences between groups for any dependent variable. Interventions were equally effective for maintenance of current body weight. Results were used in curriculum development.
- A random menu analysis of RI Department of Elderly Affairs’ Congregate meal Program revealed that menus do not meet USDA/DHHS Dietary Guidelines (high in total fat, saturated fat, sodium, kilocalories). As a result, DEA will engage in a two-year study to investigate the impact of meal participation on health/nutrition outcomes and medical costs in older clients.

**Source of funds:**

Smith-Lever

Hatch

State

Other

- 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 linked 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 was recently formed to organize, unify and activate a community/institutional model where students and faculty will work within both the academic and external communities to more comprehensively study and seek solutions. This model will integrate training, research, service learning and outreach into communities in RI where food insecurity is most prevalent.

**Outputs:**

- Four Faculty from four different Colleges from within the University have worked cooperatively to develop the President's Partnership in Food, Hunger and Nutrition.
- 29 students in the FHN interdisciplinary seminar collected 372 food security surveys at 40 sites as part of the national Second Harvest National Hunger Study.
- 75 URI freshman students participated in modular instruction on hunger and nutrition in an effort to raise awareness, and to study and seek solutions to the complex issues related to food insecurity and nutrition.
- Assessment of food experiences and daily survival strategies related to hunger was gathered on 70 clients from Crossroads, the state's major agency serving the homeless. Preliminary data analysis indicates that participants consume no fruit or vegetables on most days, have diets extremely high in fat and carbohydrate, and are overweight or obese.
- Preliminary development of GIS maps to illustrate food access issues in Rhode Island (location of federal food programs, retail food outlets, emergency food sites, state and federal assistance programs, health care, senior meal sites, etc).
- Development and refinement of the FHN website for students and community members.

**Outcomes/Impact:**

- Three community based agencies are now collaborating with the URI Partnership in Food, Hunger and Nutrition to assess the nutrition and food needs of clients living in poverty. This collaboration has submitted a grant proposal to support student training and outreach with targeted populations (CSREES Higher Education Challenge Grant).

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- URI Partnership funding

**Scope of impact:** State and local.

**Expenditure and Full-time Equivalent (FTE) Summary  
FY 2005**

**Goal 3**

<b>AES Federal FTE</b>		1.50
<b>AES State FTE</b>		0.44
<b>AES Formula \$</b>	\$	40,568
<b>AES Match \$</b>	\$	41,240
<b>CE Federal FTE</b>		-
<b>CE State FTE</b>		0.25
<b>CE Formula \$</b>	\$	-
<b>CE Match \$</b>	\$	27,796
<b>Total FTE's</b>		2.19
<b>Total Formula \$</b>	\$	40,568
<b>Total Match \$</b>	\$	69,036

## **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 water quality, since water quality protection and restoration can integrate a wide variety of land management efforts. Other themes include: Critical Habitats; Wetlands Restoration and Protection; 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.

##### **Situation:**

Coastal managers, resource specialists, and wetland scientists have considerable interest in subtidal substrate (subaqueous 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 littoral zone. 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. This project addresses the questions: 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.

##### **Outputs:**

- Bathymetric maps for Greenwich Bay and Wickford Harbor that can be used for numerous purposes.
- 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/](http://www.ci.uri.edu/projects/mapcoast/)).

**Outcomes/Impact:**

- Masters and undergraduate student training.
- Funded research through NRCS.
- Expected federal appropriated funds administered through NOAA.
- Framing of an integrated NSF proposal focused on subaqueous soils and carbon sequestration.

**Source of funds:**

- Smith-Lever
- Hatch, Multi-state
- State
- Other

**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.

**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 05 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*

- Co-sponsored and participated in Logic Model training workshop for all New England States offered by NOAA Coastal Services Center. Development of logic models for each state programs resulting in greater ability to distinguish outcomes and outputs and to quantify objectives. We are planning for volunteer monitoring, NEMO, sustainable landscapes and private wells working groups.
- Co-sponsored and participated in training in fostering sustainable behavior which resulted in 4 regional project members representing different states to participate in Fostering Sustainable Behavior advanced training (developed by Dr. Douglas McKenzie Mohr of Environment Canada) on the use of social marketing to promote environmentally-friendly behaviors.
- Working in partnership with the University of Idaho, a needs assessment of water quality priorities by New England citizens is currently underway. Revise, develop and conduct a regional programmatic needs assessment.
- *New England Wide Water Quality Program Website:*

The University of Rhode Island continued its leadership in updating and expanding The New England Water Quality Project website. The website represents the overall New England Program as well as the New England Focus Areas. This page 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 webpage articulates the capacity of the New England Region Water Quality 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 198,000 requests, with a daily average of 153 requests. Specific activities include:

1. The webpage has been updated to reflect the changes in the New England Program with new project funding. The six New England



Focus Areas are now reflected on the regional website and content for each of these has been developed and posted.

2. Using the latest software technology and geographic data we developed a prototype ArcIMS system to serve map information over the World Wide Web. This application focuses on the concept of location and watershed. Users are able to find the location of their municipality and identify the watershed they live within. The site is located at <http://mapper.edc.uri.edu/website/Waterquality-html/>. The advantages of this system are that the user doesn't need to use complex software to make decisions about the resources they impact. The information is presented in a way that anyone who uses the tool can be empowered with the same information as experts and decision makers.
3. Conducted inventory of other available tools to include as links on New England site under "On-line Resources".
4. Developed and posted content additions.
  - Reorganized website with team to sort content by Research, Education, and Extension topics to facilitate navigation through site.
  - Continued work with steering committee to ensure website is meeting needs of New England Region.
  - Marketed website to search engines.
  - Continued routine maintenance of hardware that hosts the website, as well as maintenance of the website itself.
  - Ensured continued compliance with Americans with Disabilities Act.
  - Maintained NEWQ listserv
  - Maintained current events calendar
  - Created Activities pages under each focus area
  - Created Steering Committee page

*National, Multi-state 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 Watershed Management Theme pages. This included:

- 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.
- Development of the a new logo design for the National and Regional Programs
- Hosting a workshop for regional and project specific web developers at the National Conference in La Jolla, CA
- Added Success Stories: 4 under Watershed Management, CSREES Science and Education Impacts (found and posted links to projects specified by CSREES), posted National Integrated Water Quality Program Impact Report

- Maintained current events calendar
- Posted updated versions of National Directory
- Posted CSREES FY2005 RFAs
- Maintained CSL webpage & current posting of minutes
- Developed and ran web workshop at National Conference
- Updated National and Regional logos
- Maintained CSL-WQ, WQ-L, and 406developers listservs
- Posted FY 2004 funded projects (CSREES Integrated, NRI and CEAP)
- 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, Multi-state
- State
- Other
  - 406 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). Our research aims to understand the factors that control the variability of groundwater nitrate removal in both streamside and coastal riparian areas. 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  $^{15}\text{N}$  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.

### **Outputs:**

- Funding granted from USDA-CSREES NRI as a seed project to begin to refine methods and select sites for the assessment of in-stream N removal.

### *Publications*

- Kellogg, D.Q., A.J. Gold, P.M. Groffman, K. Addy, M.H. Stolt, and G. Blazejewski. 2005. In situ ground water denitrification in stratified, permeable soils underlying riparian wetlands. *Journal of Environmental Quality* 34:524-533.
- Kellogg, Q., K. Addy, A. Gold, P. Groffman, M. Stolt. 2005. Ecohydrology of riparian zones in Rhode Island and areas of the glaciated northeastern United States. IX INTECOL International Congress of Ecology. Montreal, Canada.
- Blazejewski, G.A., M.H. Stolt, A.J. Gold and P.M. Groffman. 2005. Macro- and Micromorphology of Subsurface Carbon in Riparian Zone Soils. *Soil Science Society of America Journal* 69:1320-1329.
- Addy, K., A.J. Gold, B.L. Nowicki, M.H. Stolt, and P.M. Groffman. 2005. Groundwater denitrification capacity of Rhode Island estuarine riparian zones. *Proceedings of the USDA-CSREES National Water Quality Conference, La Jolla, CA.*
- Gold, A.J. 2005. Scientific overview of coastal buffer water quality functions. CRMC Workshop: Coastal Vegetative Buffer Policy: Innovative Approaches in Urban/Suburban Environments, Kingston, RI.

### **Outcomes/Impact:**

- Students (4 undergraduates, including 2 Coastal Fellows, one M.S. graduate student, and one Ph.D. graduate student) learned laboratory and field techniques to sample and test groundwater, assess groundwater hydrology, and conduct hypothesis-based research on groundwater nitrate dynamics in various riparian zones.
- 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

- 406 Water Quality Program

**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. Following their workshop, 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 riparian zone researchers viewed our publications and conference materials which helped to refine the future direction of riparian zone research on groundwater N dynamics.

**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.

### **Outputs:**

#### **Private Drinking Water Well Protection:**

- Seven educational workshops were held throughout Rhode Island for private well owners. These workshops are offered in cooperation with the Rhode Island Department of Health and local organizations. Over 200 people attended the program.
- Received funding from the USDA Healthy Homes Program to produce a video for educational television on private well protection.
- Completed development of a resource guide for New England realtors entitled, *What Every Realtor Should Know About Private Drinking Water Wells*. This guide has been developed and reviewed throughout the New England region as well as by members of the Rhode Island Realtor's Association. The Initiative is developing a distribution strategy for the brochure that will include meeting with realtor associations in each New England state to discuss the resource guide and additional educational needs and programming for this audience. The guide will be used for private well education workshops with the Rhode Island Realtor's Association.
- Completed the development of tri-fold brochure on private well testing and protection in cooperation with the Rhode Island Department of Health and the U.S. Environmental Protection Agency, New England. Five thousand brochures were distributed along with accompanying display board to public places within Rhode Island, including libraries and town halls.
- A professional training workshop was held on October 28, 2004 in Rhode Island. The workshop was hosted by the Water Systems Council, the New England Private Well Initiative, the University of Rhode Island, and U.S. EPA-New England.

### **Outputs:**

#### **Sustainable Landscaping:**

- Established a demonstration rain garden at the North Kingstown Town Hall, with assistance from colleagues who have conducted research on rain gardens at the University of Connecticut. A team of URI Master Gardeners assisted with the planning and installation, and continue to monitor and maintain the garden. Working with faculty and staff at both the Universities of Rhode Island and Connecticut, educational materials were developed to support the demonstration rain garden. These materials reviewed and distributed throughout New England via the

- regional water quality program.
- Working in cooperation with researchers and Extension faculty at the University of Connecticut, materials on proper lawn fertilizing were incorporated into the URI Healthy Landscapes Program to establish local residential sites where programming, tours, and media coverage (including Plant Pro TV and print media) focus on activities and promote practices.
  - Several educational slide presentations have been developed for several target audiences, including Master Gardener volunteers, professional sector training programs, and a residential audience. These slide presentations are used at community presentations, volunteer training programs, and professional sector trainings as highlighted below. A slideshow for the URI Master Gardener Speaker's Bureau has been completed. A training program for the speaker's bureau is underdevelopment in partnership with the URI Master Gardener Program.
  - Educational tours of demonstration landscape sites and workshops held for residents and program volunteers, including: Advanced training program to Master Gardener hotline operators; Annual training program at Master Gardener course for new members; Four demonstration site landscape tours; Two public education workshops; A presentation on the Healthy Landscapes Program was made at a regional sustainable landscapes workshop on turf grass management and water quality held at the University of Connecticut; A presentation on the Healthy Landscapes Program was made at the USDA CSREES National Water Quality Program Conference in San Diego, CA.
  - Working in cooperation with the CE Education Center, professional sector training program are held throughout the year, including: The RI Nursery and Landscape Association (RINLA) Winter Education Seminar; the URI CE Pesticide Applicator Training; and, Northeast Regional Integrated Pest Management Conference
  - RINLA's certified horticulturist training program was modified in 2005 to enhance education and knowledge of Healthy Landscapes principles including storm water runoff and nutrient management.

