

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	10%	10%	10%	10%
133	Pollution Prevention and Mitigation	10%	10%	10%	10%
141	Air Resource Protection and Management	5%	5%	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%	10%	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	20%	20%	20%	20%
	Total	100%	100%	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	55.0	4.0	25.0	6.0
Actual Paid Professional	43.0	2.0	28.0	6.0
Actual Volunteer	4.0	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
428504	100149	413821	911078
1862 Matching	1890 Matching	1862 Matching	1890 Matching
428504	93227	413821	356857
1862 All Other	1890 All Other	1862 All Other	1890 All Other
3298696	8756	3211712	423077

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	51419	60312	0	0

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	9	82	91

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Waste Management Certification Programs

Year	Actual
2012	75

Output #2

Output Measure

- Number research project completed on environmental/natural resource issues

Year	Actual
2012	96

Output #3

Output Measure

- Number of non-degree credit environmental activities conducted

Year	Actual
2012	384

Output #4

Output Measure

- Enrollees for Natural Resources Leadership Institutes training

Year	Actual
2012	0

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

2. Associated Institution Types

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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	587

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Extensive soil tillage depletes soil organic matter, decreases soil stability and decreases soil water infiltration and soil water retention.

What has been done

A field workshop was conducted on a field experiment that demonstrated to growers how reducing tillage and incorporating cover crops in farming rotations will increase soil stability, water infiltration and soil water retention significantly.

Results

Ten growers minimized tillage and planted cover crops in their farms. Eight of the ten growers noticed beneficial changes in their soil on the first crop year and two of the 10 growers noticed some change on the second crop year.

4. Associated Knowledge Areas

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

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

Year	Actual
2012	1426

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The ammonia in manure and waste treatment systems is dilute and therefore limited in use to relatively short distances, usually on the same property on which the animals are raised. In North Carolina and much of the country, this prevents use of the valuable nutrients in the feed production system.

What has been done

Scientists at the USDA Agricultural Research Service have developed a membrane technology that is selective for gaseous ammonia. The ARS scientists demonstrated in the laboratory that this technology can remove 50% of the total ammoniacal nitrogen in a lagoon sample over a period of several days. Engineers at NCSU have obtained a grant with the ARS scientists to build a pilot scale ammonia recovery system based on this technology and to develop procedures that will facilitate on-farm operation.

Results

Development of this technology will help convert the pollution potential of liquid manure application into a valuable fertilizer product that can be transported out of the local watershed. Once developed, this technology will provide business and employment opportunities in many rural communities associated with animal production. Application to other industries and waste streams is also possible.

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
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	19431

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Educating farmers about optimum fertilizer management and production practices such as high population corn management, fertilizer spreader calibration and legume and manure alternatives to inorganic fertilizers improves farm profitability and reduces the likelihood of runoff of nitrogen, phosphorus, and sediments the state waterways.

What has been done

NCSU scientists have collaborated with producers to develop fertilizer rate and timing recommendations for conventionally produced agronomic crops as well as certified organic production systems. These include studies to evaluate the nutrient availability coefficients used to estimate N and P supplied to cotton, corn and wheat by poultry litter and manure sources.

Results

Based on NC Agricultural Statistics and estimates of current fertilizer usage and costs, the following are estimated impacts. Fertilizer N in the Tidewater region is predominantly applied to

corn (213,800 acres), wheat (184,200 acres), cotton (120,100 acres), and Irish potato (16,150 acres); which account for approximately 29% of the statewide corn, 26% of the statewide wheat, 13% of the statewide cotton, and 95% of the statewide Irish potato acreages. If 50% of this area adopted best management practices (BMPs) such as water control structures, nutrient management planning, or optimum N timing resulting in a 50% reduction in N runoff on the treated fields; then total N runoff would be reduced by approximately 25%. If fertilizer N use was reduced by 10% on these farms, this would directly save farmers approximately 6.6 million pounds of N or \$3.3 million per year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

Year	Actual
2012	2910

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Due to legislation, increased public awareness, and an increasingly sophisticated population of professionals in environmental fields, there is a growing need for training programs in North Carolina on waste management, nutrient management, and watershed protection.

