

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

**Program # 3**

**1. Name of the Planned Program**

Climate Change

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
102	Soil, Plant, Water, Nutrient Relationships	20%	20%	20%	20%
111	Conservation and Efficient Use of Water	5%	5%	5%	5%
112	Watershed Protection and Management	15%	20%	10%	10%
133	Pollution Prevention and Mitigation	10%	5%	10%	10%
141	Air Resource Protection and Management	5%	15%	5%	5%
401	Structures, Facilities, and General Purpose Farm Supplies	5%	5%	5%	5%
402	Engineering Systems and Equipment	5%	5%	5%	5%
403	Waste Disposal, Recycling, and Reuse	10%	5%	10%	10%
404	Instrumentation and Control Systems	5%	5%	5%	5%
405	Drainage and Irrigation Systems and Facilities	5%	5%	5%	5%
605	Natural Resource and Environmental Economics	15%	10%	20%	20%
	<b>Total</b>	100%	100%	100%	100%

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

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

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	55.0	4.0	25.0	6.0
Actual Paid Professional	72.0	3.0	24.0	1.5
Actual Volunteer	5.0	0.0	5.0	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
1130891	56033	417797	197161
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1130891	34011	417797	149829
1862 All Other	1890 All Other	1862 All Other	1890 All Other
4385359	35405	3050626	19500

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

#### 1. Brief description of the Activity

Research will focus on creating new knowledge and solutions from basic research (e.g., nutshell-based activated carbons), to agricultural production systems research, to natural resource pollution prevention strategies, to examining people's attitudes and concerns about environmental issues and policies, including economic considerations. With this research information in hand, improved management, technological solutions and policies to environmental and natural resource utilization problems will be proposed and evaluated with farmers, businesses, stakeholders and communities. Technology transfer will occur through demonstrations, workshops, and various media from Cooperative Extension in concert with researchers.

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

Agricultural producers, environmental and governmental agencies, news media, general public, limited resource audiences, rural appraisers, commodity associations

#### 3. How was eXtension used?

eXtension was not used in this program

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

#### 1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	29000	33000	0	0

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

##### Patent Applications Submitted

Year: 2013

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

<b>2013</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	4	82	86

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

**Output Target**

**Output #1**

**Output Measure**

- Waste Management Certification Programs

<b>Year</b>	<b>Actual</b>
2013	4

**Output #2**

**Output Measure**

- Number research project completed on environmental/natural resource issues

<b>Year</b>	<b>Actual</b>
2013	95

**Output #3**

**Output Measure**

- Number of non-degree credit environmental activities conducted

<b>Year</b>	<b>Actual</b>
2013	336

**Output #4**

**Output Measure**

- Enrollees for Natural Resources Leadership Institutes training

<b>Year</b>	<b>Actual</b>
2013	26

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

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

O. No.	OUTCOME NAME
1	Number of farms utilizing precision application technologies
2	Number farms implementing best management practices for animal waste management
3	Number urban households/small farms with low-literacy individuals implementing or adopting best management practices to enhance water quality
4	Number waste management certifications gained or maintained
5	Number acres where proper waste analysis was used for proper land application
6	Number growers implementing stream protection practices
7	Number storm water systems installing BMPs
8	Number farms adopting use of biofuels
9	Number growers implementing improved irrigation and drainage systems

### **Outcome #1**

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

Number of farms utilizing precision application technologies

Not Reporting on this Outcome Measure

### **Outcome #2**

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

Number farms implementing best management practices for animal waste management

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

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

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

Change in Action Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2013	1350

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

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

Southeastern U.S. soils have low soil organic matter content. Increasing soil organic matter content using animal waste compost amendments is a way to increase soil carbon sequestration and improve soil quality.

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

The effects of poultry waste compost applications to soil on soil quality and carbon sequestration were evaluated by NC A&T scientists in 3-year field experiments located at the North Carolina piedmont and coastal plains topographical regions.

##### **Results**

At both locations, applying compost at a 10 ton/acre/year rate increased soil carbon content, soil

water retention, and nutrient retention, and also reduced soil erodibility. Statewide, Extension documented working with 1,350 producers implementing waste management plans; more than 1.5 million tons of livestock and organic waste used as fertilizer. At a value of \$10/ton, this would represent \$15 million in fertilizer value savings.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management

#### Outcome #3

##### 1. Outcome Measures

Number urban households/small farms with low-literacy individuals implementing or adopting best management practices to enhance water quality

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	320

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

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

In a continuing partnership among the land grant universities, local stakeholders, and the science faculty of ten public high and middle schools in Guilford and Durham counties, thousands of students have increased their knowledge and understanding of the science behind drinking water quality protection in urbanizing areas in North Carolina.

###### What has been done

A total of twelve urban stormwater control demonstration practices have been installed to date that effectively treat stormwater runoff from over 36,000 square feet of rooftop area in the Jordan Lake Watershed.

**Results**

Together, these practices collect and treat more than one million gallons of urban stormwater each year, reducing pollution from nitrogen and phosphorus by up to 45% and 15%, respectively. Connecting students to the science of drinking water quality protection is important as they become tomorrow's consumers, homeowners and community leaders.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

**Outcome #4**

**1. Outcome Measures**

Number waste management certifications gained or maintained

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	313

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

**Issue (Who cares and Why)**

North Carolina animal waste applicators are required to receive six hours of continuing education credit every three years.

**What has been done**

In Pitt County, Extension taught three certification classes providing 75 credit hours to 150 operators.