### **Outputs:**

#### **Animal Waste Management:**

- A fact sheet and self-assessment series tailored for small acreage livestock owners in RI was developed as part of the Healthy Landscapes Project and the demonstration site owners reviewed and worked with the materials to assess and address management issues on their site. The series includes:
  - Fact sheet 1: *Livestock on Small Acreages: Protecting Water Resources and Health*
  - Fact sheet 2: *Livestock Yards and Manure Storage Areas on Small Acreages: Protecting Water Resources and Health*
  - Fact sheet 3: *Livestock Pastures, Fencing, and Watering on Small Acreages: Protecting Water Resources and Health*
  - Fact sheet 4: *Livestock on Small Acreages: Assessing Your Risks to Water Resources*
  - Self-assessment worksheet 1: Livestock Yards and Access: Assessing Your Risks*
  - Self-assessment worksheet 2: Livestock Manure Storage: Assessing Your Risks*

**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:* As a result of attending private well water workshops, participants take the following actions to protect their drinking water supply: 45% had their water tested; 27% had their septic system inspected; 18% reduced their use of fertilizers around their well; 13% reduced their use of pesticides around their well; 72% shared workshop information with others.
- *Sustainable Landscaping:* Preliminary surveys conducted for the Healthy Landscapes Program show that 80% of survey respondents indicate a willingness to change yard care practices for water quality protection. Follow up surveys will be conducted in 2006.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- 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., H. Burdett, M. Gold. Protecting Water Quality in Rural Landscapes: A Comprehensive Community Nonpoint Source Education Program. (2002 – 2005) Funding from USDA, CSREES. \$278,000.00
- Joubert, L., A. McCann, H. Burdett, P. Hickey, A. Gold. (2002 - 2005) Source Water Assessment and Public Outreach: An Integrated Approach for Major Water

Suppliers in Rhode Island. Funding from the RI Department of Health.  
\$328,000.00.

**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 scientist-led volunteer water quality monitoring and education program that began in 1988. The goals of Watershed Watch remain consistent and relevant. 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 Rhode Island sponsors, as well as the RI Department of Environmental Management (RIDEM) and the Narragansett Bay Estuary program, all of which financially and programmatically support the program. URI Watershed Watch maintains its own analytical laboratory, and in this past year has updated and had its Quality Assurance Project Plans accepted by EPA-New England, a requirement for EPA funding and data acceptance. RIDEM considers URI Watershed Watch data on par with that collected and analyzed by professionals. Because of their years of expertise the staff of URI Watershed Watch have been recognized as leaders in the volunteer monitoring community not only statewide, but also regionally and nationally.

*CSREES New England Regional Water Program Volunteer Water Quality Monitoring Focus Area:* The Volunteer Water Quality Monitoring focus area, lead by URI, has officially assumed the full leadership role for the New England Regional Monitoring Collaborative (NERMC), replacing US EPA Region 1 in terms of logistical and programmatic support (EPA remains a strong partner in these efforts, and is a member of the focus group.) 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 our 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 housed within universities allows the member monitoring programs to emphasize scientist-led watershed level water quality monitoring with trained volunteers. These local volunteer water quality monitoring programs include the *Volunteer Water Quality Monitoring: A National Facilitation Project.*

In September 2000, Rhode Island and Wisconsin Extension received funding from USDA CSREES 406 National Water Quality Program for a four year project entitled



National Facilitation of CRSEES Volunteer Monitoring Efforts. In September 2004 this project was expanded and renewed for an additional four years, again with URI leading the project. The National Integrated Water Quality program administrator stated that this was one of the highest ranked of the over 100 applicants. In brief, the goals of facilitation projects are to build a comprehensive support system for Extension volunteer water quality monitoring efforts 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.

### **Outputs:**

#### **URI Watershed Watch Program**

- URI Watershed Watch has volunteer water quality monitors working in all 14 major RI watersheds and in all aquatic ecosystems except wetlands.
- There are over 350 citizen scientists participating in this program, some for the entire 18 years.
- Significant local support for Watershed Watch is apparent through program sponsorship from 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 since the inception of the program. In this past year we sponsored 4 undergraduate Coastal Fellows, 1 of whom was a USDA Multicultural scholarship.
- RI Department of Environmental Management is a strong supporter of the program, providing grant funding for overall program support on a five-year cycle.
- The URIWW Analytical laboratory completely updated its laboratory quality assurance project plan, receiving approval of *Quality Assurance Project Plan, University of Rhode Island Watershed Watch Analytical Laboratory*, by EPA-NE in June 2005.
- Two additional quality assurance project plans, *URIWW Ambient and Marine Field Assays*, and *URIWW Ambient and Marine Field Monitoring Program: Block Island and Green Hill Pond Watersheds, RI* were approved by EPA-NE in 2005.
- Efforts to increase coastal monitoring efforts were continued with Greenwich Bay Tributary monitoring which began in the summer of 2003, and maintained through this year. This permitted a continuation of monitoring that would have ended due to lack of State Agency & RI Sea Grant funds and also provides data for implementation of the Greenwich Bay Special Area Management Plan, and RI Department of Environmental Management Total Maximum Daily Load studies. In this past year funding transitioned from RI Sea Grant to the locally based Greenwich Bay Watershed Group.

- The Narragansett Bay Estuary Program provided funding and technical expertise to URIWW to organize and initiate volunteer monitoring on 10 sites in Greenwich Bay itself. This program is also sponsored by local marinas and the Greenwich Bay Watershed Group.
- URIWW continued to support volunteer monitoring efforts in Green Hill, Ninigret, and Great Salt Ponds, and selected tributaries to these ponds as a part of the Block Island and Green Hill Pond Watersheds, RI, EPA National Community Decentralized Wastewater Treatment Demonstration Project. This includes split sampling and analyses to compare two methods of bacteria analysis.
- The URIWW Analytical laboratory, besides performing water quality analyses for its base program, has conducted all analyses of wastewater for the Block Island and Green Hill Pond Watersheds, RI, EPA National Community Decentralized Wastewater Treatment Demonstration Project.
- URIWW program director Linda Green continues her participation with 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.
- Herron, E., L. Green, K. Stepenuck and K. Addy. 2004. Building Credibility: Quality Assurance and Quality Control for Volunteer Monitoring Programs. Fact sheet VI – Guide to Growing CSREES Monitoring Programs. CELS Contribution #4083, University of Rhode Island, Kingston, RI.
- Green, Linda T., Marie E. Esten, and Elizabeth Herron. 2005. Quality Assurance Project Plan: University of Rhode Island Watershed Watch Laboratory Program. CELS contribution #5026, University of Rhode Island, Kingston, RI.
- Green, L., and E. Herron. 2005. URI Watershed Watch Greenwich Bay Monitoring Manual. CELS contribution #5017. University of Rhode Island, Kingston, RI.
- Green, Linda T., Marie E. Esten, and Elizabeth Herron. 2005. Quality Assurance Project Plan: University of Rhode Island Watershed Watch Ambient and Marine Field Assays. CELS contribution #5029, University of Rhode Island, Kingston, RI.

### **Regional Outputs:**

- 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.
- *The New England Monitoring Summit – Shared Waters*, was held in April 2005 in Westford MA. It was a collaborative meeting of nearly 100 federal, state, and volunteer water quality monitoring partners and intended to help identify potential approaches within the Northeast that lend themselves to developing a sustainable support system for volunteer monitoring. Linda Green and Elizabeth Herron helped organize and conduct the summit.
- *New England Chapter of North American Lake Management Society annual conferences*, make presentations and conduct workshops
- *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).

## National Outputs:

### Volunteer Water Quality Monitoring: A National Facilitation Project

- The facilitation website [www.usawaterquality.org/volunteer](http://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.
  - The website has an annotated bibliography of papers and studies comparing volunteer with professional monitoring, adding to the research base of this project and also validating the efforts of volunteer monitoring programs.
  - A new section to the website typically archives exchanges from our project listserv [CSREESvolmon-list@uwex.edu](mailto:CSREESvolmon-list@uwex.edu) and that of US EPA's volunteer monitoring listserv.
- The facilitation project listserv has grown to several hundred members, rivaling EPA's volunteer monitoring listserv in size.
- The most recent fact sheet module in the Guide for Growing CSREES Volunteer Monitoring Program is *Building Credibility: Quality Assurance and Quality Control for Volunteer Monitoring Programs*. It has been particularly well received, and has become the most-sought after of all the modules.
- Presentations and workshops sponsored by the national facilitation project were held in multiple states throughout the year, at venues ranging from statewide volunteer monitoring workshops to national conferences.
- We organized and held a standing room only half-day volunteer monitoring coordinator workshop at the 2005 USDA-CSREES National Water Quality Conference in La Jolla, CA and plan to continue to do so at this conference throughout the project.
- National Facilitation Project PI Linda Green has been asked to represent all National Facilitation projects at the Committee for Shared Leadership meeting at the CSREES-USDA National Water Conference.
- National Facilitation Project PI 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.
- The National Facilitation Project is a major sponsor of the NWQMC May 2006 biennial conference, *Monitoring Networks: connecting for Clean Water*. Linda Green is a conference co-chair. For the first time at this conference volunteer monitoring will share the stage with professional efforts. Facilitation project staff have been

instrumental in helping to organize the conference and in seeking out presenters. All project staff will hold workshops and have organized multiple presentation sessions.

#### **Additional National Outputs:**

- URI Watershed Watch program coordinator Elizabeth Herron Represents the New England region on the Board of Directors of the North American Lake Management Society, and is the prime staff for the CSREES Volunteer Water Quality Monitoring National Facilitation project.
- 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 has been named to the planning committee for the National Lakes Assessment 2006 conference and was chosen to represent the volunteer monitoring community as a panelist at a 2005 workshop focused on the upcoming National Lakes Assessment.

#### **Outcomes/Impact:**

##### **URI Watershed Watch Program**

- URI Watershed Watch is the largest scientist-led volunteer water quality-monitoring program in the State as well as the most comprehensive. 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. 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. 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 eighteen-plus year data records on a number of sites are the only such long-term compilation in Rhode Island.
- The 350+ trained volunteers provided more than 14,500 hours in volunteer water quality monitoring at more than 200 lake, stream, salt pond, estuary and Bay sites statewide. At the 2004 rate of \$18.05/hr ([www.independentsector.org/](http://www.independentsector.org/)) this is equivalent to over \$260,000 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 rectify 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 improvement of water quality in others.
- Watershed organizations have successfully obtained grant funding for their monitoring efforts.
- With the completion and approval of our quality assurance project plans, the quality of our data has been validated, and 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.
- *The New England Monitoring Summit – Shared Waters*, attracted a broad geographic range of participants with representatives from all six New England states. Participants also embodied the range of monitoring partners anticipated including: academic and environmental organization-based volunteer programs as well as agency monitoring programs; regulators, and community decision-makers. Outcomes of the summit included:
  - NERMC gaining an additional partner for its efforts, the New England Interstate Pollution Control Commission.
  - Identifying successful elements of different approaches to monitoring (success stories, surveys, evaluations etc.),
  - Reaching consensus on information and resource needs of all monitoring partners,
  - Learning about obstacles that are preventing development of a successful network now; and
  - Discussing partnership opportunities and how to best plan for the future.
  - Attendees suggested that having additional summits at two year intervals will be very beneficial to maintaining and strengthening connections.
- Each year our regional project co-sponsors the NE chapter of the North American Lake Management Society’s annual conference.
- *Regional Lake Assessment Project*. This Project is in its early planning stages. 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**

- We conducted an assessment of the original project via our project listserv members. Most respondents learned of the project through a conference or workshop, followed by information received from state Extension water quality coordinators.

The most highly rated outcomes of attending workshops were an increased knowledge of volunteer monitoring program management and enhanced networking opportunities. All respondents strongly agreed or agreed with recommending the project's materials and services.

- This fiscal year marked the overlap of the extended final year of the initial national facilitation project with the start of the new four year project.
- National facilitation project staff were invited to organize and conduct volunteer monitoring workshops or presentations in New Jersey, Arizona, Wisconsin, and Virginia.
  - 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.
  - In Arizona, the group has decided to proceed with organizing a state monitoring council and a series of additional workshops.
  - Extension is recognized as a leader within the volunteer monitoring community.
- The project web site ([www.usawaterquality.org/volunteer/](http://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 is where program coordinators go to find information, using its archived listserv responses to queries and also the many links in the factsheet modules.
  - 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 will share the stage with federal and state agency programs.
  - Each of the CSREES regions is providing travel assistance for a volunteer monitoring coordinator to participate in this conference.
  - Extension has gained recognition and appreciation for its ascendant role in supporting volunteer monitoring, in contrast to EPA's diminishing role.

**Source of funds:**

Smith-Lever

Hatch

State

Other

- L. Green, E. Herron, URI Watershed Watch, 35 local sponsoring agencies and organizations, \$28,000.