What has been done

NCSU offered 94 short courses and conferences in 2012 for municipal and industrial wastewater operators, environmental health specialists, septic system installers and operators, professional engineers, soil scientists, well contractors, water quality specialists, government agency employees, and elected officials.

Results

Three thousand five hundred ninety five (3,595) participants received technical training for license renewal and/or professional development.

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 #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
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	872622

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New fertilizer materials are available and need to be evaluated for efficacy in commercial farms. These include increasing amounts of poultry litter and layer manure.

What has been done

Studies evaluated the nutrient availability coefficients used to estimate N and P supplied to cotton, corn and wheat by poultry litter and manure sources. A doctoral dissertation and planned research publications describe aspects of poultry manure used as soil fertility amendments.

Results

Providing basic soil fertility and crop problem diagnosis recommendations supports newly emerging crops and farming systems, and permits evaluation of new fertility management practices.

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

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

Year	Actual
2012	2684

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Stream restoration is an important watershed management practice improving water quality and aquatic habitat in many North Carolina watersheds. Causes of stream impairment include land use changes affecting stormwater runoff, removal of riparian vegetation, and channel straightening or other modifications. Many state and federal agencies provide funding for restoration projects, requiring that effective restoration planning, design, and construction practices be implemented. An applied research and education program is needed to evaluate and

demonstrate technologies and teach professionals how to accomplish stream restoration objectives effectively.

What has been done

NCSU faculty developed a comprehensive education program to improve the practice of stream restoration. This program includes a series of River Course workshops in which over 5,000 professionals have learned about stream assessment, design, construction, and monitoring. NCSU also provides leadership for the biennial Southeast Stream Restoration Conference, attended by over 500 practitioners, government officials, and academics. More than 60 grant-funded projects across the state are used to demonstrate and evaluate stream restoration practices in a variety of watershed conditions.

Results

The quality of stream restoration projects has improved in the past decade, as professionals have gained increased understanding of stream restoration principles and applications. Funding for projects has increased as resource agencies determine that previous projects are successful in meeting water quality and habitat goals. Ecosystem mitigation policies have been adjusted based on outcomes of this program to meet restoration goals.

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 #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

Year	Actual
2012	421

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Irrigation water was needed for conservation agriculture technology experiments for vegetable production at local high schools. Rainwater was the most economical source but was not readily available.

What has been done

Rain harvester tanks (2,500 gallons) were installed to collect rainwater. In addition, water meters were installed to monitor how much municipal water was being saved by using these tanks.

Results

In most cases, harvested rainwater is now used for experiments instead of using municipal water.

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

Year	Actual
2012	21

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increased use of biofuels on North Carolina farms may save farmers money.

What has been done

Several training workshops on biofuel use at the farm level were conducted.

Results

One small-scale dairy farmer has begun to produce biodiesel from used vegetable oil and use the fuel to power his tractors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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 environmental and economic conditions (weather extremes, economic climate) influence producers abilities to adapt to change while ensuring sustainable production systems and environments. Continued effects of the economy on

federal, state and local support for research and extension programs continue to challenge our research and extension enterprises. Likewise, regulatory and other governmental policies and rules influence the educational and research capacities of our programs and present challenges to producers, processors and marketers to comply with new and often expensive regulations. And in an environment of reduced funding, the program competition for existing funds becomes a greater challenge to manage. Nevertheless, emphasis is placed on those research and extension opportunities that have the greatest effect on sustainability of farms, families and businesses, i.e., economic, environmental and social and quality of life viability.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from North Carolina Cooperative Extension reporting system, faculty activity reports and impact statements, Office of Technology Transfer and the business offices at the two institutions. The data indicate that, despite continuing budget challenges, our research and extension programs continue to reach significant segments of our audience with relevant research and extension information that has benefit to their enterprises. Based on the impact statements, publications and patents filed, our research and extension faculty on the two campuses and across the state continue to foster and lead change.

Key Items of Evaluation

Results of research and extension programs and activities are focused on strategies to conserve and efficiently use natural resources, new technologies, engineered systems and economic and policy approaches to minimize negative impacts of agricultural, manufacturing and homeowner activities on the environment and our climate.