

# 2011 Clemson University and South Carolina State University Combined Research and Extension Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

This year's report includes all five NIFA high priority issues. In addition, South Carolina is reporting on seven other state program areas: Sustainable Animal Production Systems, Sustainable Agriculture Production for (non-food) Horticultural Crops, Water Quality and Quantity, Community Leadership and Economic Development, 4-H Youth Development and Families, Environmental Conservation for Wildlife, and Sustainable Forest Management. This year's report also covers biotechnology and sustainable agronomic crops, two programs that have been merged into the other programs in the annual plan update.

Research and Extension delivery through outreach of research results to the clients continue to be key in promoting economic development and job creation throughout the state. There were more than 110 active research projects in the reporting period. Researchers issued seven intellectual property disclosures, submitted seven patent applications, and received four patents. One license agreement was signed. Faculty also submitted 127 technical contributions for publication. The Clemson Extension Service delivered over 8,490 programs throughout the 46 counties of South Carolina, reaching some 169,633 people.

In Global Food Security and Hunger (GFSH), Research and Extension sustains companies and jobs and creates new opportunities, in part by investing in creative, productive scientists that know how to identify and solve problems and by the delivery of knowledge that consumers can use. New production techniques shared with growers by Extension agents made it possible for the average farmer to feed 155 people in 2010 vs. 19 people in 1940 through improvements in varieties, agronomic practices, and disease and pest resistance. Planting high-yield cotton increased from 22% in 2002 to 70% in 2009 because of research on varieties, production techniques and resistance to disease and weeds. About 30 field studies are conducted each year at the Pee Dee and Edisto Research and Education Centers, and on commercial farms. The tests evaluate cotton varieties, pesticide systems, plant growth regulators, harvesting equipment and techniques, and agronomic practices such as plant density, planting date, tillage systems and irrigation. In addition, research on modifying milk fat composition in dairy cattle revealed that feeding additional potassium lowers the milk fat percentage. It also identified the processes in rumenlipid metabolism that cause those changes.

A test to target treatment for brown rot has saved SC and Georgia peach growers \$20 million by reducing spray costs and preventing yield loss. Brown rot fungus is a hardy survivalist that has adapted to resist control efforts. The test allows growers to identify the correct chemicals and correct amounts needed to control the fungus and protect their crop. The test also targets brown rot treatments for nectarines, plums, cherries and strawberries.

Researching the ecology and management of the European corn borer and other corn pests helps SC growers protect over 300,000 acres of corn and harvest over 30 million bushels. Recommended controls include crop rotation, early planting, plowing under old corn residue, planting selected Bt hybrids and using targeted insecticides.

Peanut research and Extension programs have improved S.C. peanut grower profitability by more than \$3 million per year through increased yields and improved disease resistance. Research focused on

biological and chemical disease inoculants, gypsum source and application timing, potash fertility under high yield conditions and foliar-applied nutrient supplements.

Producers adopted best management practices as a result of participation in Extension programs. Monitoring systems and reduced pesticide spraying guidelines developed by Clemson saved South Carolina soybean growers more than \$25 million a year, with about \$10 million saved in reduced crop losses and about \$15 million in reduced spraying costs. Based at Clemson's Edisto Research and Education Center, the monitoring program involves Clemson Extension agents, Clemson Regulatory Services agents and growers in 16 South Carolina counties and serves as a model for the nation. In addition, reduced seeding rates developed at the Edisto Center save S.C. growers \$10 million per year.

In Sustainable Energy, biofuels renewable energy research led to a contract of \$20 million per year for S.C. growers to sell switchgrass to European power plants as a substitute for coal. Researchers at Clemson's Pee Dee Research and Education Center investigated switchgrass production systems, including soil and crop management, new variety development and measuring environmental impacts. Their studies found that switchgrass, a native perennial warm season grass, is very hardy, drought tolerant and can thrive in soil that cannot support other crops. The plant produces twice as much ethanol per acre than corn and the energy return ratio from switchgrass can be as much as five times that of corn-based ethanol.

Variable rate irrigation technology matches needs to specific zones, increasing crop yields, while reducing water and fertilizer use and saving up to 40% in production costs. The system uses sensors and computer controls to apply water only in the areas and amounts needed, based on soil type and terrain. This saves in both energy and water usage and decreases the effects of wind and evaporation as water is applied to crops.

In Climate Change, remote sensing technology for use in rivers was developed and patented which will provide valuable data for gauging the impact of climate change on water systems. Researchers are finding alternatives to chemical pesticides that reduce both chemical use and production costs. Leafy greens producers can reduce applications of insecticides from about 15 per season to just two or three by using microbial agents and advanced field scouting techniques. This reduces both costs for the grower and impact on the environment.

In Sustainable Agriculture Production for (Non-food) Horticulture, turfgrass research at the Pee Dee REC saved a Myrtle Beach golf course thousands of dollars a year in labor costs and tens of thousands of gallons in wasted water. Scientists identified the problem as hydrophobic turf, meaning the soil was repelling water. A prescribed series of chemical treatments returned the turf to full health. Clemson scientists work to minimize economic and environmental costs of turfgrass management, while meeting federal and state regulations. Extension activities included site visits to commercial nurseries to address plant and pest problems and conducting trainings and designing sustainable landscapes for consumers, volunteers and community organizations. Educational information was delivered through the media and the Internet.

In Water Quality and Quantity, education programs on water quality reached 6,472 participants, including municipal officials, contractors, homeowners, farmers, landowners, and youth. Extension conducted a watershed survey on stream degradation and conducted training on rainwater harvesting systems. The Certified Erosion Prevention/ Sediment Control Inspector Program reached 550 professionals. Intelligent River pilot sites were installed to remotely collect and display real-time water quality data to aid policy decision makers. The EPA-DHEC designated a Watershed Center of Excellence for S.C. A federally-funded green infrastructure stormwater management system was installed in Aiken County to mitigate erosion of Sand River.

In the area of Food Safety, the approximate economic value of the food handlers trainings was more than \$11 million due to the prevention of food borne illness outbreaks. In nutrition and Childhood Obesity, 90% of the participants showed improvement in one more nutrition practices.

4-H Youth Development agents and volunteers conducted over 2,565 programs that reached 69,054 youth and families. In addition, 909 adult volunteers were trained, who then trained youth in leadership development; hunting safety; plant and animal projects; science, technology and engineering projects; day and overnight camping; financial/resource management; nutrition, health and fitness; natural resources; and water quality and conservation.

Sustainable Forest Management Extension programs increased biodiversity in the state and restored longleaf pine ecosystems. Master Naturalist volunteers provided 4,327 hours of service, which equates to a value of \$90,867 in program support. eased biodiversity in the state, restored longleaf pine ecosystems, and facilitated the conservation o lal In

In the area of Environmental Conservation for Wildlife, a Clemson Extension Specialist is the southern US partner in maintaining the national web-based clearinghouse Internet Center for Wildlife Damage Management (<http://icwdm.org>). The Master Wildlifer course had a major impact on improving lands for wildlife and other natural resources. Extension programs resulted in better management of feral hogs and problem wildlife. A statewide cogongrass survey was conducted and the results were used in training programs. A wildlife food plot planting guide was developed to enhance hunting as an alternative income source for landowners. In the area of Sustainable Animal Production Systems, producers completed certification programs, improved herd management and forage selection.

In Community Leadership and Economic Development, projects under the Pee Dee Agritourism initiative such as establishing and maintaining the area Farmers Market Associations and organizing the coastal farm-to-chef initiative focused on the distribution of local agriculture products in coastal restaurants. CLED assessed the economic impact of agriculture and forestry for selected counties in the state and analyzed the direct contribution by major agribusiness sector separately for all 46 SC counties. Leadership programs were conducted with local county governments. Support was provided for seven local farmers markets with over \$250,000 in sales for the Sandhill Market with an economic impact of over \$300,000. Staff members partnered to grow and diversify the Catawba regional agribusiness economy through strategic planning and grant support.

South Carolina State University had a total of 55 FTEs. Of that total, 13 FTEs belonged to Research and 42 slots were obligated to 1890 Extension. During FY 2010, there was no increase in FTEs as previously anticipated and indicated in the FY 2012-2017 Updated Plan. It is anticipated the FTEs will remain the same for the coming year, if not decrease. 1890 Research continues to conduct studies in the areas of Sustainable Agriculture Production for Horticultural Crops, which is now transferred under Global Food Security and Hunger; Food Safety and Nutrition; Community, Leadership and Economic Development; 4-H Youth Development and Families, Water Quality and Quantity and Childhood Obesity. The 1890 Research efforts are expanding as more researchers attempt to study in the priority areas established by USDA.