- 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, A. Gold and R. Shepard, Volunteer Water Quality Monitoring: A CSREES National Facilitation Project, CSREES-USDA, 10/1/00 – 9/14/05, \$360,000.
- 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 – 9/30/06, \$100,438.
- L. Green, Donations to the Gloria Hurley Endowment of the URI Foundation, 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, \$4,906.
- A.J. Gold, R. Jeffrey, A. McCann, P. August, The New England Regional Water Quality Program, USDA-CSREES, 9/15/00 – 9/14/05, \$13,400.
- L. Green and E. Herron, Greenwich Bay Tributary Monitoring Program, New England Grassroots Environmental Fund via the Greenwich Bay Watershed Group, \$2,500.
- 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:**

In 2005 we completed an intensive, 4-year field study of amphibian breeding effort, hydroperiods, and related site characteristics in 65 seasonal ponds in the Pawcatuck River watershed of Rhode Island (RI00MS970: “Vernal Pool Hydroperiod Prediction as a Basis for Habitat Assessment and Management of Forest Amphibians”). Major goals were: (1) to

demonstrate the influence of pond hydroperiod on egg-mass production by wood frogs (*Rana sylvatica*) and spotted salamanders (*Ambystoma maculatum*), and (2) to develop methods for estimating hydroperiod from morphologic, edaphic, chemical, or vegetative characteristics of the ponds. We have created a hydroperiod classification for seasonal ponds and shown that maximum egg-mass counts for both species increase from Class 1 (less than 20 weeks) to Class 3 (28-36 weeks) and then decline with additional increases in hydroperiod (Class 4). We have also developed two models for estimating pond hydroperiod. The first model, which requires field data on tree canopy cover, basin depth, water chemistry, surficial geology, and soil parent material texture, permits correct classification of ponds as suitable or unsuitable for breeding wood frogs 95% of the time and spotted salamanders 75% of the time. The second approach, which is based on the plants growing in a pond's deepest zone, allows one to estimate pond hydroperiod class with 72% accuracy. These techniques should greatly enhance the process of amphibian habitat assessment and provide a solid framework for prioritizing protection of these critical habitats at the watershed scale.

### **Outputs:**

- Two Master's theses: Skidds, D.E. 2003. Potential predictors of hydroperiod in southern Rhode Island seasonal ponds; Mitchell, J.C. 2005. Using plants as indicators of hydroperiod class and amphibian habitat suitability in Rhode Island seasonal ponds.
- One refereed journal article: Skidds, D.E. and Golet, F.C. 2005. Estimating hydroperiod suitability for breeding amphibians in southern Rhode Island seasonal ponds. *Wetlands Ecology and Management* 13: 349-366. Three more manuscripts are in preparation.
- Two poster presentations at the Annual Meeting of the RI Natural History Survey.
- Two \$3,000 grants from the RI Chapter of The Nature Conservancy.
- A \$50,000 grant (2006) from the RI Department of Environmental Management to prioritize seasonal pond protection efforts in the Queen's River watershed using methods developed in RI00MS970.
- Research proposal to RIAES for FY 2007-2009 to assess the possible impacts of groundwater withdrawal from municipal wells on seasonal hydroperiod and habitat suitability for pond-breeding amphibians.

### **Outcomes/Impact:**

- Two Master's degree candidates (D. Skidds and J. Mitchell) and three undergraduate Coastal Fellows (E. Walsh, E. Gibson, and M. Groff) received intensive, hands-on training in wetland ecology and management research techniques.
- 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 shared this knowledge included: 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; 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 pieces of property play in maintaining pond-breeding amphibian populations and other types of forest wildlife throughout the watershed as a whole.
- We transmitted our findings to the general public via presentations at the Annual Meeting of the RI Natural History Survey in 2003 and 2005 and vernal pool walks conducted for the RI Wild Plant Society in 2003, 2004, and 2005. These events gave participants a better understanding of the ecology of seasonal ponds and the need for effective land use management and regulation in their vicinity.
- The results of our work were conveyed to more than 100 undergraduate and graduate students enrolled in a URI Wetland Ecology course (NRS 423) from 2001 through 2005.
- Publication of our results in *Wetlands Ecology and Management*, an international peer-reviewed journal, assured that the science of seasonal pond ecology would be advanced and that the scientific community at large would benefit from our findings.
- Knowledge gained from our work was used to frame and initiate new research efforts that will further advance knowledge on this topic (Note \$50,000 grant from RIDEM and recent RIAES 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 northeastern United States at a minimum.

**Source of funds:**

- Smith-Lever
- McIntyre-Stennis
- Hatch
- State
- Other

**Scope of impact:** state, regional and national

**Knowledge Area:** KA 131. Alternative Uses of Land.

**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:

- Began 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. Public debut is anticipated for May 2006.
- 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. Improved visitor experience by streamlining design of this system.
- Designed and lead project to convert legacy RIGIS metadata to FGDC-compliant metadata.
- Established a node on the FGDC metadata clearinghouse network on behalf of RIGIS.
- Continuing work with the National Geospatial One-Stop to provide access to RIGIS metadata. The upcoming Rhode Island Geodata Gateway will work in concert with the National Geospatial One-Stop.
- Lead successful application to the FGDC Cooperative Agreement Program. This FY06 project will establish a suite of standards-based web feature services to RIGIS.
- Processed and reviewed data prior to their incorporation into the RIGIS data catalog.

**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:

- Began development of a new online Rhode Island atlas. It will serve as the base map for the Rhode Island Geodata Gateway and as the flagship for the RIMAP network.
- Exploring easier methods of sharing recent acquisitions of RIGIS digital orthophotography via Internet Map Server applications.

**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:

- Designed and lead innovative *Navigating Software Options for Internet Mapping Services* workshop. University of Rhode Island Coastal Institute, March 18, 2005.

- Co-moderated *GIS in City and Town Hall: What Worked and What Didn't* forum with RIGIS Coordinator.
- Provided ESRI ArcIMS software training to the University of Connecticut Center for Land Use Education and Research.
- Provided instruction in use of ESRI ArcView software to both Rhode Island and Massachusetts 4-H personnel.
- Loaned computer hardware to the Town of New Shoreham for *CommunityViz* software training.
- Provided Internet technology instruction to the URI Coastal Institute.
- 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.

### **Support of programmatic outputs:**

Coordination, communication, and facilitation activities:

- Lead a unique pair of meetings to share geospatial programmatic knowledge between University of Connecticut (UConn) and URI personnel.
- Co-organized a coastal remote sensing meeting in conjunction with the USFWS and the UConn Geospatial Technology Program. Representatives of USFWS, URI, UConn, and EPA participated.
- Managed logistics for ESRI-sponsored and taught *Getting the Most Out of ArcGIS Desktop* workshop.
- Coordinated ESRI *GIS Portal Toolkit* software training, funded by the Rhode Island Department of Health.
- 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.
- Assumed management of RIGIS-L, a statewide email listserv for geospatial technology users, and successfully revived it after a four year hiatus.
- Implemented the first-ever RIGIS RSS feed.
- Attended NOAA Coastal Services Center *Program Implementation* training hosted by University of New Hampshire Sea Grant.

*Professional Conferences and Workshops:*

- Northeast Arc Users Group (NEARC)
- Institute for the Application of Geospatial Technologies (IAGT) Northeast Affiliate Workshop
- Fall 2004 meeting of the ASPRS New England region hosted by the URI Coastal Institute and URI Department of Natural Resources Science.
- Rhode Island Land & Water summit
- National Nonpoint Education for Municipal Officials (NEMO) Network's Fourth Nemo University Conference
- NASA/USDA Workshop on Earth Science Applications and Decision Support
- ESRI International Users 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 FY2005, the RI Geospatial Extension Program is helping build the community of those savvy in geospatial technology in Rhode Island.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- 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 Connecticut in partnership with the UConn Geospatial Technology Program. Individuals from across the New England region traveled to participate in training opportunities arranged 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.

**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, URI 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, URI 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, URI NEMO is the only consistent source of resource-based training for Rhode Island municipal officials. Three levels of outreach are offered to target assistance to communities based on current issues and training needs: regional, statewide and community-based training programs; GIS-based watershed assessment tools, applied in partnership with local communities; and technical support in implementing local pollution prevention actions.

### **Outputs:**

- The URI NEMO locally-based Source Water Assessment Program (SWAP) enables communities to analyze approaches that can reduce health risks and hydrologic risks associated with various land use/land management strategies. This program partners with the Rhode Island Department of Health, which has committed \$280,000 to the URI NEMO Program. A GIS-based risk management model was employed to provide local communities with maps displaying high risk “hot spots,” along with a suite of water quality risk indices within the contributing catchments and recharge zones of public wells and reservoirs. The risk management and BMP techniques developed this year include a research summary and technology review on water quality and hydrologic features of pervious pavement and water quality aspects of shoreline buffers in residential settings. Group exercises using guided discussions with community leaders provided an excellent format for building community support, establishing goals and tailoring the content of the workshops to local community needs.
- Nine workshops were conducted with local officials from five Rhode Island communities, focusing on the topics of “How Changing Land Use Affects Water Quality”, and “Building Drinking Water Protection into Local Ordinances.” In each case, the program was tailored to community needs and interests, using GIS mapping and pollution risk indicators generated for the community through Source Water Assessment Plans.
- In five communities, nine technical assistance workshops were offered. These workshops focused on evaluating pollution risks associated with alternative future development options and incorporating updated land use controls into municipal zoning ordinances and land development regulations. The later highlighted improved stormwater management using low impact techniques, wetland buffer protection, and wastewater management.
- URI NEMO participated in the Massachusetts Stream Flow Conference, April 29, 2005 in Leominster, MA. The program focused on stream flow science and standards, legal issues, managing stream flow withdrawals and demands, and restoration efforts.
- URI NEMO participated in the Connecticut Stormwater Quality Manual Training sponsored by the University of Connecticut NEMO program for local officials and agency staff responsible for implementing Phase II stormwater plans. URI staff presented information on treatment performance, function and maintenance

- requirements of permeable pavement parking lots installed at the University of Rhode Island.
- URI NEMO, in cooperation with the New England Onsite Wastewater Training Center, published a three-volume set of visual guides illustrating how communities can use alternative individual and cluster disposal systems to achieve “smart growth,” improve the efficiency of land use, and sustain hydrologic functions. These guides serve as a cornerstone for URI NEMO Source Water Assessment Program (SWAP) training and were the focus of talks presented at the Massachusetts Streamflow Conference, sponsored by the Massachusetts Riverways Program in conjunction with EPA Region I in Tyngsboro, MA.
  - Through face-to-face meetings and listserv interactions, URI NEMO provided guidance on the use of interactive group activities to improve audience acceptance and adoption of BMPs and geospatial analyses. At the request of the New England NEMO focus area, the GIS tools and workshop format of the Source Water Protection Program were presented at the National NEMO conference in April 2005.
  - URI NEMO staff responded to requests for presentations on the relationship between land use activities and water quality impacts, conducting programs for the Salt Pond Coalition and for the South County Conservancy Land Trust Annual Meeting.
  - URI NEMO staff created posters describing URI educational programs and technical support and displayed these at local conferences including the RI Land and Water Conservation Summit and the Annual meeting of the RI League of Cities and Towns. Staff of the RI Department of Health and URI NEMO engaged conference participants in discussion of local resources issues and recruited local sponsors for drinking water protection workshops.
  - URI NEMO delivered talks, or co-authored papers and presentations on GIS-based pollution risk assessment, source water protection strategies, and techniques for establishing local wastewater management programs at regional and national conferences. This included a poster presentation at the Nonpoint Source and Stormwater Pollution Education Programs National Conference in Chicago, IL and oral presentations at the National Onsite Wastewater Recycling Association Annual Conference in Albuquerque, NM, the National Environmental Health Association, Annual Conference in Providence, RI, and the New England Interstate Water Pollution Control Commission in Mystic, CT. This later program, which attracted more than 240 participants from the private and public sectors from all six of the New England states, was supported by EPA Region I and New England Interstate Water Pollution Control Commission.
  - In partnership with the New England Onsite Wastewater Training, URI NEMO 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 as a model for other communities under the Block Island/Green Hill Pond Watershed National Wastewater Treatment Demonstration Project. This included technical assistance in implementing South Kingstown and Charlestown’s mandatory septic system inspection, repair and cesspool phase out ordinance, developing technical support for enhance wetland buffer standards, and development of educational fact sheets for residents. These were distributed by the

- town via direct mail to residents, and through workshops for local officials and residents in basics of onsite wastewater treatment system function and maintenance.
- URI NEMO staff, with NEOWTC colleagues, wrote and published 4 booklets/ manuals relating to creative community decentralized (onsite) wastewater treatment and management. These were made available through websites, listserves, and by direct mail.
  - To assist municipal officials in Exeter, Rhode Island as they evaluate alternative locations for new development, taking into consideration compact options to limit site disturbance, avoid sensitive groundwater aquifers, and control sprawl, NEMO staff prepared a GIS-based pollution risk assessment of alternative development patterns.
  - To assist municipal officials and professionals in reducing impervious cover and implementing stormwater runoff controls, NEMO staff completed a series of 3 technical bulletins on alternative pavement options. These were the focus of two talks presented by URI NEMO at the Comprehensive Environmental, Inc. October 2005 workshop entitled “Stormwater: Is LID for Real?” and at the New England NEMO November workshop entitled, “Low Impact Development In-Service Training.”
  - Ten alternative and innovative nitrogen removing wastewater treatment systems were 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.
  - URI NEMO and NEOWTC hosted a workshop for communities on new techniques to inventory and track onsite wastewater treatment systems.
  - NEOWTC and URI NEMO assisted the town of Charlestown, RI to develop a request for proposals for the development of a web-based septic system tracking and data management program. This program has saved the town staff time and has improved the quality of collected data from the private sector service providers.

