

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

**Program # 5**

**1. Name of the Planned Program**

Climate Change- improving the quality of water runoff from agricultural production

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				50%
133	Pollution Prevention and Mitigation				50%
	<b>Total</b>				100%

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

**1. Actual amount of FTE/SYs expended this Program**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	0.0	6.6
<b>Actual Paid</b>	0.0	0.0	0.0	3.3
<b>Actual Volunteer</b>	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	0	165827
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	165827
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**

Conduct research in water quality monitoring.  
 Develop outreach materials.  
 Communicate findings to producers/end users.  
 Train students.

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

Agricultural producers, environmental scientists, environmental regulatory agencies.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2014  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2014	Extension	Research	Total
<b>Actual</b>	0	1	1

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Workshops to communicate research findings to stakeholders.

<b>Year</b>	<b>Actual</b>
2014	1

**Output #2**

**Output Measure**

- Workshops to educate producers in the target population on how to reduce sediment load to surface water.

<b>Year</b>	<b>Actual</b>
2014	1

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

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

O. No.	OUTCOME NAME
1	Nursery producers in the target population will be aware of non-point source pollution from field production of specialty crops.
2	Students will be trained in water quality monitoring.
3	Producers in the target population will have increased knowledge of the relationship between land cultivation practices and sediment load to surface water.
4	Graduate students will have increased knowledge regarding advanced large-scale environmental modeling techniques that would identify significant changes in the variability explained in Southeast total phosphorus SPARROW models.
5	Local, state, and/or federal agencies will have increased knowledge regarding non-point source and land-to-water linkages between land cover, riparian stream buffers, and climate to predict and monitor phosphorus at the southeast regional scale.
6	Stakeholders will adopt use of new data gained from the identification of non-point source and land-to-water linkages between land cover, riparian stream buffers, and climate to reduce the quantity of total phosphorus loadings in watersheds at the southeast regional scale.

## **Outcome #1**

### **1. Outcome Measures**

Nursery producers in the target population will be aware of non-point source pollution from field production of specialty crops.

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

- 1890 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	7

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

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

During storm events, a large volume of sediment can be added to creeks from surface runoff, especially in field plots where the landscape has been disturbed (plowed or disked). Nursery crop growers are not aware of the impact of this management practices on surface water. Water managers and residents that live in the Collins River sub-watershed and the State regulatory agency (Tennessee Department of Environment & Conservation, TDEC) are concerned about this issue because plowing, liming and fertilization of nursery fields can result in the runoff of tons of soil and essential crop nutrient such as phosphorus to inflow creeks (tributaries) of the Collins River. Phosphorus, metals and many organics adsorb to fine silt and clay, resulting in increased potential for surface water contamination. Fine silt and clay are some component of sediments.

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

2014 was the last year of the project. We monitored Hills Creek and Mountain Creek in Warren County Tennessee in the spring and summer of 2014 for water quality impairment. As previously stated in earlier years, these creeks are major tributaries of the Collins River. Water samples were collected mostly during base flow (normal stream flow) and in very few instances after rainstorm events. The creeks were monitored for the following water quality parameters: Turbidity (because of the strong correlation between turbidity and sediment), Specific conductance, Total dissolved solids, Dissolved oxygen, pH and Temperature. Nitrogen, Phosphorous, Calcium, Magnesium and Potassium were also monitored in the creek water samples.

#### **Results**

While growers may be viewed as contributors to surface water quality degradation, our data for the last three years have been consistent and indicate otherwise. We found during base flow that essential crop nutrients like phosphorus (P) and Nitrogen (N) were relatively low in the creeks

monitored. For example, the dissolved P in the creeks monitored were less than 0.02 ppm in Mountain Creek and less than 0.10 ppm in Hills Creek. It is worth mentioning that these nutrients have the tendency to support eutrophication in surface water. However there was no visual evidence of eutrophication in either creek.

#### 4. Associated Knowledge Areas

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

#### Outcome #2

##### 1. Outcome Measures

Students will be trained in water quality monitoring.

##### 2. Associated Institution Types

- 1890 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2014	3

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

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

There is the need to train future workforce (students) to meet the need of water resource issues, especially in the area of surface and ground water quality assessment and monitoring.

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

Three students (one graduate student and two undergraduate students) hired as student workers were involved in the project; they gained both research and extension experiential training. The graduate student developed and completed a thesis on one of the primary objectives of the project.

###### **Results**

The students assisted in instrument calibration; the analyses of stream water quality parameters and data entry. The graduate student completed an MS thesis.

#### 4. Associated Knowledge Areas

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

#### Outcome #3

##### 1. Outcome Measures

Producers in the target population will have increased knowledge of the relationship between land cultivation practices and sediment load to surface water.

##### 2. Associated Institution Types

- 1890 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2014	7

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

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

Nursery crop production activities can contribute to both point and non-point source pollution. While the majority of ornamental plants in the sub-watershed are field grown, plowing, liming and fertilization of nursery fields can result in the runoff of soil and essential crop nutrients at a watershed scale. There is a strong correlation between surface water quality and land use within a watershed. The residents, including nursery growers, in the Collins River watershed care about the water quality of the water bodies that drain the watershed.

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

Results of our findings have been shared with some nursery crop growers and county agents in forums such as field days and in an organized workshop.

###### **Results**

While turbidity values were used as a surrogate for sediment load. As expected, turbidity values were found to be relatively high (greater than 20 ntu) during storm events. Concentrations of essential crop nutrients such as phosphorus were also found to be low in the creeks monitored; suggesting efficient use of fertilizers by growers. Seven (7) growers in the sub-watershed

indicated an increase in knowledge concerning land use and water quality.

#### 4. Associated Knowledge Areas

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

#### Outcome #4

##### 1. Outcome Measures

Graduate students will have increased knowledge regarding advanced large-scale environmental modeling techniques that would identify significant changes in the variability explained in Southeast total phosphorus SPARROW models.

##### 2. Associated Institution Types

- 1890 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2014	0

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

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

Not Reporting on this Outcome Measure. The PI for this portion of the program has left the university; this portion of the program is being re-structured.

###### What has been done

###### Results

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

## **Outcome #5**

### **1. Outcome Measures**

Local, state, and/or federal agencies will have increased knowledge regarding non-point source and land-to-water linkages between land cover, riparian stream buffers, and climate to predict and monitor phosphorus at the southeast regional scale.

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

- 1890 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	0

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

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

Not Reporting on this Outcome Measure. The PI for this portion of the program has left the university; this portion of the program is being re-structured.

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

#### **Results**

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

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation

## **Outcome #6**

### **1. Outcome Measures**

Stakeholders will adopt use of new data gained from the identification of non-point source and land-to-water linkages between land cover, riparian stream buffers, and climate to reduce the quantity of total phosphorus loadings in watersheds at the southeast regional scale.

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

- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2014	0

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

**Issue (Who cares and Why)**

Not Reporting on this Outcome Measure. The PI for this portion of the program has left the university; this portion of the program is being re-structured.

**What has been done**

**Results**

**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
- Government Regulations
- Competing Public priorities

**Brief Explanation**

For outcomes 4, 5 and 6, the PI for this portion of the program has left the university; this portion of the program is being re-structured.

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

**Evaluation Results**

The effectiveness of the project was determined by a) the heightened local awareness of surface water quality problems and solutions associated with field nursery production; b) best management practices (BMPs) adopted by growers for individual nursery fields; c) demand by growers for better and efficient fertilizers that are not prone to excessive

surface runoff during storm events and d) better trained students in the environmental protection and enhancement area.

**Key Items of Evaluation**