**Total Actual Amount of professional FTEs/SYs for this State**

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	157.0	42.0	43.0	13.0
Actual	125.0	42.0	34.3	13.0

**II. Merit Review Process**

**1. The Merit Review Process that was Employed for this year**

- Internal University Panel
- External Non-University Panel
- Expert Peer Review

**2. Brief Explanation**

The Research and Program Development Committee of the South Carolina State Extension Advisory Council was responsible for reviewing and commenting on new programs initiated by Clemson University and South Carolina State University. The seven-member Research and Program Development Committee is one of the Council's three committees that reviewed the list of programs and descriptions that were conducted. The committee serves as the external non-university panel for program review. The committee members are knowledgeable of South Carolina's social and economic demographics and are sensitive to the needs of underserved and underrepresented populations. The total Council had the opportunity to give input about programs. There are Extension volunteers, producers, a community center program coordinators, public school educators and business owners.

There are internal university review panels. All proposed research projects were reviewed and critiqued by a research panel. Clemson Extension programs were reviewed by State Extension Program Team Leaders and administration. Both panels reviewed projects and programs based on organizational capacity, relevance and impact. In addition, all research projects go through a review process as outlined under Hatch regulations. This serves as the Expert Peer Review process. The Internal University Panel periodically reviews the South Carolina Plan of Work. The Research and Program Development Committee is kept abreast of new national priority areas and of the realignments of Research and Extension activities to focus on the NIFA priority areas. The program review activities of the committee complements the scientific peer review process established at both institutions.

**III. Stakeholder Input**

**1. Actions taken to seek stakeholder input that encouraged their participation**

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals

- Targeted invitation to selected individuals from general public
- Survey specifically with non-traditional groups

**Brief explanation.**

Stakeholder input is encouraged through Advisory Council Meetings that are held throughout the state to assess programs and identify issues for agricultural Research and Extension. Stakeholders were identified and invited to attend meetings. Stakeholders include those internal to the Cooperative Extension and 1890 System--administrators, extension agents, agent associations, specialists, faculty and department chairs, as well as those external to the system. External stakeholders are Extension advisory board members, commodity group representatives, community leaders, human service providers, business/industry representatives and collaborators (Farm Bureau, Chamber of Commerce, Farm Service Agencies, etc).

1890 Extension continues to provide and encourage the application of research-based knowledge and leadership techniques to individuals, families and youth who reside in the targeted service areas. The Staff is committed to providing conferences, workshops, activities and programs to help assist limited resource clients in urban and rural areas to improve their overall quality of life. 1890 Extension provides programs and activities in the areas of Global Food Security and Hunger; Food Safety and Nutrition; Community, Leadership and Economic Development; 4-H Youth Development and Families; and Childhood Obesity. Through participation in the programs and activities offered, stakeholders, also, provide input as to what services they would like to see in their communities.

**2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them**

**1. Method to identify individuals and groups**

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

**Brief explanation.**

People who are already involved in Research and Extension programs or receive services as well as people who may not be involved, but may have similar interests or are addressing similar concerns are identified and contacted.

**2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them**

**1. Methods for collecting Stakeholder Input**

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals

- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

**Brief explanation.**

Focus groups and a survey instrument are used to collect stakeholder input and issue identification for Research and Extension. Participants are asked to evaluate the effectiveness of Extension programs, major concerns in the county and recommend topics they feel Extension can adequately address. They also give program ideas. Each county compiles data from the stakeholder meetings and uses the information to make adjustments in program design and implementation.

**3. A statement of how the input will be considered**

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

**Brief explanation.**

Program issues are identified and programs are developed, expanded or eliminated based on their quality and/or effectiveness.

**Brief Explanation of what you learned from your Stakeholders**

The stakeholders felt that more clarity is needed in terms of the kinds of water activities that would fit under the category of Sustainable Energy. Methodology in the area of agriculture resiliency and climate change needs to be strengthened.

#### IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
5662218	1815086	4217821	2237090

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	5404629	1815086	3627683	2237090
<b>Actual Matching</b>	5404629	907543	3627684	1118545
<b>Actual All Other</b>	292856	0	0	0
<b>Total Actual Expended</b>	11102114	2722629	7255367	3355635

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous</b>				
<b>Carryover</b>	0	0	0	0

## V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Sustainable Animal Production Systems
2	Sustainable Agriculture Production for (non-food) Horticultural Crops
3	Sustainable Agronomic Crop Systems
4	Water Quality and Water Quantity
5	Biotechnology
6	Food Safety and Nutrition
7	Community, Leadership, and Economic Development
8	4-H Youth Development and Families
9	Environmental Conservation for Wildlife
10	Sustainable Forest Management
11	Childhood Obesity
12	Climate Change
13	Sustainable Energy
14	Global Food Security and Hunger



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

**Program # 1**

**1. Name of the Planned Program**

Sustainable Animal Production Systems

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	20%	20%	15%	10%
302	Nutrient Utilization in Animals	20%	20%	30%	10%
303	Genetic Improvement of Animals	15%	10%	10%	10%
307	Animal Management Systems	20%	25%	20%	30%
308	Improved Animal Products (Before Harvest)	15%	10%	15%	10%
315	Animal Welfare/Well-Being and Protection	10%	15%	10%	30%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	6.0	3.5	0.0
Actual Paid Professional	10.0	7.5	3.7	0.5
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
483234	344098	382630	135396
1862 Matching	1890 Matching	1862 Matching	1890 Matching
483234	172047	382630	67699
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**

Specialists conducted research experiments and focused on farm/enterprise management, production and marketing and provided training sessions, workshops and demonstrations to deliver research based information. Educational activities included improved herd health practices, animal nutrition, select breeding practices, reproductive efficiency, pasture production and management.

Research on **modifying milk fat composition** in dairy cattle revealed that feeding additional potassium lowers the milk fat percentage. It also identified the processes in rumen lipid metabolism that cause these changes. Researchers identified the key gene involved in lipogenesis in ruminants and then developed strategies to alter lipogenesis and **reduce excess fat deposition**. Study results show that specific fatty acids regulate fat deposition, and that dietary supplements containing these specific fatty acids could target excess fat accumulation in meat-producing animals as well as humans.

Research was conducted to develop **integrated gastrointestinal nematode control** methods that decrease reliance on chemical dewormers. A companion study was conducted to develop a forage-based feeding system for year-round grazing that meets nutritional requirements by evaluating the performance of various forages. Results showed that lambs grazing chicory had lower fecal egg counts, increased performance and reduced GIN infections compared to those grazing bermudagrass with protein supplementation.

Research into the veterinary importance of **blood-sucking arthropods** was initiated because of the threat of economic losses and disease epidemics in domestic animals. More than 6,600 blood-feeding flies of 54 species in 4 families, predominantly mosquitoes, were collected at three different heights in the state. This suggests that different fly species forage for hosts at different heights, which provides an important basis for monitoring and preventing potential arthropod-borne diseases.

Studies identified the quantity and types of **heat-resistant microorganisms** present in rendering animal co-product materials. They also proved that traditional microbial enumeration methods are not accurate for use on these products. The microbial ecosystems in raw and rendered animal co-products are extremely complex. More research is needed to develop accurate enumeration methods to ensure pathogen-free products and safe animal feeds.

Research is being conducted to use a multi-agent framework to design and implement a **computer-based epidemiological simulation model** for livestock emergency response in South Carolina. The model combines the traditional herd-based epidemiological methods with the role of transportation and the interferences of individual objects for herds.

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

Producers, Limited-Resource Farmers, and agency personnel.

### **3. How was eXtension used?**

eXtension was not used in this program

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

### **1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	14852	106182	121	54

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

**Patent Applications Submitted**

Year: 2011

Actual: 1

**Patents listed**

Methods of isolating specific compounds from lymphatic tissue

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	0	7	7

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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

Year	Actual
2011	1

**Output #2**

**Output Measure**

- Licenses

Year	Actual
2011	0

**Output #3**

**Output Measure**

- Number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	6364

**Output #4**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

**Output #5**

**Output Measure**

- Number of educational workshops conducted

<b>Year</b>	<b>Actual</b>
2011	467

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

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

O. No.	OUTCOME NAME
1	Number of publications authored or co-authored (fact sheets, papers presented at Extension meetings, etc.)
2	Number of people reporting increased knowledge

**Outcome #1**

**1. Outcome Measures**

Number of publications authored or co-authored (fact sheets, papers presented at Extension meetings, etc.)

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of people reporting increased knowledge

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	6224

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

**Issue (Who cares and Why)**

Small livestock producers desire to reduce their feed costs during the winter months, while maintaining the animals' body condition, milking ability and ability to rebreed on time. Supplemental feed costs in the winter are among one of the greatest, if not expensive, livestock enterprises. By testing, hay producers can determine what additional supplementation is required and provide only the nutrients that are lacking in the animals' diet.

In Extension, the program aims to improve production efficiency, environmental sensitivity, and profitability of animal production systems and reduce the environmental impact of animal waste in South Carolina.