**Outcomes/Impact:**

- Cesspool phase-out amendment was adopted for the Charlestown, RI wastewater management ordinance as a result of URI NEMO and OWTC technical assistance.
- Dissemination of research results and performance of permeable pavements increased the effectiveness of municipal decision maker training programs in the use of low impact development techniques for water resource protection and management.
- Regional agencies and researchers benefited from research-based smart growth training guides on wastewater management.
- Stream flow regulators, planners, and engineers benefited from NEMO-based research and education methodologies.
- The long-term viability of community drinking water supplies was improved through the efforts of the URI NEMO program.

- Professionals learned GIS-based techniques to evaluate onsite wastewater treatment impacts and evaluate treatment options to reduce pollution risks within a village setting.
- Over 500 hundred Southern New England onsite wastewater practitioners attended one and two-day NEOWTC classes during this reporting period. These professional development classes provided continuing education opportunities for many of them who needed to maintain their wastewater professional licenses.
- Onsite Wastewater Training Center staff reached an estimated 2300 wastewater professionals while delivering 14 talks at national and regional conferences.
- As a direct result of the publication of the URI NEMO and NEOWTC Program co-authored 4 booklets/manuals relating to creative community decentralized (onsite) wastewater treatment and management, the following outcomes occurred:
  - 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.
  - Authors invited to speak at a Massachusetts Riverways water quality conference.
  - State of Maryland purchased 300 copies of the booklets / manuals to promote statewide awareness of use of decentralized wastewater systems as a sewer alternative and to promote compact development and enhance dialog among stakeholders in the Chesapeake Bay area.
  - Towns of Block Island, South Kingstown, and Charlestown distributed booklets to town councils, boards and commissions, and citizen groups to enhance awareness.
  - Town of Glocester, RI distributed several hundred copies of the Chepachet booklet / manual at the town hall, library, and local businesses to enhance awareness of how alternative wastewater treatment systems and management can help revitalize historic mill villages.
  - 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. In a highly competitive selection process, this project, done in conjunction with Massachusetts, selected Chepachet Village in Glocester, RI 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.
- NEOWTC and NEMO staff trained approximately 160 Cooperative Extension educators and their professional wastewater clientele in Puerto Rico and the US Virgin Islands at 2-day outreach education training sessions that we coordinated, co-developed and co-delivered with other Cooperative Extension colleagues from TX, MN, and AZ. This ten element outreach training series helped our Cooperative Extension colleagues at the University of Puerto Rico to develop their own onsite wastewater training program, which will begin outreach activities to island practitioners in 2006.



- As a result of NEOWTC and NEMO providing technical support to Connecticut communities, USEPA offered to mediate discussions between CT Dept. of Environmental Protection and the town of Old Saybrook concerning use of innovative decentralized wastewater treatment systems. Based upon URI CE recommendations, a decentralized wastewater approach was adopted rather than the traditional state approach consisting of costly and unnecessary sewer expansions. In the neighboring town of Westbrook, CT, town officials adopted a wastewater management program integrating alternative wastewater treatment systems as a result of NEOWTC and NEMO input.
- 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 NEOWTC 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 (10) actual system designs plans. As an outcome from this effort, an estimated 200 pounds of nitrogen will be removed from this watershed by these nitrogen reduction systems on an annual basis.
- As a result of the URI CE community workshop about new techniques to inventory and track onsite wastewater treatment systems, and because of NEMO and NEOWTC technical advice, the towns of Charlestown and Block Island have contracted with one of the leading private sector companies providing web-based septic system tracking and data management programs. This will result in a staff time cost savings for both communities.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- L. Joubert, A. McCann, and A.. Gold., Source Water Program, 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.

**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. A highlight involved the coordination with colleagues from

Texas, Minnesota, and Arizona to help the University of Puerto Rico adopt a new approach to training wastewater professionals.

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 adopted 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**

### **Situation:**

The objective of this program is to provide technical information and training through which the best available digital natural resource data are made available, interpretable, and useful to municipalities, professionals, environmental organizations, and public agencies.

**Forest Management:** Presently, 60% of Rhode Island is forested. Eighty-percent of this forested land (303,000 acres) is privately owned by roughly 32,000 people. Approximately 80% (over 26,000 people) own forest parcels of less than 10 acres which amounts to roughly 250,000 acres of forestland in RI (SNEFCL, 2002). This trend is not unique to our small, densely populated state. Nationally, there are 150,000 new forest owners each year who acquire between 1 and 10 acre parcels. These forest owners are obtaining some of the most productive forestland. Cumulatively, they can have a significant impact on the Rhode Island landscape.

It is very important that today's forest owners gain awareness about the value of their resource and have the tools and educational materials to make informed decisions that protect and enhance the state's forests. Most landowners are unaware of how their activities affect environmental quality. Failure to protect and conserve forest resources can affect the quality of Rhode Island's natural resources. Landowners interested in preservation and management of natural resources are frequently not aware of the options available to them to do so. The development of educational programs and materials for landowners can encourage conservation and preservation of the state's forest resources.

Our Forest Management activities deliver educational programming and materials to private landowners in RI, specifically those with 10 acres or less of woodland (~26,000 people). The Woodscaping Program is designed to provide support for conservation, preservation, and wise management of forest resources.

**Public Policy Related to Forest and Range Land:** At the local level, an increasing awareness of the state's unique forest resources is developing. This awareness is generating a need for information and knowledge about forests and their protection, management, and preservation. It is important to note that the protection and management of the state's natural resources is decided upon in the 39 town and city halls across the state. Town councils, conservation commissions, and planning/zoning boards approve or deny exceptions to building permits, establish zoning laws, and issue or deny exceptions to zoning

ordinances. Ultimately, local governments decide the fate of Rhode Island's vital natural resources. Policy makers and professionals need information on which to base their land use decisions, including options for land preservation, identification of sensitive areas, and the management and protection of open space areas.

We provide data and training to planners, conservation groups, and land trusts at the municipal level to increase awareness of vital natural resources and critical habitats, including forest resources throughout the State. We focus on delivering training in GIS technology and provide access to a wealth of spatial data through the Environmental Data Center Web pages to include data from the Rhode Island Geographic System (RIGIS), Rhode Island Digital Atlas, and Global Positioning System (GPS) base station. Starting in FY05 we won the privilege to house and support the USDA CSREES, NASA Earth Science Enterprise, and NOAA Sea Grant funded RI Geospatial Extension Program (GES). The mission of the GES program is to promote the use of geospatial data through activities designed to educate citizens, scientists, resource managers, and decision-makers on the availability and application of contemporary geospatial data and tools.

The core of our overall program is instructor-led and Internet-based training, database development, GIS analysis, and Internet-based data access for local decision makers and the public in Rhode Island and beyond. It may be conceptualized in three components; the first is a data distribution component. Using the Internet, we provide geospatial data to users, including the Rhode Island Geographic Information System (RIGIS) data and Global Positioning System (GPS) base station files. The second component of the Program is to provide both instructor-led and Internet-based technology training programs that allow resource managers to use and access Geographic Information System (GIS) and remote sensing software, data, and tools. The third component of the Program is to conduct demonstrations and pilot projects on the use of the technology and data to resource managers.

#### **Outputs – Forest Management:**

- Burdett H., Modisette C., McCann A. and B. Neptin. 2004. 'Today's Forest, Tomorrow's Legacy: A Guide for Small Acreage Woodland Owners Fact Sheet Series, 18 fact sheets on small acreage woodland management. Fact sheet Contribution # 3976. URI CE, Dept. NRS, CELS.
- 2 workshops (35 total participants) on Woodscaping featuring the Small Acreage Woodland Owners fact sheet series, were implemented by partner agency Southern New England Forest Consortium, Inc. in the fall of 2004. Nine-hundred land owners of small woodland parcels in the (up to ten acres) RI Scituate Reservoir watershed were contacted by mail regarding the Woodscaping training materials and resources.
- Updated and enhanced the URI CE Woodscaping website [http://www.uri.edu/ce/wq/has/html/has\\_woodscaping.html](http://www.uri.edu/ce/wq/has/html/has_woodscaping.html), which delivers educational materials on forest protection to forest landowners. This site now includes the Woodscaping manual fact sheet (18) series when as well as links to partnering agencies and organizations and their training and assistance programs.

### **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 May 2006.
- RREA staff continued to participate in the RIGIS Executive Committee quarterly meetings.
- The RIGIS web site that is maintained in part by RREA was updated to simplify navigation to geospatial data for Rhode Island.
- Statewide digital orthophotography from 3 different dates was added to the RIGIS data access web site.
- A web-based Really Simple Syndication (RSS) feed was developed to inform users of new data additions to the RIGIS database.
- Reestablished the RIGIS-L statewide email geospatial listserv to enhance communication and collaboration among the natural resource management community.
- Within the suite of geospatial data servers overseen by RREA (RIGIS vector data, GPS Base Station correction file server, orthophotography image server) over 476 Gb of data have been distributed during 2005.
- Introduction to ArcGIS 1 course was held 5 times for a total of 75 participants: January 10 – 12, 2005; March 14 – 16 2005; May 24 – 25, 2005: This course was held for RI Department of Health staff; June 14 – 16, 2005; August 2 – 4, 2005
- Multi-state training programs were developed and offered for land use decision makers in the use of geospatial technologies and techniques for watershed management and water resource protection. New England NEMO and the Geospatial Extension Programs in Connecticut and Rhode Island conducted 2 full-day meetings to discuss current and planned research and Extension projects. Geospatial tools and techniques employed by each program were demonstrated, including the work of UConn's website Connecticut's Changing Landscape. As a direct result, an in-service training workshop was held at the URI campus on March 18, 2005. The workshop, titled Navigating Software Options for Internet Mapping Services, also involved the URI Geospatial Extension Program, The Providence Plan, and University of Connecticut's Geospatial Technology Program, and was sponsored by Rhode Island GIS and the URI Coastal Institute. The workshop had about 90 participants from Connecticut, Massachusetts and Rhode Island, and reviewed the many ways that maps can be accessed or served over the internet, which is a promising educational and technical assistance tool that many NEMO programs are either using, or would like to use.
- Hollister, J., Paul, J., August, P., Copeland, J., and Gonzales, L.. 2004. Assessing the Accuracy of the National Land Cover Dataset at Multiple Spatial Extents. *Photogrammetric Engineering and Remote Sensing*, 70:405-414

- Tiner, R.W., I. Huber, T. Nuerminger, and A. Mandeville. 2004. Coastal Wetland Trends in Narragansett Bay Estuary During the 20th Century. U.S. Fish and Wildlife Service, Northeast Region, Hadley, Mass. In cooperation with the University of Massachusetts-Amherst, Narragansett Bay Estuary Program, and University of Rhode Island. National Wetlands Inventory Report. Narragansett Bay Estuary Program Report No. 04-124. Providence, R.I. 37 pp. + Appendices

### **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 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 the RREA-managed RIGIS data access system. 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: In 1999, the Narragansett Bay Estuary Program continued working with the URI-EDC, USFWS, and the University of Massachusetts to perform a reverse trends analysis in the Rhode Island portion of the Narragansett Bay Estuary. Using baseline information obtained from RIGIS, Narragansett Bay Estuarine Habitat and Land Use Adjacent to Wetlands, the analysis looked at coastal wetland and buffer zone trends including losses, gains and changes in classification in the Estuary from the 1950s and the 1990s eras.
- Integrated project: We teamed with the Rhode Island Geospatial Extension Specialist, Geographic Information System (RIGIS), Environmental Monitoring Collaborative (RIEMC), Environmental Management (RIDEM), and Transportation (RIDOT) in submitting a successful proposal to the USGS Federal Geographic Data Committee for developing a more efficient method for the RI Geospatial

Community to more efficiently download online data depicting hydrographic 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 Roosevelt-Vanderbuilt National Historic Site in New York.
- Integrated project: We started a project that will help the Coastal Resources Management Council to gain access to the RIGIS database by developing a computerized statewide GIS atlas using ArcPublisher. The agency will use this to streamline its permit review process.
- Integrated project: Our RREA project has enabled us to assist 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: 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.

**Source of funds:**

Smith-Lever

Hatch

State

Other

- 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.

**Remote Sensing to Relate Impervious Cover to Lake and Stream Water Quality**

**Situation:**

Impervious surface 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. ISA has been identified as a key environmental indicator due to its impacts on water systems and its role in transportation and concentration of pollutants. Quantification of the percentage of ISA in

landscape has become increasingly important with growing concern over water quality in this country.

