

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Soil and Water Quality

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
112	Watershed Protection and Management			30%	
133	Pollution Prevention and Mitigation			70%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.5	0.0
Actual Paid Professional	0.0	0.0	6.8	0.0
Actual Volunteer	0.0	0.0	4.8	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	90175	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	303427	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	777648	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The main research objectives are to develop chemical, biological and mechanical methods of

controlling invasive plants, to use molecular methods to identify invasive plants, and to develop procedures to monitor herbicides in water. Good progress has been made on these objectives. The expected outputs are new scientific findings; scientific publications, newsletters, and fact sheets; talks and interviews; and numbers of state residents served directly by analyzing soil samples, identifying invasive aquatic or terrestrial weeds, or controlling these pest plants. These activities, services, or events are designed to provide new information that will be used by the general public and to seek their input on the research program and findings. Participation by members of lake associations in group discussions and workshops are particularly important because these stakeholders must agree on how to remove aquatic weeds from lakes. Options are limited for herbicide treatment and mechanical methods, which can vary in effectiveness depending on the extent of invasive weed infestations. Diagnostic services are available to determine the extent of pollution problems and to determine the success of field experiments. Water quality standards for acceptable herbicide concentrations are those established by the CT Department of Energy and Environmental Protection. Information will also be made available to all stakeholders on the CAES website, in newsletters and fact sheets, and in displays at the open house events or at agricultural fairs. It is also expected that there will be interest from reporters to write articles on the research, thereby enhancing awareness of invasive plant infestations. Results of these output activities will lead to specific outcomes, such as removing pesticides from soil and water, clearing lakes and ponds of invasive aquatic plants, and preventing loss of water quality.

2. Brief description of the target audience

A broad base of stakeholders, including under-represented and under-served persons, is targeted. It is expected that the following stakeholder groups will directly benefit from the research: farmers, lake associations, boaters, homeowners, water company officials, environmentalists, extension specialists, corporate and municipal officials, and pesticide producers. Special efforts will be made to contact and include members of minority organizations, women, and children to provide information and to participate in open house events.

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	851	2852	180	570

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	14	14

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Total research papers

Year	Actual
2012	20

Output #2

Output Measure

- # of talks and interviews given to stakeholders

Year	Actual
2012	88

Output #3

Output Measure

- # of diagnostic tests performed

Year	Actual
2012	10657

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of homeowners gaining knowledge on pesticide pollution and invasive aquatic plants
2	# of homeowners gaining knowledge about watershed protection and soil and water quality
3	# of lakes and ponds surveyed and/or cleared of invasive aquatic plants

Outcome #1

1. Outcome Measures

of homeowners gaining knowledge on pesticide pollution and invasive aquatic plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	931

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Extensive growths of invasive aquatic weeds, such as Eurasian water-milfoil (*Myriophyllum spicatum*) and curly leaf pondweed (*Potamogeton crispus*) can significantly reduce water quality and alter wildlife habitats. Grannis Lake in East Haven, Connecticut, is infested with these invasive plants. Homeowners requested assistance on surveying and controlling both weeds.

What has been done

In a 7-year study, herbicides failed to control the aquatic weeds. A new approach was needed to mitigate the weed problems. A plant-eating fish called grass carp (*Ctenopharyngodon idella*) was then introduced. A total of 200 sterile (triploid) fish were released into the 20-acre lake in 2007.

Results

In May of 2010, survey results indicated that the fish were reducing populations of the aquatic weeds. The lake will be restocked with grass carp to continue to correct the invasive weed problem. These findings had impact because the use of grass carp to control certain species of aquatic weeds is an acceptable method. Long-term benefits will be a clean water supply and a body of water which can be used for recreation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

of homeowners gaining knowledge about watershed protection and soil and water quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3197

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Homeowners, landscapers, municipal workers, golf course managers, and farmers frequently use fertilizers. In many cases, these chemicals are applied without knowledge of soil quality. This practice can lead to polluted surface and ground water and encourage rapid growth of algae and other invasive aquatic plants. People who own or rent lake-front properties have expressed concern over reduced water quality and the inability to navigate boats in areas where aquatic weed populations are dense.

What has been done

At the request of stakeholders, 4,557 soil tests were performed at our research laboratories in Windsor, CT to determine nitrogen and phosphorous concentrations, acidity, and amounts of organic matter present. Specific results were provided on soil quality, and, as a part of an educational program, written suggestions were made concerning the application of fertilizers and lime to improve soil quality, or a statement was provided that no fertilizers were needed. A state bill to restrict phosphorous use near lakes passed in 2012.

Results

Analyses revealed that 1,117 (24.5% of 4,557 samples) were considered adequate for plant growth and did not require fertilizer applications. These stakeholders, mainly homeowners who submitted soil samples collected from their lawns or gardens, learned that they did not need to purchase fertilizers and, collectively saved about \$22,340. Another important short-term benefit is less fertilizer leaching into surface and ground water. The long-term benefit is a cleaner environment.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

of lakes and ponds surveyed and/or cleared of invasive aquatic plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Invasive aquatic plants reduce public access to water, restrict boat navigation, decrease water quality by increasing sedimentation and eutrofication rates, and alter wildlife habitats. People who own or rent lake-front properties have requested assistance on the control of aquatic weeds, such as Eurasian water milfoil, variable water milfoil, curly leaf pondweed, fanwort, common water hyacinth, yellow iris, and watercress. These aquatic plants, however, are sometimes very difficult to identify when conventional morphological methods are used. Scientists, therefore, need more precise molecular techniques.

What has been done

A database of plant DNA sequences for molecular identification of the aquatic invasive and native species was developed for 56 different plants. One hundred and thirty sequences have been submitted to Gen Bank where they are available to researchers worldwide. Novel methods using cesium chloride/ethidium bromide density gradients and ultra-centrifugation have been developed to isolate and purify DNA bands.

Results

The database and molecular sequencing technology were successfully used to identify and distinguish species of banned plants being sold by Connecticut aquarium retailers. Of the 29 chain stores surveyed, 7% sold banned species, compared to 56% of 27 independent stores. These results had impact because all store owners, upon learning about the findings, ceased selling the banned plants. Expected long-term benefits are preserving water quality and reducing costs of mitigating invasive plant infestations. The new technology will greatly aid surveys of lakes and ponds and identifying invasive plants for control programs. Results were published in a

scientific journal: Lake and Reservoir Management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Public priorities
- Other (Staff changes)

Brief Explanation

Although there were no external factors that immediately affected outcomes during this reporting period, the current economy, changes in state or federal appropriations, and resulting staff changes remain the primary external factors that could affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

"Before and after" and "during" evaluations were conducted to document increased knowledge of aquatic plants, whereas "during" evaluations were most helpful in assessing advanced knowledge of stakeholders on soil and water quality issues. More than 70 stakeholders participated in the aquatic weed abatement programs and in town meetings. They followed progress as treatments cleared the weeds from targeted areas.

Key Items of Evaluation

Written information on evaluation forms following workshops, held in different towns, was an important information collection method for program assessments. During this reporting period, there were 372 citations for scientific articles written by 4 scientists for the entire planned program. These citations indicate that knowledge was gained by scientists and used in their studies.