**What has been done**

A forage sampler was purchased allowing producers to sample hay to determine crude protein, acid detergent fiber, neutral detergent fiber and nitrate level. Fifteen producers conducted forage samples on purchased and produced hay. The forage sample results aided in their decision making process of where to purchase hay and what supplements to buy to correct nutritional deficiencies.

In Extension, producers were reached through Extension animal production programs such as Master Cattleman, the Grass Master's program, Cattleman's Day and Bull Sale, the Artificial Insemination School, backyard poultry clinic, goat and sheep seminars, and the USDA small farm workshop.

### Results

100% of the producers who utilized the forage probe to determine hay quality reported a lower feed bill as a result of purchasing better quality hay and providing supplementation only when necessary to correct nutritional deficiencies.

In Extension, changes in the management style of the Clemson Bull Test Sale program (transitioning from a 1.5% BW grain supplement on grass to pure forage) resulted in an approximately 60% decrease in consignment fees with no practical decreases in bull performance. This will allow purebred producers a more economical genetics testing option while still providing buyers with an excellent and productive resource. Sixty-eight (68) producers earned first-time certification.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

## 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
- Populations changes (immigration, new cultural groupings, etc.)

### Brief Explanation

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

### Evaluation Results

As a result of research evaluation studies:

1. Success in modifying milk fat composition in dairy cattle.
2. Developed strategies to alter lipogenesis and reduce excess fat deposition.
3. Developed gastrointestinal nematode control methods.

4. Determined veterinary importance of blood sucking arthropods.
5. Identified the quantify and types of heat resistant microorganisms in rendering animal co-products.
6. One disclosure was made, one patent action was taken and seven technical contributions were written.

The program met the objectives set out in the planning phase. Resources dedicated to research in milk fat will be diverted to forage fed research on dairy cattle. Research in rendering will be shifted to sustainable small ruminant production.

Purchasing better quality hay and providing supplementaton only when necessary to correct nutritional deficiencies resulted in a lower feed bill.

In Extension, 68 producers earned first-time certification. An evaluation of over 257 programs involving 5,380 people revealed that over 91% reported knowledge gained.

### **Key Items of Evaluation**

Additional potassium in dairy feed lowers the milk fat percentage.

Methods were developed to reduce reliance on chemical dewormers by selected use of forages.

Specific fatty acids regulate fat deposition and related dietary supplements may target fat accumulation in meat producing animals and humans.



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

**Program # 2**

**1. Name of the Planned Program**

Sustainable Agriculture Production for (non-food) Horticultural Crops

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	10%	0%
202	Plant Genetic Resources	10%	0%	5%	0%
204	Plant Product Quality and Utility (Preharvest)	15%	0%	10%	0%
205	Plant Management Systems	15%	0%	15%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	10%	0%	15%	0%
212	Pathogens and Nematodes Affecting Plants	15%	0%	10%	0%
215	Biological Control of Pests Affecting Plants	10%	0%	10%	0%
216	Integrated Pest Management Systems	15%	0%	20%	0%
601	Economics of Agricultural Production and Farm Management	10%	0%	5%	0%
	<b>Total</b>	100%	0%	100%	0%

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	24.0	7.0	7.5	3.0
Actual Paid Professional	20.0	0.0	5.8	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
763231	0	537797	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
763231	0	537797	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

Research was conducted. Horticultural education programs were conducted. Field trials were conducted and demonstrated. Agents conducted media programs and made information available through websites.

Economic impact of international institutions (WTO, IMF, World Bank) and trade agreements on the competitiveness of southern agriculture were reviewed. Presentations were documented outlining information identified by the researchers. The researchers will investigate the dispersal of *L. serricornis* among habitats by defining food resource use pattern and dietary history.

Experiments were conducted to determine the effect of fertilizer concentration applied to stock plants on cutting production, cutting quality, postharvest performance and rooting in propagation. This research provided new guidelines for the improved production, transport and propagation of un-rooted cuttings that have been implemented by South Carolina growers.

An environmentally sustainable water treatment system, called a **constructed wetland system**, developed by Clemson research is serving the nursery and greenhouse industries. Tailored to manage nutrient, pesticide and pathogen contaminants, it can provide an environmentally sound and economically feasible alternative to traditional systems. Results from this research showed measurably cleaner water using the new system. Nitrogen, phosphorus, temperature and *Phytophthora* spp colony-forming units were consistently lower after water was treated in the constructed wetland.

Fine root activity is a crucial determinant of plant productivity, ecosystem nutrient cycling and global carbon sequestration. A multi-year study was completed on soil compaction and amendment treatments for urban trees, using the latest miniature camera equipment and RootFly minirhizotron image analysis software. Statistical models were developed that relate **urban tree root growth** to soil water content and temperature. Mulch was found to be the most effective of the individual treatments, increasing both organic matter and water content of the soil.

The U.S. **micro-propagation industry**, with more than 150 laboratories nationwide, is under pressure from low-cost imports. Research to lower the cost for U.S. laboratory production of plant material yielded progress in developing a liquid-matrix system that prevents hyperhydricity in sensitive plants, both herbaceous and woody. Specific nutrients also were identified that are critical to the subsequent growth of laboratory plants in greenhouse nurseries. Response surface methods and experimental platforms have been developed to allow in vitro biologists to refine media formulations for critical applications.

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

The audience will include producers, small farmers and Extension personnel, horticulture professionals, residents in counties with Master Gardener programs, Master Gardeners, and consumers.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	45954	2000000	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 3

**Patents listed**

Development of two bitter melon medicinal varieties, CBM-10 and CBM-12 containing high concentration of an anticancer (curcubitacin-B phytomedicine) and an antidiabetic (Charantin) phytomedicine in their fruits.

- 2. Increased resistance of plants to pathogens from multiple higher-order phylogenetic lineages.
- 3. Tumor and mutation suppressing plant extract

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	55	45	0

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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

**Year**

**Actual**

2011 2

**Output #2**

**Output Measure**

- Licenses

<b>Year</b>	<b>Actual</b>
2011	0

**Output #3**

**Output Measure**

- Number of people completing horticultural educational workshops

<b>Year</b>	<b>Actual</b>
2011	19073

**Output #4**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

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

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

O. No.	OUTCOME NAME
1	Number of Master Gardeners reporting activities and programs
2	Number of participants gaining knowledge

**Outcome #1**

**1. Outcome Measures**

Number of Master Gardeners reporting activities and programs

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	281

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

**Issue (Who cares and Why)**

This program seeks to inform horticulture professionals, master gardeners, and consumers on environmentally sound horticultural practices that will improve communities.

**What has been done**

Master Gardener and Jr. Master Gardener trainings were conducted.

**Results**

Over 281 new Master Gardeners contributed over 36,020 hours of service conducting programs and activities such as oral presentations, newsletters, radio programs, and TV appearances, a value of \$648,360 program support.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
216	Integrated Pest Management Systems

**Outcome #2**

**1. Outcome Measures**

Number of participants gaining knowledge

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	18077

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

**Issue (Who cares and Why)**

The Horticultural Program at Clemson University seeks to inform horticulture professionals, master gardeners, and consumers on environmentally sound horticultural practices that will improve communities.

**What has been done**

Some 827 horticultural programs were conducted reaching 24,053 persons. Activities this year included site visits to commercial nurseries to address plant and pest problems, meetings with horticultural professionals to diagnose turf problems, conducting plant identification classes, sustainable landscapes, and trainings for Master Gardeners and community organizations. A total of 22,074 consumers received information through HGIC Information Center. There were almost 2 million visits to university horticulture websites. Agents conducted media programs such as appearances on Making it Grow radio and TV shows, wrote newspaper articles, developed fact sheets and published websites.

**Results**

Of the 19,073 persons participating in horticultural programs, 95% reported a gain in knowledge.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

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

### **Evaluation Results**

1. Research on the effect of fertilizer concentration to stock plants has led to new guidelines for improved production, transport and propagation of un-rooted cuttings.
2. An environmentally sustainable water treatment system (constructed wetland) was developed and is in use by the nursery and greenhouse industries.
3. A multi year program on soil compaction and amendment treatments for urban trees determined that mulch was the most effective, increasing both organic matter and water content in the soil.
4. A new micro-propagation liquid-matrix system was developed which prevents hyperhydricity in sensitive plants, both herbaceous and woody.
5. Of the 19,073 persons participating in horticultural programs, 95% reported a gain in knowledge.

### **Key Items of Evaluation**

Research on the effect of fertilizer concentration to stock plants has led to new guidelines for improved production, transport and propagation of un-rooted cuttings.