As the results of urban development and suburban sprawl, coastal state of Rhode Island experiences the problems caused by urban runoffs. However, Rhode Island has no high spatial resolution information for impervious surface areas (ISA) and effective impervious area (EIA) available, which limited the accuracy of impact analysis from urban runoff and the related research. 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 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 obtain changes of ISA and EIA using existing land use and land cover change data in 1980s, 1990s, and 2000s, derived from classification of Landsat images.
3. To extract EIA information by integration of GIS modeling techniques and remote sensing derived ISA.
4. To identify sensitive areas through change detection of pre-development and post-development ISA and EIA using GIS modeling.
5. To examine the impacts from changing ISA and EIA on the water quality and receiving water hydrology in the inland and coastal waters of the state with information from other data sources.

**Outputs:**

- This project used conventional digital image classification and developed a multiple agent segmentation and classification modeling to extract ISA and EIA information. The information extraction will be supported by ground verification and accuracy assessments.
- One Ph.D. student (Yuyu Zhou) is funded by this project and conducting dissertation research.

**Outcomes/Impact:**

- The project will link the changes of ISA and EIA with water qualities for impact analysis.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- NASA

**Validating Best Forest Management Practices around Vernal Pools: Amphibian Metapopulations, Harvester Adoption Costs and Public Values**

**Situation:**

The project objectives are (1) to evaluate the influence of forest harvesting on populations of amphibians that rely on seasonally-flooded wetlands (vernal pools); (2) to evaluate the economic opportunity foregone by forest harvesters if best management

practices are implemented to protect amphibians; (3) to examine the public's value for protecting amphibians and to compare that value to opportunities forgone by forest harvesters.

### **Outputs:**

- Under the first objective, we have added a seventh year of data to a long-term field study involving 14 vernal pools in western Massachusetts. The design will examine dispersal and metapopulation viability in vernal pool breeding amphibians, focusing on the marbled salamander. (Metapopulation refers to a population that relies on subpopulations existing in numerous habitat patches, vernal pools in this case, in order for the entire population to remain viable.) In addition, based on initial estimates of demographic parameters and dispersal rates for the marbled salamander, we parameterized a spatially-explicit metapopulation model, using RAMAS Metapop software, and conducted preliminary sensitivity analyses. Our initial results confirm the suitability of RAMAS as a modeling framework for the examining forest management practices and amphibian populations.
- Complementary work in Rhode Island was done to identify suitable field sites to investigate amphibian dispersal ecology in response to forest harvesting disturbance. We used 1:5000 aerial orthophotos to find vernal pools in Big River Management area. We then conducted egg mass counts in 10 vernal pools to document the breeding populations of wood frogs. We also determined the distance from vernal pools to adjacent forested habitats that had been logged in the past decade. We surveyed logged areas to determine logging history and plans for future logging in Big River management area.
- Our evaluation of the forgone economic opportunities for forest harvesting will be based on a dynamic optimization computer program. At end of 2005, two preliminary programs written in Matlab computer code were running correctly; these programs allow an assessment with different numbers of forest management units and age classes. For these, we have obtained a basic harvest-schedule that maximizes the value for the harvester, while maintaining the canopy restrictions designed to protect amphibians. We have solved a series of issues, such as rules for breaking ties in our value matrix or rules for determining feasible transitions from one forest condition to another. We anticipate developing a model that allows for six management units and six age classes. Discussions landscape ecologists are on-going to improve the link between preliminary models and amphibian dynamics.
- The research also intends to use survey-based methods to evaluate the public's value for tradeoffs between amphibian conservation and forest harvest opportunities. However, the incentive properties of both of these survey-based methods to measure willingness to pay are controversial. The third aspect of the research tries to develop an incentive compatible method to measure values: Such a new method will give respondents incentives to truthfully reveal their preferences in survey questions and the choices that they state. We have developed a formal proof of this method for binary choice situations. We have designed an experiment to test the incentive property in the binary case. At present, we are working to extend the method to the choice situations involving multiple alternatives, where each alternative produces a set of ecosystem outcomes relative to forest harvesting and amphibian conservation. Economics experiments will be implemented in 2006.



*Publications*

- Jenkins, C. L., K. McGarigal, and B. C. Timm. (Accepted). Orientation of movements and habitat selection in a spatially-structured population of marbled salamanders (*Ambystoma opacum*). J. of Herpetology.
- Gamble, L. R., K. McGarigal, C. L. Jenkins, and B. C. Timm. 2006. Limitations of regulated buffer zones for the conservation of marbled salamanders. Wetlands 26(2):in press.
- Paton, P.W.C., R.S. Egan, and T. Tyrell. 2005. Multi-scale habitat characteristics of pond-breeding amphibians across a rural-urban gradient. Oral presentation at the Joint Meeting of Ichthyologists and Herpetologists, Tampa, FL.

**Outcomes/Impact:**

- We expect that our findings will assist investigators and managers in identifying configurations of forest harvesting practices that may sustain amphibian metapopulations, including: a thoroughly documented empirical example of how amphibian populations operate at a landscape-scale; rigorously quantified dispersal rates in for salamanders; improved understanding of local dynamics in amphibian populations; providing critical information to better direct conservation strategies for vernal pool amphibians. Economics work will identify costs faced by forest harvesters due to conservation practices and establish new methods for measuring the economic value of conservation practices to the general public. The economics work will provide both computer simulation results and economic experiments as valuable examples for management and policy professionals.

**Source of funds:**

- Smith-Lever
- Hatch
- State
- Other

- Paton, P. et. al, NRI grant.

**Scope of impact:** State, regional and national

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

**Situation:**

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 identified a 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 are asked whether they are willing to pay a stated fee for a stated level of forest amenities, we have proven it is a dominant strategy for respondents to answer truthfully if they are asked to pay only if their contribution makes the difference between being able to provide the good, given the answers of the other respondents, and not.
- We are currently developing a laboratory test of this mechanism, and a proof extending it to multi-alternative questions.
- 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. Data for the survey are expected to be available for results in late 2006.

**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

**Scope of impact:** State, regional and national

**Identifying Public Preference Surprises for Policy Assessment**

**Situation:**

The proposed research focuses on public preferences for amenities provided by farm and forest land. The investigators will design focus groups and a contingent choice survey to assess whether preferences of rural and non-rural residents satisfy assumptions underlying valuation-based policies to balance rural development with the conservation of farm and forest landscapes. Unanticipated preference structures would imply that marginal values of land-cover types may be positively related to the quantity of the land-cover type in a rural community, contrary to standard economic intuition. The proposed work incorporates economic methodology with values clarification from landscape aesthetics. If conservation policy is driven by preferences of a regional or national public, divergence between the structure of preferences of rural and non-rural residents could lead policy to unintentionally encourage changes in rural community character that are contrary to the well-being of residents living in these communities. If policy analysts remain unaware of unanticipated preference structures, unintended policy outcomes are possible.

**Outputs:**

- The project intends to identify the relationship between the current land cover of a rural community and the value residents state for conservation of land in either forest or farm uses. The investigators completed a series of focus groups to design our survey on public preferences and values for land conservation in rural communities. The survey allows three areas of evaluation based on respondent's choices in questions that present two land conservation alternatives and the status quo. One pair of questions is designed to identify perceptions of what characteristics of land contribute to their community's character. Parcel characteristics include whether the parcel is a working farm or a wooded parcel, acreage, most common wildlife, most common sounds (e.g., traffic, nature sounds and wind), human elements (e.g., remnants of farms, wire fences, stone walls), and the surrounding landscape. Respondents identify their preference of whether to implement preservation restrictions on one parcel of land or leave both available for development, and then they identify which parcel contributes most to their community's rural character, environmental quality or sense of culture and history. The next pair of questions describes a similar choice, but adds a cost to preserve the parcels of land being described. Respondents are asked whether they would vote to pay the cost and implement preservation of the land (such as through purchase of development rights or the land itself through a town land trust). The third pair of questions is designed to address a larger scope of land preservation programs for the town. It describes two town-wide programs to preserve land, in terms of total acres

of farm or forest protected and likely taxpayer costs over the next 10 years. Questions generally offer one program that preserves relatively more farmland and another that preserves relatively more wooded land. Respondents indicate their preference for either program or for rejecting both programs. The survey also includes questions to identify the respondents background and socioeconomic characteristics.

- The survey was implemented through the summer, targeting a randomly selected sample of residents in Portsmouth-Middletown, Richmond, and Little Compton in Rhode Island. The initial mailing went to 3900 addresses drawn from the voter registration lists of the towns. After adjusting for non-deliverable addresses, and after multiple mailings, the response rate is approximately 30-35%. Through fall, data were being recorded in an Excel data base using double entry (entry by two different data handlers). Next steps will include analysis of stated preference data to identify factors influencing the choices outlined above and evaluation of methodological issues. These issues include the influence of the explicit request to consider rural character, environmental quality, and culture and history on the willingness to pay for land conservation; the scale of the questions considered; and the influence of respondents childhood community and reasons for choosing their current residence on their willingness to support various conservation choices.

**Outcomes/Impact:**

- The project will improve understanding of the relationship between preferences and values for conservation in local communities as compared to the preferences and values of a larger regional or statewide population. In addition, the project may uncover significant points at which the approaches to environmental valuation by economists could be better informed (to avoid misspecification of value models) by attention to insights from landscape aesthetics or environmental philosophy.

**Source of funds:**

- Smith-Lever
- McIntire-Stennis
- Hatch
- State
- Other

- NRI Competitive Grant

**Scope of impact:** State, regional and national

**Knowledge Area:** KA 133. Pollution Prevention and Mitigation

**New England Onsite Wastewater Training Program**

**Situation:**

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 and the many clientele

practitioner groups engaged in onsite wastewater design, installation, service providers, 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 NEOWTC staff, with State regulatory and private sector partners, ran a series of twenty 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.
- NEOWTC staff created and presented three new classes during this period designed to help meet the continuing education credit needs for our licensed wastewater practitioners.
- During this reporting period, NEOWTC staff delivered 14 talks at national and regional conferences involving ongoing URI onsite wastewater research.
- NEOWTC staff along with colleagues in the URI Nonpoint Education for Municipal Officials (NEMO) Program, wrote and published 4 booklets /manuals relating to creative community decentralized (onsite) wastewater treatment and management.
- NEOWTC staff wrote 2 book chapters in a refereed peer reviewed publication entitled *Residential Onsite Wastewater Treatment System: Operation and Maintenance Service Provider Program* textbook published during this reporting period by the Consortium of Institutes for Decentralized Wastewater Treatment.
- NEOWTC staff participated in and presented information at an onsite wastewater management forum for the town of Old Lyme, CT and several neighboring communities. The purpose of the forum was to establish local wastewater management programs that incorporate innovative and alternative treatment systems. NEOWTC staff showcased Rhode Island efforts 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.
- Cesspool phase-out amendment was adopted for the Charlestown, RI wastewater management ordinance as a result of URI NEMO and OWTC technical assistance.

- Ten 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. NEOWTC staff provided technical assistance to the town on establishing the program and reviewing system designs.
- URI NEMO and NEOWTC hosted a workshop for communities on new techniques to inventory and track onsite wastewater treatment systems.
- NEOWTC and NEMO assisted town of Charlestown, RI to develop a request for proposals for the development of a web-based septic system tracking and data management program. This program has saved the town staff time and has improved the quality of collected data from the private sector service providers.
- A NEOWTC staff member is an appointed member of the RI DEM Onsite Wastewater Technical Review Committee (TRC) which makes decisions on new and emerging alternative wastewater treatment technologies for Rhode Island. The TRC and RIDEM have benefited from OWT Center research-based recommendations.

**Outcomes/Impact:**

- The NEOWTC operates in partnership with state and federal agencies, municipalities, and over 40 private sector contractors. Since 1996, the OWTTC 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 NEOWTC'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 NEOWTC is also a major information resource for Extension programs throughout New England, regionally in the Northeast, and nationally.
- Over 500 hundred Southern New England onsite wastewater practitioners attended one- and two-day NEOWTC classes during this reporting period. These professional development classes provided continuing education opportunities for many of them who needed to maintain their wastewater professional licenses.
- Onsite Wastewater Training Center staff reached an estimated 2300 wastewater professionals while delivering 14 talks at national and regional conferences.
- As a direct result of the publication of the URI NEMO and NEOWTC Program co-authored 4 booklets/manuals relating to creative community decentralized (onsite) wastewater treatment and management the following outcomes occurred:
  - 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.