**Results**

Participants gained knowledge on managing spray fields for hay production, over-seeding with winter annuals and coping with wet application conditions. Participating applicators valued maintaining their legal compliance and improving their knowledge of environmentally appropriate manure application at \$1,875. Statewide, 2,164 waster applicator certifications were obtained or maintained as a result of waste applicator training.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management

#### Outcome #5

##### 1. Outcome Measures

Number acres where proper waste analysis was used for proper land application

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

<b>Year</b>	<b>Actual</b>
2013	3465

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

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

Nonpoint source pollution continues to negatively impact North Carolina's water resources. The primary pollutants of concern are sediment, nutrients, pathogens, and toxins. Water quality improvements are best approached by a watershed approach.

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

Regional Training Centers under the Soil and Water Environmental Technology Center (SWETC) are being further developed throughout North Carolina.

**Results**

SWETC has developed, evaluated, and demonstrated innovative technologies related to soil and water resources, waste management, land use, and ecosystem restoration that address societal needs for environmental protection and enhancement. Watershed citizens, local agencies, and state agencies in North Carolina are better poised to effectively identify pollutant sources and management strategies to improve water quality. Extension recommended waste analyses were used for proper land application BMPs on approximately 1.25 million acres.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

**Outcome #6**

**1. Outcome Measures**

Number growers implementing stream protection practices

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	137

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

**Issue (Who cares and Why)**

The North Carolina Division of Water Quality included Beaverdam Creek in Western North Carolina on its Clean Water Act Section 303(d) list of impaired streams in 2008. Biological

pollutants, sediment or high water temperatures can cause an impaired designation.

**What has been done**

Cooperative Extension helped develop a watershed rehabilitation plan for Beaverdam Creek. The first year was dedicated to developing a plan, communicating with the community, documenting conditions in the watershed, and identifying areas that would benefit most from rehabilitation efforts.

**Results**

Installing best management practices on eight private properties stabilized almost 5,000 linear feet of stream and reduced approximately 78 tons of sediment per year. Statewide, growers or landowners installed 137 stream protection BMPs and 344 landowners developed a management plan for their property.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

**Outcome #7**

**1. Outcome Measures**

Number storm water systems installing BMPs

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
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2013

451

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Stormwater runoff in developed watersheds has become a major concern to citizens and leaders throughout North Carolina.

#### What has been done

Throughout 2013, demonstration sites have been installed throughout North Carolina, covering every eco-region. These sites not only function to help mitigate water quality problems, but also to educate the public on what the practice is and how it works. The technologies that have been installed include everything from bioretention cells to permeable pavement parking surfaces.

#### Results

The field research projects embarked on in 2013 are seen statewide, and have resulted in positive feedback from citizens to decision makers as well as a greater understanding of structural storm water practice installation. The input NCSU has provided on the stormwater technical review workgroups affects how legislation on stormwater is implemented in this state, which affects the developmental community and North Carolina's overall economy. Statewide, 451 program participants were involved in implementing community-based projects for environmental protection.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

#### Outcome #8

##### 1. Outcome Measures

Number farms adopting use of biofuels

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	18

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

**Issue (Who cares and Why)**

Dependence on foreign oil and the increasing cost of energy have led to an increase in research for alternative and renewable fuels. The Southeastern United States and North Carolina in particular is uniquely situated in a climate zone adaptable to multiple crops suitable for bioenergy synthesis. Research in production and conversion of biomass to renewable energy can provide new opportunities and jobs for the region.

**What has been done**

North Carolina State University, in conjunction with the University of Kentucky, has initiated research in on-farm biomass processing working towards an integrated high solid transporting/storage/processing system. Work has begun to provide production and processing practices for growing and conversion of biomass feedstock?s into renewable energy. Using previous design and testing knowledge new gasification systems are being developed to better utilize biomass that is consumed during the integrated conversion process. In addition, pre-gasification processing of the biomass residues is being developed and equipment is being acquired.

**Results**

If this program is successful, growers in North Carolina and the southeastern United States could potentially utilize more dynamic crop production rotations as well as bring underperforming or marginal lands into biomass to biofuel production. Additionally, technology transfer licensure of integrated systems that are designed may be possible. Statewide, 18 producers increased or implemented bioenergy production, creating product with a value over \$300,000.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
401	Structures, Facilities, and General Purpose Farm Supplies

## **Outcome #9**

### **1. Outcome Measures**

Number growers implementing improved irrigation and drainage systems

Not Reporting on this Outcome Measure

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

#### **External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

#### **Brief Explanation**

Rapidly changing economic and environmental conditions influence producers' and communities capacities to adapt to change and at the same time, sustain their operations. Water supplies for irrigation, high cost of fuels, and harsh weather systems present significant challenges all too often. Changing federal, state local funding commitments for research and extension programs are challenged regularly. And regulatory and other governmental policies challenge the entire community, which our research and extension programs serve. Nevertheless, we are committed to ensuring that programs that endure are those that will have significant economic, environmental, social and quality of life benefits to our stakeholders.

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

#### **Evaluation Results**

Examination of the outcomes and impacts in this program area indicate significant progress and benefit in the areas of waste management, nutrient capture and utilization, and water quality protection, along with some of the economic benefits that accrue to those outcomes. As pressures increase for access to large quantities of irrigation water, it is anticipated that our research and extension programs will need to play a greater role in providing technology and systems to manage that water efficiently to optimize crop and food production, use nutrients efficiently and conserve water.

#### **Key Items of Evaluation**

Our strong programs in water quality and animal waste management and utilization continue. Our evaluation approaches are not collecting sufficient data and information on outcomes and impacts from our research and extension on irrigation and drainage systems and their benefits to farmers, communities and other land managers. We will strive to make changes in our evaluation tools to capture that information.