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

**Program # 3**

**1. Name of the Planned Program**

Sustainable Agronomic Crop Systems

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
204	Plant Product Quality and Utility (Preharvest)	0%	0%	10%	0%
205	Plant Management Systems	0%	0%	10%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	0%	0%	10%	0%
212	Pathogens and Nematodes Affecting Plants	0%	0%	15%	0%
213	Weeds Affecting Plants	0%	0%	10%	0%
215	Biological Control of Pests Affecting Plants	0%	0%	10%	0%
216	Integrated Pest Management Systems	0%	0%	15%	0%
601	Economics of Agricultural Production and Farm Management	0%	0%	10%	0%
604	Marketing and Distribution Practices	0%	0%	10%	0%
	<b>Total</b>	0%	0%	100%	0%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.7	0.0
Actual Paid Professional	0.0	0.0	3.3	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	335459	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	335459	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**

Research was conducted

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

The target audience includes producers, Extension and other agency personnel.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

<b>2011</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	1	7	0

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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

<b>Year</b>	<b>Actual</b>
2011	1

**Output #2**

**Output Measure**

- Licenses

<b>Year</b>	<b>Actual</b>
2011	1

**Output #3**

**Output Measure**

- New Variety Releases

<b>Year</b>	<b>Actual</b>
2011	1

**Output #4**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

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

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

O. No.	OUTCOME NAME
1	Number of people gaining knowledge

## **Outcome #1**

### **1. Outcome Measures**

Number of people gaining knowledge

Not Reporting on this Outcome Measure

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

#### **Brief Explanation**

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

#### **Evaluation Results**

1. It was determined that weeks 3 through 5 were critical times for increasing control of lepidopterous insects on cotton and therefore increasing yields.

2. A sensor array was developed to identify and monitor the presence of damaged cotton and stink bug emitted VOCs. this makes it possible to identify pest density and minimize pesticide usage.

3. Twenty four field trials were conducted to compare performance of new transgenic cotton varieties.

4. A new site specific nematicide placement technology makes it possible to accurately match nematicide rate with the spatial distribution of nematodes to reduce chemical inputs and expenditures.

5. Research has shown that herbicide options will become more limited in cotton and soybeans in controlling glyphosate-resistant Palmer Amaranth.

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

It was determined that weeks 3 through 5 were critical times for increasing control of lepidopterous insects on cotton and therefore increasing yields.

A new site specific nematicide placement technology makes it possible to accurately match nematicide rate with the spatial distribution of nematodes to reduce chemical inputs and expenditures.

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

**Program # 4**

**1. Name of the Planned Program**

Water Quality and Water Quantity

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	30%	0%	40%	15%
112	Watershed Protection and Management	20%	0%	30%	15%
131	Alternative Uses of Land	20%	0%	0%	25%
133	Pollution Prevention and Mitigation	20%	0%	30%	30%
134	Outdoor Recreation	10%	0%	0%	15%
	<b>Total</b>	100%	0%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	4.5	1.0	4.4	1.0
Actual Paid Professional	8.0	0.0	0.0	1.0
Actual Volunteer	0.0	0.0	4.3	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
338935	0	324547	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
338935	0	324548	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

Agents and specialists educated agriculture producers and homeowners to increase acceptance of BMPs that protect and improve water quality; educated the public on how their different land-use practices impact the quality and quantity of water in urban streams; developed and delivered educational programming on stream restoration and water quality protection; developed participation in water quality volunteer groups, trained county volunteers to deliver water quality programming; designed, demonstrated and promoted the installation of riparian buffers and other environmentally appropriate plantings to protect water quality; and promoted environmentally sound natural resource recreation and tourism opportunities in South Carolina.

The Center for Watershed Excellence has been established to work with local communities to identify watershed issues, develop site-based solutions toward economic and environmental sustainability, procure funding sources and provide "one-stop-shop" watershed planning and management support within South Carolina. Carolina Clear addresses the special significance of South Carolina's water resources and the role they play in the state's economy, environmental health, and overall quality of life. The Certified Stormwater Plan Reviewer (CSPR) educates personnel on the proper design and review of storm water and sediment control plans for development sites in order to meet regulatory and environmental requirements. In anticipation of the revised SCDHEC NPDES Construction General Permit, the course will help prepare personnel for the certification exam to be administered at a later date.

The Certified Erosion Prevention and Sediment Control Inspector (CEPSCI) Program educates field personnel on the proper installation, maintenance and inspection of erosion prevention and sediment control measures at construction sites. Preventing sediment-laden runoff not only protects our rivers, creeks and streams, but it is also a trademark of a quality construction project.

The South Carolina Water Resources Center- operates as a catalyst for research and educational projects and programs across South Carolina. The Water Center also serves as a conduit for information necessary in the resource management decision-making arena as well as the water policy arena of the state.

Research was conducted. Researchers have developed remote monitoring and real time data acquisition technologies which will be integrated into agriculture, forestry and natural resources management systems. Coupled with GIS data layers, it will be possible for these economic sectors to manage resource allocations, while minimizing impacts on the environment. It will also be possible to meet the health challenge of producing adequate and healthy food, and enhance energy production through biofuels. Based on the patented Intelligent River Research Enterprise, the technology developed will be adapted and transferred to the intelligent farm, intelligent forest and intelligent Aquaculture programs. This technology consists of an end-to-end hardware/software infrastructure engineered to support real-time monitoring and management of natural resources across large spatial and temporal scales.

The fate of metals pharmaceuticals in aquatic ecosystems has been a topic on ongoing research. It has been determined that the antidepressant Venlafaxine caused fish to reduce food consumption, which is significant since the drug is a common contaminant in surface waters impacted by domestic sewage effluents. Research in the metals area of this topic led to the development of the Biotic Ligand Model (BLM) that is able to accurately predict the toxicity of copper in various water scenarios. This tool is now being used by US EPA and several states to determine site-specific water quality criteria.

The extent of sediment pollution and carbon transport from abandoned, unfinished residential developments was assessed with remote sensing and GIS. 301 sites which demonstrated sediment

pollution and carbon transport were identified in three updates South Carolina counties.

Research is conducted to measure groundwater radionuclides throughout the Edisto River Basin in South Carolina and study the geological properties in the region. A new experimental procedure was tested for the gross alpha/beta radioactivity of the groundwater samples. Six undergraduate assistants were hired to conduct the research and lab experiments. Several field trips were made to collect groundwater samples.

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

The target audience includes farm and forest landowners, Extension agents, and administrators, natural resource professionals, Land management agency personnel, and user groups, nature-based tourism operators/industry, South Carolina citizens, tourists, children in school, after-school, summer and 4-H programs, agents and volunteers, urban, suburban and rural residents, farmers, ranchers, poultry and swine producers, foresters urban agents, agency personnel, urban planners and land owners/managers, municipal officials, and local community groups statewide, managers, government officials, and recreation and tourism operators.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	8866	722269	400	1300

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	5	5



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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

<b>Year</b>	<b>Actual</b>
2011	0

**Output #2**

**Output Measure**

- Licenses

<b>Year</b>	<b>Actual</b>
2011	0

**Output #3**

**Output Measure**

- Number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	6472

**Output #4**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

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

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

O. No.	OUTCOME NAME
1	Number of people gaining knowledge
2	Number of people using practices learned

**Outcome #1**

**1. Outcome Measures**

Number of people gaining knowledge

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	6285

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

**Issue (Who cares and Why)**

Forty-percent of the monitored waterways of South Carolina are impaired, meaning they are not meeting their water quality standard for at least one monitoring parameter. Stormwater pollution is people pollution, everything that is left out on the landscape and picked up by rain. It is not treated and washes off into the nearest receiving waterway. Education and public involvement are critical to solving this broad issue. This program will promote the use of Best Management Practices for water quality and quantity.

The EPA-DHEC designated a Watershed Center of Excellence for S.C.

**What has been done**

Over 300 persons attended the 2010 SC Water Resources Conference. They participated in 30 breakout sessions in five tracks with 140 presenters from the state's universities, federal and state agencies, environmental engineering consultants, law firms, non profit organizations, utility companies and municipal water authorities. The five tracks included water policy and planning, river basin and stream systems, stormwater, water use management and permitting and water quality and monitoring. Plenary speakers over the two days included elected and appointed leaders who have a role in addressing major water issues facing the state. The proceedings, including manuscripts, extended abstracts and posters, can be viewed online at the conference web site

A bioretention workshop for professionals was held in Lexington at Corley Park. Over 50 engineers and landscape architects attended the workshop.

Rainwater harvesting, watershed and stormwater education programs have been conducted around the state. A rain garden workshop was conducted at the SC Botanical Gardens on the campus of Clemson University. Pickens Middle School was named a Champion of the

Environment for their Watershed Connections project and received significant press.

Agents have produced media programs including newsletters, billboards and newspaper articles. Media messages target specific behaviors to increase awareness and encourage behavior change.

### **Results**

Intelligent River pilot sites were installed to remotely collect and display real-time water quality data to aid policy decision makers.

A federally-funded green infrastructure stormwater management system was installed in Aiken County to mitigate erosion of Sand River.

Rain barrels were installed at elementary schools and local Boys and Girls Clubs. A composter sale was conducted where over 125 units were sold to area residents.

At Hagood Mill, a monitoring program has been established along with plans for a stream buffer restoration project.