- Authors invited to speak at a Massachusetts Riverways water quality conference.
- State of Maryland purchased 300 copies of the booklets/manuals to promote statewide awareness of use of decentralized wastewater systems as a sewer alternative and to promote compact development and enhance dialog among stakeholders in the Chesapeake Bay area.
- Towns of Block Island, South Kingstown, and Charlestown distributed booklets to town councils, boards and commissions, and citizen groups to enhance awareness.
- Town of Glocester, RI distributed several hundred copies of the Chepachet booklet/manual at the town hall, library, and local businesses to enhance awareness of how alternative wastewater treatment systems and management can help revitalize historic mill villages.
- 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. 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.
- Along with Consortium of Institutes for Decentralized Wastewater Treatment partners at other Land Grant Universities, NEOWTC staff helped train over 200 operation and maintenance service providers at four locations around the United States using our co-authored *Residential Onsite Wastewater Treatment System: Operation and Maintenance Service Provider Program* textbook published during this reporting period by the Consortium.
- NEOWTC and NEMO staff trained approximately 160 Cooperative Extension educators and their professional wastewater clientele in Puerto Rico and the US Virgin Islands at 2-day outreach education training sessions that we coordinated, co-developed and co-delivered with other Cooperative Extension colleagues from TX, MN, and AZ. This ten element outreach training series helped our Cooperative Extension colleagues at the University of Puerto Rico to develop their own onsite wastewater training program, which will begin outreach activities to island practitioners in 2006.
- As a result of NEOWTC and NEMO providing technical support to Connecticut communities, USEPA offered to mediate discussions between CT Dept. of Environmental Protection and the town of Old Saybrook (CT) concerning use of innovative decentralized wastewater treatment systems. Based upon URI CE recommendations a decentralized wastewater approach was adopted rather than the traditional state approach consisting of costly and unnecessary sewer expansions. In the neighboring town of Westbrook, CT town officials adopted a wastewater management program integrating alternative wastewater treatment systems as a result of NEOWTC and NEMO input.

- 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 NEOWTC 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 10 actual system designs plans. As an outcome from this effort an estimated 200 pounds of nitrogen will be removed from this watershed by these nitrogen reduction systems on an annual basis.
- As a result of the URI CE community workshop about new techniques to inventory and track onsite wastewater treatment systems and because of NEMO and NEOWTC technical advice, the towns of Charlestown and Block Island have contracted with one of the leading private sector companies providing web-based septic system tracking and data management programs. This will result in a staff time cost savings for both communities.

**Source of funds:**

Smith-Lever

Hatch

State

Other

- 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. Approximately 25% 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 6 years ago which amounted to about 2-3 percent. Rhode Island municipal staff has collectively benefited by attending NEOWTC wastewater training classes and learning new ideas about wastewater management. Changes in Rhode Island DEM onsite wastewater regulations are being drafted that directly reflect findings from NEOWTC research-based onsite demonstration project systems. New draft regulations are proposed for public hearing in spring 2006. Connecticut communities have established decentralized alternative wastewater treatment programs to help address their wastewater needs, thus avoid costly and unnecessary sewer projects. Cooperative extension programs at the Universities of Puerto Rico and US Virgin Islands have begun to integrate information learned from URI NEMO and NEOWTC coordinated training. Over 200 O&M service providers were trained throughout the United States utilizing the first ever peer reviewed and nationally-sanctioned training curriculum developed by the Consortium of Institutes for Decentralized Wastewater Treatment. The NEOWTC staff was an integral part of that writing team.



## **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 are evaluating 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<sub>5</sub>), 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 have chosen 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. Gorres, 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* (In press)
- Amador, J. A., D. A. Potts, E. L. Nicosia, and J. H. Gorres. 2005. Aeration to improve the water quality and hydraulic functions of septic system leachfields. Proceedings of the 13th Northwest On-Site Wastewater Treatment Short Course and Equipment Exhibition, Seattle, WA.
- Nicosia, E. L., J. A. Atoyán, D. A. Potts, and J. A. Amador. 2005. The fate of tetracycline in conventional and aerated septic system leachfield soils. Abstracts of the ASA-CSSA-SSSA International Annual Meetings. Available online at: <http://crops.confex.com/crops/2005am/techprogram/P6363.HTM>
- Atoyán, J. A., E. L. Nicosia, D. A. Potts, and J. A. Amador. 2005. The effects of tetracycline on the microbial community of conventional and aerated leachfield soils. Abstracts of the ASA-CSSA-SSSA International Annual Meetings. Available online at: <http://crops.confex.com/crops/2005am/techprogram/P6307.HTM>
- Richard, J. T., D. A. Potts, J. H. Gorres, J. A. Amador, and B. Nowicki. 2005. Fate of ammonium in aerated and conventional septic system leachfield soil using stable nitrogen isotope tracer techniques. Abstracts of the ASA-CSSA-SSSA International Annual Meetings. Available online at: <http://crops.confex.com/crops/2005am/techprogram/P8950.HTM>

### **Outcomes/Impact:**

- *Results.* Our results suggest that the addition of tetracycline to leachfield soil at environmentally relevant concentrations has a short-term negative impact on the removal of N and P in leachfield soils, but long-term negative effects appear unlikely. Similarly, concerns with development of tetracycline resistance in fecal indicator bacteria seem unwarranted. Aerated and leachfield soil appear to respond in a similar manner to the introduction of tetracycline.
- *Student training.* Two M.S. students (E. Nicosia and J. Atoyán) have been working on different aspects of this project. They are expected to defend their thesis by May 2006. One undergraduate student (N. Schwarz) has worked as lab assistant as part of this project.

- The results of this project have been presented at the Annual International Meeting of the Soil Science Society of America. We anticipate that a number of peer-reviewed publications will result from this work. 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 and Janet Atoyán (NRS) and David Nelson and Andrew Starocik (BMMG) 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 considering using the resulting data as part of an application for research funds from the Microbial Observatories Program of the National Science Foundation

**Source of funds:**

- Smith-Lever  
 Hatch  
 State  
 Other

**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 (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 first full year of the project, one M.S. graduate student, Erik Bloomberg, was hired during 2005 to work on this project. Mr. Bloomberg completed his first field season during fall 2005. 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 determine the effect of forest type and management activities on habitat use, home range size, and survival 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) in both field biology skills and computer-intensive analysis of spatial data.
- 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

**Scope of impact:** In this first full 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 2005 (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. Ms. Smith successfully completed her third field season during fall 2005 on Block Island, RI. She 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,  $\beta$ -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. 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*

- Pierce, B.J., S.R. McWilliams, T. O'Connor, A.R. Place, C. Guglielmo. 2005. Effect of dietary fatty acid composition on depot fat and exercise performance in a migrating songbird, the red-eyed vireo. *Journal of Experimental Biology* 208:1277-1285.
- Podlesak, D., S.R. McWilliams, K. Hatch. 2005. Stable isotopes in breath, blood, feces and feathers can indicate intra-individual changes in diet of migratory songbirds. *Oecologia* 142:501-510.
- Pierce, B.J. and S.R. McWilliams. 2005. Seasonal changes in composition of lipid stores in migratory birds: causes and consequences. *Condor* 107:271-281.

### *Presentations*

- 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)
- 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)
- Max Planck Institute for Ornithology (Germany) “Nutritional ecology of migratory birds: fats as fuel, stable isotopes as tools”
- Institute for Wildlife Ecology (Vienna, Austria), “Nutritional ecology of migratory birds: insights gained by integrating physiology and ecology”
- European Science Foundation symposium entitled “Optimality in Bird Migration” (Wilhelmshaven, Germany) “Flying, fasting, and feeding in migratory birds: a nutritional and physiological perspective.” (w/ B.J. Pierce)
- Coastal Resources Management Council workshop entitled “Coastal Vegetative buffer policy: innovative approaches in urban/suburban environments” (Kingston, RI) “Scientific overview of buffer habitat functions.”

### **Outcomes/Impact:**

- This research involved the training of one Ph.D. student (Susan Smith) in field biology skills, laboratory analysis skills, and computer-intensive analysis of data. In addition, six undergraduate students participated in this research during 2005 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

- 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.

## **Ecosystem-Economics of Rural Landscapes and Land Use Change**

### **Situation:**

The project focuses on understanding economic and ecological interactions that affect opportunities for rural communities to develop economically, and on understanding mechanisms affecting ecosystem integrity within a developed landscape. The project emphasizes residential development pressures and impacts on ecosystem-integrity, integrating resource economics with conservation biological modeling of species' metapopulations (populations using habitat components throughout the landscape). This interdisciplinary analysis will clarify tradeoffs involving rural development, natural resource stewardship, and the quality of rural living.

### **Outputs:**

- Progress has been made on developing models that help quantitatively identify key interactions between the economic process and the ecological process of land use, and assembling data that support these modeling efforts. The conceptual model developed in the previous year that related the spatial dynamics of amphibian metapopulation to its long-term persistence was modified to incorporate both population size at discrete habitat patches and distance between patches in the quantitative description of the regional extinction probability of amphibian species. Correspondingly, the optimization model developed to help identify habitat critical to maintaining long-term species persistence and thus ecosystem integrity was updated to reflect the change of the conceptual model of spatial ecology. The modified optimization model was applied to an enlarged sub-area in the Wood Pawcatuck River Watershed that includes 150 vernal pools.
- A demonstration was presented comparing our ecological function-based, spatially explicit models to existing reserve design methods. The results illustrate: 1) different conservation strategies could lead to differing results by placing varying emphasis on the ecological role of specific reserves; 2) considering the ecological function of location of reserve sites may be more likely to achieve conservation objectives than only considering spatial rules *per se*; and 3) piecemeal treatment or mechanistic application of spatial rules in reserve design may be counterproductive and detrimental to the well-intended conservation objective which can be achieved otherwise.
- A simulation of varying landscape fragmentation was conducted, which shows habitat corridor could be a very valuable tool especially for conserving ecosystem integrity characteristic of metapopulation structure in landscape with residential development.
- New data sets have been identified and assembled that determine land value and that support examination of spatial dynamics and topology affecting land value. Previous data on land values that was derived from town property tax records using spatial averaging techniques was updated by using spatial econometrics techniques and economic valuation model. A model of predicting land value was developed, and will be used to examine the effect of land market dynamics on reserve sites selection in response to previous habitat conservation.

- Jiang, Yong, Stephen K. Swallow, and Peter P.C. Paton. 2005. "Selecting A Land Conservation Reserve for Local or Regional Ecosystem Health with Development: Amphibian Metapopulation and Residential Development." Presentation at the American Agricultural Economics Association (AAEA) Annual Meeting in Providence, RI, July 24-27. <http://agecon.lib.umn.edu/cgi-bin/detailview.pl?paperid=16190>

**Outcomes/Impact:**

- This research represents an interdisciplinary research initiative that incorporates ecosystem integrity to improve land management in the urban-rural fringe. The analysis and methodology involved in this project could inform and help local land managers and decision-makers to make efficient choices in managing development and land conservation with limited taxpayers support. This integrated ecosystem-economic study also identifies the interactions and research needs that would be of interest and great value to both economists and ecologists.

**Source of funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

- NRI Competitive Grant

**Scope of impact:** state, regional and national

Expenditure and Full-time Equivalent (FTE) Summary FY 2005		
Goal 4		
AES Federal FTE		5.74
AES State FTE		1.41
AES Formula \$	\$	165,524
AES Match \$	\$	156,294
CE Federal FTE		2.22
CE State FTE		0.92
CE Formula \$	\$	141,014
CE Match \$	\$	123,650
Total FTE's		10.29
Total Formula \$	\$	306,538
Total Match \$	\$	279,943



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

### **PROGRAM 7. SUSTAINABLE AND NURTURING COMMUNITIES**

#### **Situation and Priorities:**

The Children, 4-H and Families (CFF) Program Area 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 our land grant institution 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: Individual and Family Resource Management, Human Development and Family Well Being and 4-H Youth Development. We also include in this program area our research and outreach efforts in agricultural/aquacultural/seafood production and farm management. We have developed collaborative relationships with the Rhode Island Division of Agriculture and a non-profit organization, Rhode Island Center for Agricultural Promotion and Education (RICAPE) which are described below.

**Knowledge Areas:** KA 601. Economics of Agricultural Production and Farm Management; KA 602. Business Management Finance and Taxation

#### **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, and technical assistance/consulting services. The emphasis over the period of this report has been in the area of *sustainable agriculture* and the viability of RI farms.

#### **Outputs:**

- *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.
- *Capacity building:* URI Cooperative Extension provided active support over the period of this report to 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.

- *RI Agricultural Tourism Project Research and Education Project:* URI Cooperative Extension worked in association with RICAPE and RI Division of Agriculture, to secure \$85,000 USDA/SARE (via RICAPE) for a two year (2004-06) program to provide training and development opportunities in agricultural tourism and direct marketing to RI farms. Over this period six training sessions were held in RI on principles and practices of agricultural tourism. Each training session was attended by an average of 35 farm operators.
- *School to Farm Field Tours Curriculum:* Extension provided in-depth, on-site consulting services to 12 RI farms regarding alternative enterprise, school programming/curriculum development, agritourism, direct marketing and farm grant opportunities.
- *Estate Planning Training:* RI Cooperative Extension worked with the UVM Center for Sustainable Agriculture and four New England state extension programs to develop a day-long risk management workshop on estate planning and farm succession. “Transferring the Farm” – an estate planning and financial risk management workshop was held 3/16/06 at URI. A total of 60 farmers and 10 agricultural service providers attended.

**Outcomes/Impact:**

- Our efforts have built confidence in local agricultural producers and built capacity of the state agricultural network. Further, we have attracted external funding through this collaborative to build the portfolio of programs offered.

