

**V(A). Planned Program (Summary)**

**Program # 9**

**1. Name of the Planned Program**

The Environment and Adaptive Agro-Ecosystems

Reporting on this Program

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	15%		25%	
123	Management and Sustainability of Forest Resources	25%		15%	
131	Alternative Uses of Land	30%		10%	
135	Aquatic and Terrestrial Wildlife	10%		25%	
136	Conservation of Biological Diversity	20%		25%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	1.0	0.0
Actual Paid Professional	0.0	0.0	1.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	117860	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	90309	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

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

**2. Brief description of the target audience**

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

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2130	3500	76	410

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

**Patent Applications Submitted**

Year: 2012

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	5	0

## V(F). State Defined Outputs

### Output Target

#### Output #1

##### Output Measure

- Peer reviewed publications

Year	Actual
2012	21

#### Output #2

##### Output Measure

- Fact sheets, Bulletins and newsletters

Year	Actual
2012	3

#### Output #3

##### Output Measure

- Short courses

Year	Actual
2012	8

#### Output #4

##### Output Measure

- Website development and refinement

Year	Actual
2012	6

#### Output #5

##### Output Measure

- Books and monographs  
Not reporting on this Output for this Annual Report

#### Output #6

##### Output Measure

- Abstracts

<b>Year</b>	<b>Actual</b>
2012	17

**Output #7**

**Output Measure**

- Workshops and Conferences hosted

<b>Year</b>	<b>Actual</b>
2012	6

**Output #8**

**Output Measure**

- Public presentations

<b>Year</b>	<b>Actual</b>
2012	29

**Output #9**

**Output Measure**

- Student training

<b>Year</b>	<b>Actual</b>
2012	45

**Output #10**

**Output Measure**

- MS Theses and PhD Dissertations

<b>Year</b>	<b>Actual</b>
2012	9

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased (%) forest and conservation geospatial information resources and use by towns, agencies, NGOs and the public
2	Increased understanding by wildlife biologists and managers through publications and talks of how habitat quality and forest management practices affect populations of grouse, migrating song birds, amphibians and other wildlife.
3	Increased understanding by wildlife biologists and other habitat managers through publications and talks on the risks of invasive species, with special emphasis on phragmites.
4	Increased understanding by wildlife biologists, NGOs, local and state officials through publications and talks on people's willingness to support ecosystems and conservation.
5	Increased development of new sub-aqueous soils interpretive approaches and dissemination of these approaches to other scientists and natural resource managers through publications, workshops or talks.
6	Data will be used in models for coastal managers that will enable them to assess potential for coastal marsh restoration to enhance C sequestration in those ecosystems.
7	Our proposed research would increase understanding of three critical issues: inadequate GIS-based information about the spatial extent of early successional habitat, inadequate use of the Adaptive Management Paradigm to evaluate past and present efforts to expand early successional habitat, and inadequate understanding of how certain forest management activities affect populations of key wildlife species. Our proposed research will directly strengthen outreach programs to promote better targeted and more effective forest management interventions in southern New England.
8	Increased understanding and acceptance by the nursery industry, the general public, professional groups, and research scientists through patents, publications and talks of the occurrence and value of adelgid-resistant eastern hemlocks.

## **Outcome #1**

### **1. Outcome Measures**

Increased (%) forest and conservation geospatial information resources and use by towns, agencies, NGOs and the public

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Geospatial research and technology can play an enormously important role in providing decision support for land use decision making. In particular, new GIS, GPS and remote sensing tools are continually being made available which are poised to assist local decision makers to both visualize existing and future land use patterns, and model the various impacts of these patterns. Local governments also play an important role in forest and wildlife management within Rhode Island. 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.

#### **What has been done**

Several new training programs developed to use geospatial data and technology for land stewardship. 395,158 data files (832 GB) downloaded from RREA-supported geospatial data clearinghouses. Represented RI in the Northeast LiDAR Project to acquire accurate elevation data for coastal New England counties. In partnership with local land trusts, we developed a standard protocol for the creation of conservation land management plans. Assisted with the 2012 RI Land and Water Conservation Summit. Over eighty online map services now available. GPS base station correction data and equipment loans support conservation work such as evaluating forest health, mapping public access trails, and monitoring invasive species.

#### **Results**

URI RREA personnel served in a variety of leadership and supporting roles for initiatives that have far-reaching impacts on the state and region. The URI RREA Program is the sole provider of instructor-led geospatial technology training opportunities in Rhode Island and provides a unique opportunity for trainees to learn about the management of forest resources while learning new

technical skills. The RREA-supported geospatial data clearinghouse (RIGIS) is the sole portal for GIS data in the state and is extensively used by the natural resource management community. Our technical training and GIS data are the basis of thousands of land management decisions across the state.

#### 4. Associated Knowledge Areas

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

#### Outcome #2

##### 1. Outcome Measures

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

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Managing coastal environments for migrating songbirds. Migrating song birds require suitable food sources to complete their migration and coastal lands have undergone extreme changes in vegetation, potentially imperiling migration success and fecundity for many native species.

###### **What has been done**

Graduate and undergraduate students and research technicians conducted field experiments that determined (a) how variation in refueling rates of migratory birds at different coastal New England sites is related to fruit resource abundance, (b) the fruit preference of birds during migration, and

(c) how body condition of migratory birds affected their movements at stopover sites that differed in the abundance of fruits.