As a result of the bioretention workshop, rain gardens and signage were installed.

Over 300 storm drains have been marked as part of a regional effort, all led by Girl and Boy Scouts.

## **4. Associated Knowledge Areas**

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

### **Outcome #2**

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

Number of people using practices learned

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

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	450

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

**Issue (Who cares and Why)**

Federal permit regulations administered by the state, require that all inspectors participate in a recertification course before their initial certification expires. CEPSCI recertification required the development of a new curriculum, which took into account changes to the regulations, along with updates to structural best management practices, strategies for effectively completing inspection forms, and understanding emerging topics that will potentially affect permit compliance in the future.

**What has been done**

Eight (8) recertification course have been taught during the 2010-2011 reporting period in Charleston, Columbia, Greenville, Clemson, and Conway with over 450 individuals in attendance.

**Results**

Initial course evaluations have indicated an overwhelmingly positive response to curriculum modifications. All participants indicated that they had gained knowledge. Evaluations indicate that of people attending all water quality programs, 2,573 reported using practices learned.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
134	Outdoor Recreation

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

#### **Brief Explanation**

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

#### **Evaluation Results**

All participants in the CEPSCI recertification program indicated a gain in knowledge through an evaluation administered at the end of the program.

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

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

**Program # 5**

**1. Name of the Planned Program**

Biotechnology

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	25%	0%
202	Plant Genetic Resources	0%	0%	25%	0%
303	Genetic Improvement of Animals	0%	0%	20%	0%
304	Animal Genome	0%	0%	20%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	0%	10%	0%
	<b>Total</b>	0%	0%	100%	0%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	6.6	0.0
Actual Paid Professional	0.0	0.0	1.3	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	180311	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	180311	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**

Research was conducted. Currently, a highly toxic copper ablative antifouling coating dominates the world market as a means for preventing the adhesion of oyster hemocytes and oyster and barnacle larvae on the hulls of ships. Researchers have developed new test coatings that demonstrate the ability to deter the adhesion of both oyster and barnacle larvae. This research has the potential to place a new technology on the market, and at the same time, make a significant contribution to the environmental quality of the world's seaways.

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

Agricultural biotechnology research has a grower and industry focus. New approaches to improving crop and animal lines are one result of biotechnology research and the ability to better deal with a variety of pests which negatively impact productivity is another.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: {No Data}

**Patents listed**

{No Data Entered}

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	0	20	0

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

**Output Target**



**Output #1**

**Output Measure**

- Disclosures

<b>Year</b>	<b>Actual</b>
2011	0

**Output #2**

**Output Measure**

- Licenses

<b>Year</b>	<b>Actual</b>
2011	0

**Output #3**

**Output Measure**

- National Media Placements

<b>Year</b>	<b>Actual</b>
2011	0

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

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

O. No.	OUTCOME NAME
1	Development of expanded applications of legumes in nitrogen poor environments
2	Improved profitability for beef and dairy producers

### **Outcome #1**

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

Development of expanded applications of legumes in nitrogen poor environments

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

- 1862 Research

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2011	0

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

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

{No Data Entered}

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

{No Data Entered}

##### **Results**

{No Data Entered}

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

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources

### **Outcome #2**

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

Improved profitability for beef and dairy producers

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

- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2011	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

{No Data Entered}

#### What has been done

{No Data Entered}

#### Results

{No Data Entered}

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
304	Animal Genome
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

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

### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations

### Brief Explanation

{No Data Entered}

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

### Evaluation Results

Research has determined the proteins that interact during the process that regulates nodulation of legumes such as peas, soybeans and alfalfa. This will allow the manipulation of genes involved in nodulation and general plant growth and will increase yields of plant legumes and potential reduced fertilization in non-legumes.

A new, non-toxic naturally occurring compound which can be use as a coating to protect marine ship hulls from adhesion of oyster and barnacle larvae has been developed.

### **Key Items of Evaluation**

Research has determined the proteins that interact during the process that regulates modulation of legumes such as peas, soybeans and alfalfa. This will allow the manipulation of genes involved in nodulation and general plant growth and will increase yields of plant legumes and potential reduced fertilization in non-legumes.

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

**Program # 6**

**1. Name of the Planned Program**

Food Safety and Nutrition

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
503	Quality Maintenance in Storing and Marketing Food Products	5%	20%	5%	5%
703	Nutrition Education and Behavior	30%	25%	30%	35%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	30%	15%	30%	15%
723	Hazards to Human Health and Safety	30%	15%	30%	20%
724	Healthy Lifestyle	5%	25%	5%	25%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	3.0	2.8	2.0
Actual Paid Professional	8.7	3.5	2.0	2.5
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
363283	157196	211816	410008
1862 Matching	1890 Matching	1862 Matching	1890 Matching
363283	78598	211816	205004
1862 All Other	1890 All Other	1862 All Other	1890 All Other
292856	0	0	0

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

### **1. Brief description of the Activity**

Extension agents conducted food safety and nutrition programs for the general public, reaching 11,480 adults with nutrition, physical activity and health activities. Media programs were delivered covering topics of Food Safety, Nutrition, and Health. Media represents articles published in newspapers, other external publications, and information delivered through radio and television.

Nutrition education centered on My Plate and the Dietary Guidelines for Healthy Americans. Special focus was given to programming on increasing physical activity in all ages, and the development of food preparation skills that fit current nutritional needs and lifestyle. Safe handling of food was taught to handlers in the food service industry and the general public. Commercial food processors were targeted in an effort to improve commercial food processing efficiencies and effectiveness/develop new markets/improve commercial handling, processing, preservation and packaging to provide safe and high quality foods. Attention was given to providing consumers with scientifically based, reasonable nutrition and food safety information via the media. Programs on food-borne illnesses and conditions that encourage bacteria growth were conducted. Most common food-borne pathogens, additives, preservatives and basic kitchen safety techniques were taught. The following activities were conducted:

- Communities formed coalitions that focus on improving the nutritional health and fitness of their citizens.

- Participants made healthy food choices after participating in Extension food/nutrition programs.

- Participants developed skills in procuring of food for good health.

- Participants demonstrated skills in preparing food; emphasizing healthy preparation techniques.

- Participants increased knowledge and skills for the safe handling of food.

- Managers and supervisors were certified to train food handlers in safe food handling techniques.

- Food preservation and home canning workshops were conducted.

- Regulatory compliance was promoted.

- Specialists assisted in the development of new food businesses.

- Public understanding of technology, with an emphasis upon food biotechnology increased.

- Media outlets utilized Extension food safety and nutrition resources.

A series of Expanded Food and Nutrition Education Programs were conducted for 1854 limited resource families to improve nutrition, food safety, food resource management, food security, and physical activity practices. More than 1,730 volunteer hours were contributed for the program.

Research was conducted. Researchers looked specifically for sustainable packaging materials for celery and pretzels and determined that there are sustainable, bio-based materials capable of replacing existing, non-sustainable materials without adverse effects on the shelf life of the products. And, related to specific interests of packaging manufacturers, it was determined that compost temperature had a greater effect on compostable materials than moisture content. One of the materials that was expected to degrade, polylactic acid, required a much higher temperature for degradation.

Research is being conducted to study the effects of three different resistance exercise regimens on the diabetic profile of a Type 2 diabetes mellitus patient. An innovative signal processing technique to study kinetic patterns of muscular fatigue is being used. Another research project aims to develop nanomaterial-based sensors of unusual DNA structures that are implicated in human neurodegenerative diseases.

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

The target audience includes community leaders, agencies, policy makers, general public, EFNEP - limited resource families, food service managers, supervisors, food handlers, producers, commercial food handlers, processing and packaging industry, entrepreneurs seeking to start food businesses or improve existing food business, media and other marketing contacts, and publication outlets - doctors' offices and grocers.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	11480	933426	20835	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 1

**Patents listed**

Ascorbyl Palmitate-beta cyclodextrin-inclusion complex as an oxygen scavenging microparticle

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	1	1	1

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

**Output Target**

**Output #1**

**Output Measure**

- Licenses

Year	Actual
2011	0



**Output #2**

**Output Measure**

- Disclosures

<b>Year</b>	<b>Actual</b>
2011	0

**Output #3**

**Output Measure**

- Number of press kits distributed  
Not reporting on this Output for this Annual Report

**Output #4**

**Output Measure**

- Number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	12384

**Output #5**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

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

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

O. No.	OUTCOME NAME
1	Number of participants reporting increased knowledge in safe food handling and nutrition
2	Number of managers/supervisors/food handlers completing educational program and receiving a course certificate
3	Number of coalitions formed (partners, public/private, academic)
4	Number of participants reached with food safety information by volunteers who participated in an Extension training program
5	Number of new or improved food products entering the market as a result of adopting recommended practices
6	Number of people reached through media outlets that utilize Extension food safety, food biotechnology and nutrition resources

**Outcome #1**

**1. Outcome Measures**

Number of participants reporting increased knowledge in safe food handling and nutrition

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	19276

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

**Issue (Who cares and Why)**

The program promotes healthy lifestyles and improves the quality and safety of food for the citizens of South Carolina.