**Source of Funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

- 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 Resources*, 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 progress on two M.S. theses; demand analysis for salmon and a hedonic analysis of frozen seafood, both in the UK market.
- A M.S. thesis has begun on the impacts of consumer concerns of PCB contamination of farmed salmon on US import demand for farmed salmon.
- On-going work is focusing on the impact of farmed shrimp on the US market and how shrimp aquaculture is changing prices. In 2005, one Ph.D. dissertation was completed.

*Publications:*

- Anderson, J.L., 2005. "Property Rights, Fisheries, Aquaculture, and the Future." In: *Evolving Property Rights in Marine Fisheries*. Ed. by Leal, D.R. Rowman & Littlefield Publishers, Lanham, MD :239-257.
- Anderson, J.L., "Economic Analysis: Shrimp Outlook 2005." In *Proceedings of the Global Shrimp Outlook: 2005*, Global Aquaculture Alliance, Hoi Chi Minh City, Vietnam, October 24-27, 2005.
- Martinez-Garmendia, J. and J.L. Anderson. 2005. "Conservation, Markets, and Fisheries Policy: The North Atlantic Bluefin Tuna and the Japanese Sashimi Market." *Agribusiness*, Vol. 21 No. 1 (2005):17-36.
- Johnston, R.J., C. Roheim, D. Joglekar, and R. Pomeroy, 2005. "Estimating Preferences for Non-Market Attributes of Aquaculture and Sustainable Seafood Production: Methods and Empirical Applications." *International Journal of Environment and Pollution*.
- Roheim, C. 2005. "Ecolabeling and Urban Aquaculture." In: *Urban Aquaculture*, B. Costa-Pierce, A. Desbonnet, P. Edwards and D. Baker, eds., CAB International Publishing, Oxfordshire, UK: 259-266.

**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.

**Source of Funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

**Scope of impact:** Multistate, national and international

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

**Situation:**

Hatch project, RI00H328 – *Spatial Modeling of Location Within a Fishery*, addresses the lack of spatial 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. FY05 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. Technical efficiency measures were then constructed under both homogeneity and heterogeneity assumptions and compared. Results highlight the importance of heterogeneity modeling in fisheries production.
- The second stage of this project, modeling the spatial decisions of fishermen in the Northeast Atlantic herring fleet, is progressing. Recent proposed changes in the herring Fishery Management Plan (FMP) where they have proposed area and gear restrictions on the inshore herring fleet and are interested in estimating the welfare impacts of these vessels influenced by this recent action align perfectly with the objectives of the second stage of this project. A database for the second stage has been created from the logbook data for the herring fishery. This data has been assimilated into a spatial choice data set which will be used in a random utility model to investigate location choice decisions in the herring fishery.

**Outcomes/Impact:**

- Papers are under review at the American Journal of Agricultural Economics and the Journal of Applied Econometrics illustrate the pitfalls of assuming homogeneous production technologies in the Northeast Atlantic herring fishery as well as other heterogeneous production fisheries
- Work on estimating the spatial decision process of fisherman within the herring fishery will be used to investigate the economic impacts of the proposed amendments to the herring Fishery Management Plan.

**Source of Funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

**Scope of impact:** State, regional and national

**Knowledge Areas:** KA 605. Natural Resource and Environmental Economics 60%; 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. FY05 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, defended his dissertation and we are currently preparing a manuscript for publication based on the model and experiments. Bwalya, Samuel. 2005. the Political Economics of Fisheries Governance, University of Rhode Island Ph.D. Dissertation
- Fellowship: A new student, Matt Freeman has submitted a fellowship proposal to integrate into the base model heterogeneous agents. 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 will integrate heterogeneity into the model, and run additional experiments.

**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.

**Source of Funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

**Scope of impact:** State, regional and national

**Knowledge Area:** KA 801. Individual and Family Resource Management

**Situation:**

The URI Center for Personal Financial Education is an educational partnership endeavor supported by a Hatch project RI00711 “Impact of Workplace Financial Education on Employee Personal Financial Behavior and Productivity.” The Center provides outreach education and conducts research to improve the economic well being of families. Programming and research focus on topics including: personal financial management, credit use and debt management, home buying, personal investing and retirement planning. The Center directly supports the long-range goal for improving the economic well-being of families in Rhode Island.

**Outputs:**

- *Financial \$marts for Students*, one-day educator training. This program, co-sponsored with the RI JumpStart Coalition for Personal Financial Literacy, provided information on a variety of financial literacy topics to 97 registrants, primarily teachers and community-based educators.
- *Life\$marts*, a teen consumer education competition. This state-wide “game show” attracted nine teams from across Rhode Island who demonstrated their knowledge about personal finance and other life skills. It was co-sponsored by the RI JumpStart Coalition for Personal Financial Literacy.
- *Rhode Island Financial Literacy Month Celebration* drew attention to the importance of financial literacy education for youth and adults. The event began with a luncheon with featured speaker Dan Iannicola, Jr., Deputy Assistant Secretary for Financial Education, U.S. Department of the Treasury and a proclamation ceremony, held at the state house rotunda, with Governor Carcieri, Attorney General Lynch, General Treasurer Tavares and many Rhode Island legislators in attendance. Center staff participated in this RI JumpStart Coalition for Personal Financial Literacy event.

- Eight *workshops* were conducted (three in Rhode Island and five in Massachusetts) on implementation of the High School Financial Planning Program curriculum, a CSREES-sponsored program. The training for more than 150 teachers and financial service providers was sponsored by a grant from the National Endowment for Financial Education.
- A *Resume Workshop* was conducted for fourteen 4-H youth and four adults.
- 454 teachers and financial education professionals subscribed to the *Focus on Youth: Money Matters electronic newsletter*. The semi-annual newsletter is also available online to the general public. The newsletter provides updates about the NEFE High School Financial Planning Program, information about new financial literacy teaching resources and teacher training events, and summaries of recent research related to teens and money.
- *Credit 101*, an online credit education program was offered to first year students enrolled in the University of Rhode Island's first year orientation course.
- Personal financial education materials from the Center were exhibited at the annual conference of the Association of Financial Counseling and Planning Educators; at the Career Fair at Tolman High School in Pawtucket, RI; and at the Senior Fair at the South Kingstown, RI Senior Center.
- Media coverage included interviews for three television news stories, one radio program, and four newspaper articles.

### **Outcomes/Impact:**

- Financial literacy trainings for educators help them to extend financial education knowledge and skills to their students. Youth increase their understanding of the importance of building savings and reducing debt, thus enabling individuals and families to make sound fiscal decisions.
- Results of the Credit 101 evaluation found the web-based tutorial to be effective in increasing the personal financial knowledge of students who participated in the module.
- Findings from the USDA-funded research project, RI00711 “Impact of Workplace Financial Education,” were prepared for publication. The paper reported that as a result of the workshops, participants did change their financial behavior. The impact varied by task, with a low of 16 percent to a high of 70 percent of participants adopting positive behaviors for specific financial management tasks.

### **Source of Funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

- CDNE Foundation
- National Endowment for Financial Education
- Consumer Credit Counseling Service of Southern New England
- Individual donations

**Scope of impact:** State, regional and national

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

**Situation:**

URI Cooperative Extension Children, Youth & Families Unit (Bocage, Martin, Ogando) continue 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:* The Pre and Post tests for four of the workshops were reviewed and revised to simplify language. The SMOG index was used to determine appropriate reading grade level. All tests are now at approximately the 8<sup>th</sup> grade reading level. Pre and Post tests were also developed for 2 additional workshops. All have been translated into Spanish. Data were collected and analyzed. Pre and post- tests improved in 7 workshops, stayed the same in 1 workshop and declined slightly in 1 workshop. There were differences in the audience's prior exposure to the information as indicated by pre tests. Some groups scoring 3.4-3.7 on the pre test and others score a 5 on the pre test out of a possible 6.

In post workshop evaluation 86% of participants indicated that the information was practical, 85% reported they learned at least 3 new concepts/practices for working with their respective clients or children, and 97% rated the workshops as excellent.

Neighborhood Parental Nurturing Survey was modified for use with 7 other at risk cities. A total of 68 surveys were analyzed and factored into the database for final analysis.

Over the past two years the complexion of the community advisory board (CAB) has repeatedly changed. Therefore in an attempt to secure an overall accurate picture of the current state of the board the data has been combined with the data collected from the previous year.

The FACE IT Providence CAB representing 21 service based agencies is composed of 20 individuals. When data were analyzed for differences by demographic variables, no differences were found, except when data was sorted by gender. Female board members disagreed to a greater degree than males for the following: "The board has a fair and



effective decision making process” and “The board is seen as a leader in the community.” In summation, it appears that the CAB needs some remediation on function and process.

Interesting to note that the issues of “child care,” “citizenship classes” and “parenting” are not priority areas as we observed in previous years. Keeping the neighborhood safe now seems to be a major priority.

### **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; 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? Foundations of Psychosocial Development, Developmental Issues in Infancy, Developmental Issues in Toddlers, and Studying Cognitive Development: Newer Approaches.
- Update and maintain 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 4 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 increased to 89 agencies state wide
- 60 educational workshops were marketed, developed and implemented at the community level.
- Educational information is offered in English and Spanish.
- 20% increase in participation of Home Day Care providers (underrepresented group).
- 771 participants enrolled and participated in We Come to You Workshop Series.
- Face It Providence provided \$134,000 to implement and expand program opportunities in the 3 highest risk communities in Providence.
- Over 60 high school seniors completed their internship in child development reaching a total of 861 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.
- The Providence based CAB hosted and sponsored the 2<sup>nd</sup> annual Youth and Family Conference at no charge for children and their families reaching over 100 youth and families.
- The CAB and TrY CAPS program sponsored a family holiday evening in partnership with Neighborhood Health Organization and Sedesto, providing food and toys for over 600 families.

**Source of Funds:**

- Smith-Lever
- Hatch
- McIntire-Stennis
- State
- Other

- Children, Youth & Families at Risk Initiative (CSREES CYFAR)

**Scope of impact:** Local and State

**Knowledge Area:** KA 806. Youth Development

**Situation:**

The URI 4-H Youth Development program continues in a transition mode as the review and planning process for a rebirth of the CFF program continues to progress at a slow but deliberate pace. The State 4-H Transition team (which consists of approximately 2.5 FTEs) continues to maintain on going educational programs through a traditional club system. 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. Communication, problem solving and other life skills
2. Self confidence, self esteem and a sense of belonging
3. Interaction and relationships with adults and peers through 4-H clubs and learning opportunities
4. Leadership development and leadership opportunities for youth
5. Youth initiatives in non-formal science, technology and healthy lifestyles
6. Volunteerism and community service for youth

**Outputs:**

- State 4-H Staff and 253 4-H volunteers provided 836 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.

- Strengthened programmatic connections with the Department of Animal and Veterinary Science resulting in the redesign of the statewide 4-H Horse Program including a new quiz bowl training CD, addition of a qualifying Pattern Class and standardization of policies and safety guidelines for all horse shows and clinics.
- 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.
- Recognized the achievement of outstanding 4-H members and volunteers - RI 4-H Awards Program and Banquet – Twenty-two clubs submitted record books for county medal awards. In partnership with the RI 4-H Foundation and the 4-H All Stars, 180 4-H volunteers, members and parents attending a State 4-H Awards Banquet in their honor.
- Creation of a new training program for public presentations – 65 4-Hers from 9 4-H clubs participated in the new program “Speak Up and Speak Out.” 4-H teen leaders assumed responsibility for the development and delivery of three 20-minute workshops focusing on speech writing, dealing with stage fright, informative and entertaining talks, voice and body language.
- Major educational programs and events for FY05 included District and State 4-H Public Presentations Contests, 4-H Teen Leadership Camp, State 4-h Photo Fine Arts Show, Funtastic Foods Program, 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 FY05 4-H State Conservation Field day focused on Agriculture in our Environment. 4-Hers visited 3 learning sites at URI; East Farm, the Greenhouses/Botanical Gardens and Peckham Farm where they learned about composting, safe pesticide use, sustainable plantings, integrated pest management, agricultural biotechnology, animal husbandry and pasture management. A major purpose of this day was to introduce 4-Hers to their college and provide them with new knowledge and skills while exposing them to future career opportunities at their land grant institution.

### **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. FY05 participations levels were: 188 4-H members enrolled in leadership, 162 in environmental education, 208 in public presentations, 347 in photography and visual arts, 305 in community service, 243 in the horse and pony projects, 111 with rabbits/cavies, 76 with dog care and training, 86 with dairy cattle, 89 with birds and poultry, 33 with sheep, 32 with goats and 31 with beef.
- Increased participation at the state public presentation contest in FY05 reflected an increase in the number of 4-Hers who achieved a score of 90% or better at the district events.
- Thirty teens, who participated in Teen Leadership Camp enhanced their leadership skills and then applied this new knowledge by working on 3 statewide events, Junior

Conference, 4-H Fitness Day and a statewide community service project to provide books for patients in Hasbro Children's Hospital.