### **Results**

All proposed field experiments were completed. One MSc student successfully defended her thesis in August 2012, one PhD student completed his last field season and will complete his degree by Dec 2013, one PhD student completed her first field season on this project. McWilliams and colleagues presented results from this research at two scientific conferences and published ten peer-reviewed publications based on this research.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

### **Outcome #3**

#### **1. Outcome Measures**

Increased understanding by wildlife biologists and other habitat managers through publications and talks on the risks of invasive species, with special emphasis on phragmites.

Not Reporting on this Outcome Measure

### **Outcome #4**

#### **1. Outcome Measures**

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

Not Reporting on this Outcome Measure

### **Outcome #5**

#### **1. Outcome Measures**

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

#### **2. Associated Institution Types**

- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2012	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Hydropedology: Genesis, Properties, and Distribution of Hydromorphic Soils. Developing subaqueous soil use and management interpretations is critical to providing coastal managers with tools to make decisions. Of particular interest water quality, aquaculture and restoration of commercially important shellfish populations, effects of dredging, the role of subaqueous soils in the regional and global carbon cycle, and submerged aquatic vegetation health and restoration.

#### What has been done

In this project, we are testing various subaqueous soil types to determine the most productive areas for shellfish aquaculture, evaluating which aquaculture methods may be the best approach depending on the soil type, and determining what dredging for navigation purposes does to the biological community. In our associated outreach efforts we are coordinating with coastal managers, regulators, and aquaculture specialists to insure that the results from our studies are delivered directly to the stakeholders. We also presented our findings at several regional meetings.

#### Results

In both years of our studies significant differences were found in growth and survival of oysters relative to the soil type. Differences in growth between on-bottom and bag-and rack aquaculture approaches are still being assessed. Our preliminary analyses suggest that the degree of mortality and oyster quality may differ depending on the approach. The size of the seed oyster that is placed on the bottom is also important, the larger the better. Our preliminary studies of water column and soil pH suggest that coastal acidification may be impacting recruitment of oysters in the wild. Effects of dredging on soil ecology are still being assessed. Our preliminary studies suggest that dredging areas with eelgrass significantly impacts the soil biology and ecology.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources

## **Outcome #6**

### **1. Outcome Measures**

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

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Nutrient loading to coastal ecosystems alters primary production, promotes hypoxia, and can alter the sustainability of many resources that depend on coastal wetlands. This work will specifically help to predict impacts of nutrient loading on greenhouse gas emissions from coastal salt marshes in Narragansett Bay, RI.

#### **What has been done**

Greenhouse gas fluxes were measured by 3 undergraduates and 2 Ph.D. graduate students in 3 marshes along an N gradient. Methods were optimized and will be applied in the next field season. Preliminary data were provided to a collaborator who is modeling major environmental controls on the gas fluxes observed thus far.

#### **Results**

Data thus far indicate strong potential for N loading to affect greenhouse gas emissions from coastal ecosystems, and on-going work will aim to better quantify the extent of this impact while identifying major environmental controls.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
101	Appraisal of Soil Resources

## **Outcome #7**

### **1. Outcome Measures**

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

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Conservation of early successional forests within the eastern United States is an important management concern because these forests and their associated wildlife species are relatively rare and require active management.

#### **What has been done**

The research on the spatial extent of early successional habitat in RI concluded that the extent of shrubland habitat in RI is still decreasing, and that the populations of many wildlife species depending on this habitat are at risk. The research on private involvement in forest management concluded that the RI Coverts program has been effective in motivating private landowners to play an important role in creating wildlife habitat. The research on American Woodcock provided new insights on the impact of forest management on this important and charismatic early successional species.

#### **Results**

This research involved the continued training of four graduate students and six undergraduate students in field biology skills, laboratory analysis skills, and computer-intensive analysis of data. The proposed GIS analyses are completed. A third successful field season was completed on the woodcock project. During the last year of the project, we successfully evaluated past and present

management efforts to expand early successional habitats for wildlife species at risk.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

#### Outcome #8

##### 1. Outcome Measures

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

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The hemlock woolly adelgid is an invasive pest that kills eastern hemlocks. Some rare naturally-occurring eastern hemlock trees may possess some degree of resistance to the adelgid. If borne out, these trees could play an important role in combatting the threat posed by this pest.

###### **What has been done**

We have worked with the URI Office of Intellectual Property to prepare for the filing of a preliminary patent. We have greatly increased the number of grafted and propagated cuttings we have in our common garden. We have spoken at three symposiums about the potential for adelgid-resistant hemlocks and their role in an integrated pest management program.

###### **Results**

We have learned that adelgid resistance does persist in propagated cuttings from putatively-resistant parent trees, and developed improved grafting techniques suitable for large-scale plant production. Working with researchers from the Alliance to Save Threatened Forests, and RI-based nursery professionals, has enabled us to communicate our results to a wide range of constituencies.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

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

##### Brief Explanation

We exist in turbulent times nationally, regionally, locally, and institutionally. Appropriations budgets are being cut dramatically on many fronts, resulting in fewer resources for increasing need areas. As finances and personnel change, it is likely our programs and outcomes will have to shift to accommodate them.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

- Workshops and training programs use pre and post assessment vehicles to evaluate change in stakeholder knowledge.
- Google analytics tracking software is used to generate detailed information about website use. Information includes the number of views and downloads per webpage and the numbers and types of visitors (.gov, .edu, .org, .com) to each portion of the websites.
- Extension and research outputs are subject to peer evaluations before publication.
- Citations of published works are quantified through services such as the ISA Web of Science and Google Scholar.

##### Key Items of Evaluation