**What has been done**

Food Safety and Nutrition Educators conducted educational programs for the general public reaching 19,276 adults on nutrition and nutrition-related diseases.

Over 778 Food Safety, Nutrition, and Health media activities were conducted, which include newspaper, magazines, other external publications and radio and television. Programs included Cooking Healthy-Eating Smart, Best of Health, Healthy Eating Habits for Seniors, So Easy to Preserve, and Eat Smart, Move More. Agents conducted cooking demonstrations at farmers markets.

Extension specialists conducted HACCP inservice training for foodservice workers in two school districts.

**Results**

Of the adults participating in the educational programs, 96% reported a gain in knowledge. Proceeds from a volunteer led effort helped to provide food for some SC upstate families.

The 1890 participants who made 70% or better on the post-test about the importance of safe food handling practices received certificates. The cost of the ServSafe Class is \$75.00 per participant. The 1890 Extension Program provided the classes at no cost for a savings of \$4,875.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

#### Outcome #2

##### 1. Outcome Measures

Number of managers/supervisors/food handlers completing educational program and receiving a course certificate

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2011	298

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

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

The Centers for Disease Control reports that there are five situations which cause most of the outbreaks of foodborne illness. Those situations are poor personal hygiene, improper holding temperatures, purchasing food from unsafe sources, failing to cook food adequately, and using contaminated equipment. In South Carolina, foodborne illness outbreaks from restaurant facilities numbered approximately 100 in both 2009 and 2010, according to data collected by the South Carolina Department of Health and Environmental Control. The CDC estimates for the whole nation that 5200 deaths from foodborne illness occur annually.

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

In an effort to reduce food-borne illness, agents conducted ServSafe® food safety training for managers, supervisors, and other food handlers.

**Results**

A total of 298 food service employees received a course completion certificate, representing 153 food establishments. These food handlers can potentially affect 323,140 people. The National Restaurant Association has estimated that the average cost of a food-borne illness outbreak to an establishment is about \$75,000. The approximate economic value of the trainings could be as high as \$11,475,000 by preventing outbreaks.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

**Outcome #3**

**1. Outcome Measures**

Number of coalitions formed (partners, public/private, academic)

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	20

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

**Issue (Who cares and Why)**

Adults, young adults and children are becoming aware about their health and that of their families. Benefits are gained by engaging in activities that help reduce the risk of developing diseases and maintaining a healthy diet. Many churches, communities and organizations are concerned with the well-being of youth and families and have expressed interest in collaborating with Extension to provide trustworthy information to their constituents.

**What has been done**

Over 8,000 persons completed educational workshops and received training through food demonstrations, meal planning reading food labels and physical activities.

**Results**

Twenty coalitions were formed with community organizations and businesses, such as Soil and Water Conservation Districts, high schools, First Steps programs, Senior Citizens Centers, churches, YMCA, and county health community projects.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety

**Outcome #4**

**1. Outcome Measures**

Number of participants reached with food safety information by volunteers who participated in an Extension training program

Not Reporting on this Outcome Measure

**Outcome #5**

**1. Outcome Measures**

Number of new or improved food products entering the market as a result of adopting recommended practices

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	74

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

**Issue (Who cares and Why)**

This program promotes healthy lifestyles and improves the quality and safety of food for the citizens of South Carolina.

**What has been done**

Extension Specialists assisted local food processing establishments in developing food products and processes development. Commercial food processors around the USA were reached and informed about a canning workshop and processors were contacted in South Carolina through media, mail, email and phone.

**Results**

Seventy four new or improved food products were analyzed entered the market as a result of adopting recommended practices.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #6**

**1. Outcome Measures**

Number of people reached through media outlets that utilize Extension food safety, food biotechnology and nutrition resources

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	1132800

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

**Issue (Who cares and Why)**

This program promotes healthy lifestyles and improves the quality and safety of food for the citizens of South Carolina

**What has been done**

Extension agents advertised nutrition, health and food safety programs through fairs exhibits, television, radio, and news articles for magazines and newspapers. Radio and television programming featured the availability of fresh fruits and vegetables at farmers markets, ways to improve nutrition and health, and Farm City Week. Nutrition and health displays were presented

### Results

It is estimated that over 1,132,800 persons were reached through food safety and nutrition media programs.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

#### 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
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

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

##### Evaluation Results

1. It was determined that bio-based materials could replace existing non-sustainable packaging materials for celery and pretzels without adverse effect on the product shelf life.
2. In response to packaging manufacturer requests, it was determined that compost temperature had a greater effect on compostable materials than did moisture content. For example, polylactic acid required a much higher temperature than expected for degradation.
3. Extension program evaluations revealed that of the 8,399 persons participating in food safety and nutrition programs, 96% reported a gain in knowledge.
4. The ServSafe Class provided a savings of \$4,875 for the 1890 Extension Program.

##### Key Items of Evaluation

In response to packaging manufacturer requests, it was determined that compost temperature had a greater effect on compostable materials than did moisture content. For example, polylactic acid required a much higher temperature than expected for degradation.



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

**Program # 7**

**1. Name of the Planned Program**

Community, Leadership, and Economic Development

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

**1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
608	Community Resource Planning and Development	15%	10%	15%	25%
609	Economic Theory and Methods	10%	10%	10%	10%
610	Domestic Policy Analysis	15%	10%	15%	10%
801	Individual and Family Resource Management	15%	25%	15%	10%
802	Human Development and Family Well-Being	15%	20%	15%	15%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	15%	15%	15%	20%
806	Youth Development	15%	10%	15%	10%
	<b>Total</b>	100%	100%	100%	100%

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

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

<b>Year: 2011</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	14.0	8.0	4.7	2.0
Actual Paid Professional	11.8	5.0	3.0	3.0
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
517194	233502	176786	530901
1862 Matching	1890 Matching	1862 Matching	1890 Matching
517194	116756	176786	265450
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

Research projects were conducted. Research was underway to investigate the biology, ecology, colony relatedness, geographic range and control of the invasive species *Pachyondyla chinensis*, and the needle ant. The venom in the sting causes a broad range of allergic reactions from local urticarial to anaphylaxis. This species has been documented in in Virginia, North and South Carolina, and Georgia, and unpublished records exist in Tennessee and Alabama. It has been discovered that the ants prefer protein over carbohydrate or lipid as a food source, and this information will be valuable in the selection of bait products.

Researchers analyzed the relative benefits and costs to producers and consumers of government and industry led marketing and policy programs, such as certifications, leafy greens marketing order, country of origin labeling and farmers markets.

Research is being conducted to examine barriers to trade faced by small scale agribusiness enterprises in South Carolina. The formulation of improved export models are being developed. A survey has been developed and is ready for distribution and a list of agribusiness exporters in South Carolina was acquired, along with a judgment sample of 50 firms. The potential of educational attainment, business climate and investment-based economic development in South Carolina is being studied.

Researchers are examining the distribution of municipal services in small towns in South Carolina. The focus is on public services that small towns generally provide and includes basic public infrastructures like roads, streets, water and sewer systems. A SPSS database has been compiled of returned surveys and a descriptive analysis of the data has been performed. Research on the economic impacts of international trade and domestic policies on southern agriculture addresses US agriculture competitiveness with a focus on southern agriculture. The project completed the econometric estimation of generalized gravity models of specific vegetable trade flows with a focus on world trade flows of melons, beans, etc. Set up codes for regional free trade groups. Drafted two manuscripts.

A research project dealing with the examination of Chapter 13 in South Carolina bankruptcy filings is being researched. Surveys have been distributed and data is being compiled. One publication has been developed from the research.

Extension regional agents worked closely with state extension specialists, practitioners, and researchers located on campus and at the various research and education centers. They provided expertise in topics ranging from agribusiness and other leadership development, to strategic planning,

town charrettes, entrepreneurial training and support with an emphasis on agribusiness and natural resources, local economic and community development planning and support, industry cluster development, and economic impact analysis.

Agents collaborated with organizations to offer leadership and team building programs, promoted the participation of youth and adults in community youth development activities and in Children, Youth and Families At Risk Extension programming (CYFAR), shared community and regional economic impact assessment data to business leaders, and addressed issues associated with youth through a youth leadership program.