- As documented through 4-H record books submitted to the state office for county medal awards, 104 URI 4-Hers carried out 2,856 hours of community service during FY05.
- Three 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.
- Over 90 4-Hers displayed 160 pieces of art work at the 22<sup>nd</sup> Annual Photo Fine Arts Show was held at the Warwick Mall. Over 150 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

- 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 multi-state collaboration

**Expenditure and Full-time Equivalent (FTE) Summary  
FY 2005**

**Goal 5**

<u>AES Federal FTE</u>		<u>3.00</u>
AES State FTE		0.80
AES Formula \$	\$	71,609
AES Match \$	\$	183,739
CE Federal FTE		3.63
CE State FTE		1.11
CE Formula \$	\$	262,581
CE Match \$	\$	156,397
<u>Total FTE's</u>		<u>8.54</u>
<u>Total Formula \$</u>	<u>\$</u>	<u>334,190</u>
<u>Total Match \$</u>	<u>\$</u>	<u>340,136</u>

## 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 through with a host of state agencies, federal agencies and local groups, committees and commissions. At the state level we seek input from: RI Department of Administration, 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 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.

In FY2005, we continued utilizing an ad hoc CE advisory group that we call "Triboard". Triboard is composed of leaders from the three RI Cooperative Extension District Associations or boards. (These are boards that are similar to the county boards from other states.)

## 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 used in FY 2004 for projects funded in FY 2005 (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 2005, 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” multi-state, 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 and 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 FY04, 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 FY05 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. Richard Casagrande:** 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 have undergone a federal review of our programs in Children, Youth and Families in the fall of 2004.

## **APPENDICES**

Appendix A – RIAES Call for Proposals FY 2005

Appendix B – RIAES Portfolio of Current Projects

Appendix C – CSREES-REPT (2/00)

Appendix D – Expenditure and Full-time Equivalent (FTE) Summary

*College of the Environment and Life Sciences and the Rhode  
Island Agricultural Experiment Station FY2005*

## **CALL FOR PROPOSALS**

**The Rhode Island Agricultural Experiment Station (RIAES) is dedicated to supporting relevant outcome-oriented and hypothesis-based research leading to external grant funding.**

**SCHEDULE.** The Rhode Island Agricultural Experiment Station requests proposals for fiscal year 2005.<sup>1</sup> Hatch and McIntyre-Stennis proposals will be accepted. We **are not** soliciting proposals for multi-state projects.

**If you are interested in submitting a proposal, please provide the Director of RIAES with a statement indicating which program you are applying to, the title of the project and a list of 5 possible external reviewers by October 31, 2003.**

**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 November 28, 2003.** 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 1, 2003. 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. Seed projects will normally be funded for either a shorter time period or receive less annual funding than other types of projects.

**ELIGIBILITY FOR FUNDING.** All tenure-track faculty, Appendix F faculty, Research Associates and Educators may apply. PIs may not have more than one project in each category, but may have two projects across project categories. For example, a PI may have one Hatch and one McIntyre-Stennis project, but not two Hatch projects or two McIntyre-Stennis projects.

**PRIORITIES FOR STATION FUNDING** (as described in the RIAES/CE Plan of Work available at [www.riaes.org](http://www.riaes.org)).

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<sup>1</sup> Begins October 1, 2004.

- Aquaculture and fisheries
- Biotechnology
- Animal health
- Coastal environments
- Food safety
- Nutrition
- Natural resources
- Nurturing and sustainable communities
- Sustainable agriculture

# GUIDELINES FOR PROPOSALS

## TITLE PAGE:

**Title** (*maximum 100 characters*)

**PI Name(s) and Departmental Affiliation(s)**

**Type of Proposal:** Clearly identify the type of Proposal you are submitting. **The RIAES is soliciting proposals for two types of projects:**

- **Hatch Projects:** These proposals must focus on hypothesis-based research. The proposal should either 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.
- **McIntyre-Stennis Projects:** These proposals must focus on forest issues<sup>2</sup> using hypothesis-based research. The proposal should either 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? 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. *Summarize* previous and current research on the problem. All work cited should be referenced.

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<sup>2</sup> See AES Director or Associate Director for guidelines on forest-related research.

*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. LEVERAGING:** All proposals will be expected to serve as magnets for additional outside funding. Explicitly demonstrate either existing sources of outside funding or external panels and programs that fund comparable proposals. Details on the outside funding source and the relevance of this AES proposal to the specific priorities of external sources of funding are strongly recommended. In exceptional circumstances, the RIAES may fund proposals that address a unique and important problem for Rhode Island that fall outside of national priorities. Specific questions to address are:

- How does the project strengthen, complement, and leverage your existing research program?
- How will this research lead to further studies supported by external grants?
- How will the research connect to ongoing or future outreach efforts?

## **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 peer-reviewed publications, extension projects and external grants in the past five years,
- Relevant service (i.e., State and National Panels, Editorships, Conferences)

## **Budget**

Provide a completed budget form (attached). **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 dynamic 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. Specify research associates or technicians, by name if appropriate, and their role in the project.

**Graduate students:** 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 defines 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 highly congruent with a Program in the RIAES Plan of Work ([www.riaes.org](http://www.riaes.org))?
- 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?
- 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 avenue?

- 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.

## RI AES PORTFOLIO OF CURRENT PROJECTS

<i>RI AES Proj. No.</i>	<i>Description</i>	<i>Responsible Person(s)</i>	<i>Goal</i>	<i>Knowledge Area</i>
<b>NE-009</b>	Conservation and Utilization of Plant Genetic Resources	B. Maynard	1	202
<b>NE-1019</b>	Alternative Management Systems for Plant-parasitic Nematodes in Horticultural and Field Crops	N. Mitkowski	1	212
<b>S-290</b>	Technical and Economical Efficiencies of Producing, Marketing, and Managing Environmental Plants	B. Maynard	1	204, 205
<b>H-668</b>	Production and Analysis of Transgenic Lines to be Used for Functional Genomics of Rice	A. Kausch, J. Chandlee	1	202
<b>H-667</b>	Biological Control of Invasive Species in RI	R. Casagrande	1	211, 215
<b>H-402</b>	Nutrient- Based Approach to Vaccine Development for Bacterial Pathogens	P. Cohen, D. Nelson, M. Gomez-Chiarri	1	311
<b>H-327</b>	Assessing the Value of Shellfish Aquaculture Gear as Fish Habitat	G. Forrester	1	307
<b>AH-882</b>	Vaccine Development for Bacterial Pathogens: The Nutrient Approach	M. Gomez-Chiarri	2	311
<b>NE-1023</b>	Improving Plant Food (Fruit, Vegetable, and Whole Grain) Availability and Intake in Older Adults	N. Fey-Yensan, C. English	3	703, 704
<b>H-324</b>	Carbon Sequestration and Flux in Forests at the Landscape Scale	M. Stolt	4	101
<b>H-326</b>	The Importance of Coastal Environments for Migrating Songbirds: Implications for Management of Natural Resources	S. McWilliams	4	136
<b>H-325</b>	Groundwater Nitrate Removal Capacity of Riparian Zones in Mixed Use Watersheds	A. Gold	4	112
<b>MS-970</b>	Vernal Pool Hydroperiod Prediction as a Basis for Habitat Assessment and Management of Forest Amphibians	F. Golet	4	123
<b>H-105</b>	Experimental Analysis of the Political Economics of Fishery Governance	C. Anderson, J. Sutinen	4	605, 607, 610

<b><i>RI AES Proj. No. (cont.)</i></b>	<b><i>Description</i></b>	<b><i>Responsible Person(s)</i></b>	<b><i>Goal</i></b>	<b><i>Knowledge Area</i></b>
<b>MS-972</b>	Valuation of Forested Land Conservation Alternatives: Tools to Evaluate Validity of Willingness-to-Pay	C. Anderson, S. Swallow	4	131, 136
<b>NE-1021</b>	Hydropedology: Genesis, Properties, and Distribution of Hydromorphic Soils	M. Stolt	4	101
<b>W-1004</b>	Marketing, Trade and Management of Fisheries and Aquaculture Resources	J. Anderson, C. Roheim	4	605, 610
<b>MS-973</b>	Management of Southern New England Forests for Roughed Grouse and Associated Wildlife	S. McWilliams	4	135
<b>H-669</b>	Identification and Modeling of Environmental Tick Mortality Factors	T. Mather	1	721
<b>H-330</b>	Increasing Urban Impervious Surface in Rhode Island and the Environmental Impacts	Y. Wang	4	131
<b>H-329</b>	Removal and Effects of Antibiotics in Conventional and Aerated Septic System Leachfield Soil	J. Amador	4	133
<b>H-86</b>	Innovative Aquaculture Feed Development for Fish Meal Replacement	C. Lee, D. Bengtson	1	302
<b>H-328</b>	Spatial Modeling of Location within a Fishery	K. Schnier	5	605, 607
<b>H-87</b>	Metabolic, Hormonal and Appetitive Responses to Different Carbohydrates in Lean and Obese Adults	K. Melanson	3	702, 703
<b>NC-219</b>	Using Stage Based Interventions to Increase Fruit and Vegetable Intake in Young Adults	G. Greene	3	703

U.S. Department of Agriculture  
 Cooperative State Research, Education, and Extension Service  
 Supplement to the Annual Report of Accomplishments and Results  
 Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities  
 (Attach Brief Summaries)  
 Fiscal Year: 2005

Select One:  Interim  Final

Institution: University of Rhode Island

State: Rhode Island

	Integrated Activities (Hatch)	Multistate Extension Activities (Smith-Lever)	Integrated Activities (Smith-Lever)
<i>Established Target %</i>	25%	25%	25%
<i>This FY Allocation (from 1088)</i>	\$ 1,166,639.00	\$ 976,088.00	\$ 976,088.00
<i>This FY Target Amount</i>	\$ 291,659.75	\$ 244,022.00	\$ 244,022.00
<b>Title of Planned Program Activity</b>			
Administration	\$ 109,564.17	\$ 55,637.71	\$ 84,148.70
Aquaculture, Fishing and Animal Health	\$ -	\$ 1,234.50	\$ 16,994.50
Landscape Horticulture	\$ 137,274.24	\$ 30,687.97	\$ 102,448.55
Natural Resources and the Environment	\$ 99,238.80	\$ 125,016.40	\$ 113,700.40
Nutrition and Food Safety	\$ 20,714.27	\$ 40,557.64	\$ 38,978.95
Sustainable and Nurturing Communities	\$ -	\$ 27,462.25	\$ 25,646.25
<b>Total</b>	\$ 366,791.48	\$ 280,596.48	\$ 381,917.34
<b>Carryover</b>	\$ -	\$ -	\$ -

**Certification:** I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays represented here accurately reflect allowable expenditures of Federal funds only in satisfying AREERA requirements.

  
 \_\_\_\_\_  
 Director

May 19, 2006  
 \_\_\_\_\_  
 Date

University of Rhode Island  
Agricultural Experiment Station and Cooperative Extension  
Expenditure and Full-time Equivalent (FTE) Summary  
FY 2005

	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Admin	TOTAL
<b>AES Federal FTE</b>	7.53	-	1.50	5.74	3.00	6.12	23.88
<b>AES State FTE</b>	2.83	-	0.44	1.41	1.50	2.94	9.11
<b>AES Formula \$</b>	\$ 213,577	\$ -	\$ 40,568	\$ 165,524	\$ 71,609	\$ 446,464	\$ 937,743
<b>AES Match \$</b>	\$ 327,988	\$ -	\$ 41,240	\$ 156,294	\$ 183,739	\$ 541,337	\$ 1,250,598
<b>CE Federal FTE</b>	3.04	0.84	-	2.22	3.63	1.19	10.92
<b>CE State FTE</b>	3.62	0.90	0.25	0.92	1.11	3.04	9.84
<b>CE Formula \$</b>	\$ 191,526	\$ 80,019	\$ -	\$ 141,014	\$ 262,581	\$ 104,741	\$ 779,881
<b>CE Match \$</b>	\$ 356,566	\$ 100,066	\$ 27,796	\$ 123,650	\$ 156,397	\$ 316,076	\$ 1,080,550
<b>Total FTE's</b>	17.02	1.74	2.19	10.29	9.23	13.28	53.75
<b>Total Formula \$</b>	\$ 405,103	\$ 80,019	\$ 40,568	\$ 306,538	\$ 334,190	\$ 551,205	\$ 1,717,624
<b>Total Match \$</b>	\$ 684,554	\$ 100,066	\$ 69,036	\$ 279,943	\$ 340,136	\$ 857,412	\$ 2,331,148

Financial Notes:

FTE include Graduate Assistantships.

Admin includes special research projects and farm operations not allocated to specific program areas.