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

The target audience includes students, child care providers, limited-resource persons, community leaders, board/council members, nonprofit organization boards and groups, adults, youth, business and workforce preparation agencies and disadvantaged citizens and communities, state, federal, and local agency personnel, association members, citizens faced with public issues, and citizens engaged in economic and tourism development.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	14837	916440	80	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	1	1

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

**Output Target**

**Output #1**

**Output Measure**

- Publications, business plans and housing grants

<b>Year</b>	<b>Actual</b>
2011	0

**Output #2**

**Output Measure**

- Total number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	11288

**Output #3**

**Output Measure**

- Number of board members trained

<b>Year</b>	<b>Actual</b>
2011	109

**Output #4**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

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

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

O. No.	OUTCOME NAME
1	Total number of people reporting increased knowledge as a result of participation in CLED activities
2	Number of facilitated public meetings addressing public issues
3	Number of printed materials used to promote understanding of public issues
4	Number of participants engaged in community promotion projects

## **Outcome #1**

### **1. Outcome Measures**

Total number of people reporting increased knowledge as a result of participation in CLED activities

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

- 1862 Extension
- 1890 Extension
- 1890 Research

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2011	10900

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

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

This program will promote engagement, community enhancement and improvement that is linked to community image, sustainable economic development, and improved quality of life for the citizens of South Carolina.

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

Agents conducted 526 educational programs. Palmetto leadership programs were conducted at the county level in cooperation with local county governments or local chambers of commerce. Senior and Youth leadership programs were conducted. Also, an 1890 Money and Business Entrepreneurship (MBE) Camp was held for youth ages 9-12.

Training was provided to 147 youth from the military and surrounding communities through Operations Military Kids on topics such as violence prevention. One hundred eighty-five youth also received training on Cyber Safety. Thirty-two participants designed and started their own businesses in the MBE Camp.

CIECD faculty and staff developed and delivered leadership programs on best practices for non-profit management to 20 local non-profit organizations from Colleton and Hampton Counties. Grant writing workshops were provided for over 1,800 community leaders in 35 different settings to build local capacity.

The CIECD staff located at Sandhill working with local agents provided several workshops and support for numerous businesses seeking USDA-Rural Development and other sources of funding with an emphasis on agriculture in places such as Saluda and Lake City. For example, numerous agricultural producers have been assisted with energy and value added agriculture

grants and rural communities with facilities grants.

Adults participated in keyboarding classes. The participants used the Mavis Beacon software, which provided individual progress reports for each participant.

**Results**

Of the 11,288 people participating in educational programs, 10,900 indicated they gained knowledge. As a result, grants total \$8.3 million were submitted with currently over \$3.1 million being received by local organizations. Two computer technology centers have been opened in North Charleston with new computer centers to be opened in other areas of the greater Charleston region and elsewhere.

Support was provided for seven local farmers markets with over \$250,000 in sales for the Sandhill Market with an economic impact of over \$300,000.

As a result of the facilitation of the Cyber Safety 101 Project, 92.6% of the respondents surveyed stated the project sessions were helpful and informative, while 91% said they would recommend the training to others.

The MBE Camp students (52%) reported they made the Superintendent's List at their respective schools.

Ninety-five percent of the keyboarding participants learned to feel comfortable with the computer without assistance. They gained skills that helped in securing employment.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
608	Community Resource Planning and Development
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

**Outcome #2**

**1. Outcome Measures**

Number of facilitated public meetings addressing public issues

Not Reporting on this Outcome Measure

### **Outcome #3**

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

Number of printed materials used to promote understanding of public issues

Not Reporting on this Outcome Measure

### **Outcome #4**

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

Number of participants engaged in community promotion projects

Not Reporting on this Outcome Measure

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

#### **Brief Explanation**

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

#### **Evaluation Results**

It has been determined that the invasive species *Pachyondyla chinensis* (needle ant) prefers protein as a food source more than carbohydrates or lipids, which will be valuable in selecting bait products.

Extension program evaluations revealed that of the 11,223 persons participating in community leadership and economic development programs, 97% reported a gain in knowledge.

Because of their MBE summer learning experiences (decision-making, finance, economics, marketing and public speaking), 52% of the participants made the Superintendent's List at their respective schools.

The Cyber Safety 101 Project was helpful and informative to 92.6% of the participants, while 91% said they would recommend the Project to others.



Ninety-five percent of the participants stated they felt more comfortable using a computer without assistance. Participants gained skills that helped in securing employment. As a result of the keyboarding classes, participants were able to start a new form of contact by typing letters to family and friends, sending emails and surfing the Internet.

### **Key Items of Evaluation**

It has been determined that the invasive species *Pachyondyla chinensis* (needle ant) prefers protein as a food source more than carbohydrates or lipids, which will be valuable in selecting bait products.

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

**Program # 8**

**1. Name of the Planned Program**

4-H Youth Development and Families

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	10%	25%	0%	10%
802	Human Development and Family Well-Being	15%	10%	0%	20%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	15%	20%	0%	20%
806	Youth Development	60%	45%	0%	50%
	<b>Total</b>	100%	100%	0%	100%

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	41.0	15.0	0.0	2.5
Actual Paid Professional	24.0	15.0	0.0	2.0
Actual Volunteer	18.0	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
894776	578996	0	347724
1862 Matching	1890 Matching	1862 Matching	1890 Matching
894776	289498	0	173862
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**

4-H is a youth development educational program that is committed to assisting youth and adults in acquiring knowledge, life skills, and attitudes that will enable them to become self-directing, contributing, and productive members of society. Participants are youth ages 5-19 who are currently taking part in programs by Extension personnel in cooperation with volunteers. 4-H is characterized as being community centered, volunteer led, Extension staff supervised, research based, home and family oriented, publicly and privately funded and responsive to change.

Cooperative Extension programs were conducted to provide a wide variety of experiential educational opportunities and curricula through a number of different delivery modes such as clubs, short-term interest programs, camps, and other means. Youth participated in agriculture, natural resources and environmental stewardship, science, engineering and technology, nutrition and fitness, leadership and citizenship, and many other helpful learn-by-doing projects. Clemson Extension has revitalized its emphasis on volunteerism by working to train its volunteers and encouraging the use of a middle manager volunteer system. Volunteers led educational programming that provided productive youth/adult partnerships. Youth participated in service projects.

1890 Extension provided a variety of programs and activities that dealt with financial management, conflict resolution, social skills, gardening, nutrition information, character education, leadership and citizenship. In addition, the youth and family development programs offered youth skills needed to become well-rounded students. Adults were able to get involved with the basic computer skills classes, nutrition information and opportunities for volunteering. 1890 extension is committed to providing workshops and programs to help assist limited resource individuals improve their overall quality of life.

Research is also being conducted in regards to youth development and families. One project, Barriers to Parents' Participation in their Children's Education in Rural South Carolina, aims to identify the barriers that one must overcome in order for parents to participate more successfully in their children's education. Nine focus group sessions were held at 3 elementary schools. A total of 77 parents attended the the sessions. A final research bulletin is being published. Another research project, Effectiveness of Community Action Research and Professional Development Activities on the Roles and Partnerships of Rural Pre-Service Teachers, is designed to create learning communities through an intervention model to bring about teacher collaboration as the kind of professional development that leads to transforming classroom practices and student learning in rural low-achieving classes. The research project, Culturally Relevant Teaching on Rural African American Students' Achievement, was terminated.

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

- 1) All youth between the ages of nine and nineteen
- 2) All youth between the ages of five and eight
- 3) Parents and other adults interested in the development of South Carolina youth.
- 4) 30-44 parent and young adult
- 5) 45-64 Mature volunteer
- 6) 65+ Grandparent and Senior Volunteers.
- 7) Adult learners (college students)

8) Teachers

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	3593	217	79327	710000

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	2	2

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

**Output Target**

**Output #1**

**Output Measure**

- Number of educational workshops conducted

Year	Actual
2011	3418

**Output #2**

**Output Measure**

- Total number of adult volunteers ( including non-Extension staff) trained in club, school enrichment, and special interest program delivery and management in all 4-H project areas.

2011 Clemson University and South Carolina State University Combined Research and Extension Annual Report of Accomplishments and Results

<b>Year</b>	<b>Actual</b>
2011	919

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

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

O. No.	OUTCOME NAME
1	Number of trained adult volunteers and staff, (including non-Extension staff) who teach subject matter and life skills to youth, meeting S.C. educational standards by utilizing National 4-H Cooperative Curriculum System (4-HCCS) curriculum materials as available
2	Number of youth who gain knowledge in leadership and citizenship projects areas
3	Number of youth participating in service learning projects for the community and to improve themselves, and help others
4	Number of youth who gain knowledge and skills about plants, livestock and/or pets.
5	Number of youth who develop knowledge and skills in science, engineering, and technology (including electricity, computers, pontoon classroom, etc.).
6	Number of youth gain knowledge in nutrition and fitness
7	Number of youth who gain knowledge in natural resources and shooting sports
8	Number of youth who develop and improve communication skills through speaking and debating

## **Outcome #1**

### **1. Outcome Measures**

Number of trained adult volunteers and staff, (including non-Extension staff) who teach subject matter and life skills to youth, meeting S.C. educational standards by utilizing National 4-H Cooperative Curriculum System (4-HCCS) curriculum materials as available

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

- 1862 Extension
- 1890 Extension

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2011	919

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

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

There is a need for an effective system to develop volunteer trainers in 4-H Youth Development.

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

This year, 919 new volunteers were trained. These along with other volunteers taught others using approved curriculum materials.

#### **Results**

Volunteers were equipped for leadership roles and have made positive impacts and contributions in their communities and trained youth with new knowledge and skills. Adults contributed 19,778 hours of volunteer service, which represents a \$328,226 value of program support. Volunteers reported seeing significant improvement in the children's overall reading, writing, and math skills as well as the children's willingness to work together as a team to solve problems and make decisions. In addition, there were reports that the children's self-confidence and self-pride increased.

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

<b>KA Code</b>	<b>Knowledge Area</b>
801	Individual and Family Resource Management
802	Human Development and Family Well-Being

**Outcome #2**

**1. Outcome Measures**

Number of youth who gain knowledge in leadership and citizenship projects areas

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	10830

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

**Issue (Who cares and Why)**

Youth have basic needs that include developing a sense that they are valuable contributing members of their family and community.

**What has been done**

South Carolina 4-Hers participated in State Congress and statewide Ambassador Training, Senior Leadership Training, and Senior and Junior Teen Weekend to help them serve more effectively in their leadership roles at the club, county, regional, or state levels.

**Results**

Coordinators and volunteers have reported that youth are learning organizational and time management skills that will be useful as they enter college.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
806	Youth Development



**Outcome #3**

**1. Outcome Measures**

Number of youth participating in service learning projects for the community and to improve themselves, and help others

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	60

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

**Issue (Who cares and Why)**

Studies show that youth develop in areas of civic engagement, respect, and social responsibility through participating in service-learning projects. Service learning can also have a positive effect on students' ability to relate to culturally diverse groups (Fox, 2010).

**What has been done**

Some 60 youth provided leadership in service learning community projects.

**Results**

Examples of teen leadership and service include a 4-H group that made t-shirt dresses to send to Africa, 4-Hers who organized a fashion show and modeled outfits they made to benefit a local children's home, and 4-H members that collected and delivered toiletry items to a community center that has a bath house for families without bathrooms. One club helped the Historical Club by building butterfly habitats. Club members received \$500 grant for the butterfly project.

Again this year, the Marion County Jr. Leadership Club teamed up with Katie's Project to distribute gowns, shoes, and other accessories to young ladies from low income families who needed them for prom. Over 137 girls received gowns and accessories to wear to prom. The Club estimated that \$60,000 was saved by Marion County families as a result of this project.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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806 Youth Development

**Outcome #4**

**1. Outcome Measures**

Number of youth who gain knowledge and skills about plants, livestock and/or pets.

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	0

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

**Issue (Who cares and Why)**

Youth need opportunities to develop assets such as communication skills, organizational abilities, wise decision-making skills, independence, self-confidence and caring. They have opportunities for such development by participating in the 4-H Plants and Animals project.

**What has been done**

Over 667 Plants and Animals programs were conducted reaching 21,994 youth. Youth from South Carolina and surrounding counties in Georgia participated in Dairy Heifer, Livestock, Barrow, Swine, Sheep, Beef, Poultry, Gardening, Goat and Horse projects.

**Results**

In Anderson County, volunteers coordinated a livestock show and raised \$10,000. By competing in the shows and raising show animals, the youth learned valuable animal husbandry lessons in nutrition, genetics, reproduction, animal health, and handling techniques. Youth also were able to increase their ability to select good livestock and learned the responsibility needed to raise and manage these animals. Showing livestock also helps build confidence in the youth and teaches them responsibility.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
806	Youth Development

**Outcome #5**

**1. Outcome Measures**

Number of youth who develop knowledge and skills in science, engineering, and technology (including electricity, computers, pontoon classroom, etc.).

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2011	1816

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

**Issue (Who cares and Why)**

Science and technology skills are needed if youth are to keep up with the rapidly changing knowledge-based and knowledge-transfer society. According to the Department of Labor's Employment and Training Administration, 80% of careers this year 2012 will require some knowledge of geospatial technology and systems. The 4-H program in South Carolina offers youth the opportunity to develop knowledge and skills in science, engineering, and technology.

**What has been done**

Some 1,816 youth were reached in Science Technology and Engineering projects SC. A 4-H Science Training was held for 4-H Agents and volunteers. Participants were trained in robotics, GPS/GIS and aerospace projects. We are working to expand our STEM program with a joint project with FFA. The Extension Program developed the TechBridge Summer Academy (a 5 week program) to build your own computer.

**Results**

Youth demonstrated knowledge gained through the use of geospatial technology and systems. Also, TechBridge post-test scores in mathematics and reading increased by an average of 10% or a full grade level as compared to the pre-test scores. Computers were built and eventually carried home at the end of the 5-week period and are being used by the entire households. Academy participants are teaching their parents the technology skills learned in the program.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
806	Youth Development

**Outcome #6**

**1. Outcome Measures**

Number of youth gain knowledge in nutrition and fitness

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	20743

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

**Issue (Who cares and Why)**

Gaining knowledge in nutrition and fitness can help youth make decisions that will positively affect their lifestyles as they mature into adulthood.

**What has been done**

Some 611 Nutrition, Fitness, and Safety programs were conducted reaching 20,743 youth. Youth participated in programs such as Kids in the Kitchen, Healthy Lifestyles, MyPyramid, Camps, Nutrition Basics, and Color Me Healthy.

**Results**

Eighty-six percent of the youth participating in 4-H nutrition and fitness programs reported that they gained knowledge.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
----------------	-----------------------

802 Human Development and Family Well-Being  
806 Youth Development

**Outcome #7**

**1. Outcome Measures**

Number of youth who gain knowledge in natural resources and shooting sports

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	4958

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

**Issue (Who cares and Why)**

Many youth either participate in hunting or have family members who hunt and, therefore, have access to guns. Many youth do not have any formal training in the safe use and handling of firearms. Although rare, accidents with firearms do occur, and often are the result of improper handling of firearms. Exposing youth to firearms and teaching both adults and youth the proper way to safely handle firearms can reduce the risk of accidents.

**What has been done**

Some 172 programs were conducted reaching over 4,958 persons. Youth participated in hunting safety programs, natural resource clubs, Jr. Naturalists and Fisheries, Food and Cover Establishment for wildlife programs.

**Results**

Youth demonstrated wise decision-making skills and self-confidence. They demonstrated caring of their environment and established food plots to benefit small game and other wildlife species. They demonstrated proper shotgun handling.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
806	Youth Development

## **Outcome #8**

### **1. Outcome Measures**

Number of youth who develop and improve communication skills through speaking and debating

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

- 1862 Extension

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

Change in Action Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2011	539

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

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

Youth need opportunities to develop assets such as good communication skills, organizational abilities, reasoning skills, and self-confidence. They have opportunities for such development through participating in the Communication and Expressive Arts projects.

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

Fifty-three programs were conducted reaching 539 youth. Youth gave presentations and demonstrations during club and county level contests and gave speeches at community organizations promoting 4-H.

#### **Results**

Youth successfully prepared and gave presentations. They demonstrated good communication skills, organizational abilities, reasoning skills, and self-confidence.

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

<b>KA Code</b>	<b>Knowledge Area</b>
806	Youth Development

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

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

- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

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

### **Evaluation Results**

Over 89% of the youth participating in 4-H Youth Development programs indicated they gained knowledge, self-confidence and organizational skills.

Over 35% stated they plan to eat more fruits and vegetables.

TechBridge students increased their mathematics and reading by a full grade level.

Nine focus group sessions were held at 3 schools with 77 parents participating. As a physical barrier, parents indicated the highest hopes and aspirations for their children. A few conceded a college education was not the only road to success. Another physical barrier was parents perceived themselves to be essential in supporting their children's education.

### **Key Items of Evaluation**

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

**Program # 9**

**1. Name of the Planned Program**

Environmental Conservation for Wildlife

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
135	Aquatic and Terrestrial Wildlife	100%	0%	0%	0%
	<b>Total</b>	100%	0%	0%	0%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	0.0	0.0
Actual Paid Professional	4.0	0.0	0.0	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
144149	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
144149	0	0	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

Educational programs were conducted in the area of Environmental Conservation for Wildlife. Programs included Master Wildlifer/ Master Naturalist, deer and feral hog management, and wildlife habitat improvement. Agents conducted Cogongrass surveys, Nuisance Wildlife Control



Workshops and wrote news articles pertaining to nuisance wildlife. In addition, agents educated landowners about pond management for lease fishing, hunting, birding.

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

The target audience includes state, local government and civic leaders, business owners, developers, home and garden clubs, area homeowners, wildlife specialists, state and federal biologists and administrators, potential volunteers, farm and forest owners, landowners/homeowners, Nuisance Wildlife Control Operators, natural resource professionals, Aquatic Pesticide Applicators, general public, farmers, ranchers, poultry and swine producers, foresters, urban, suburban and rural residents, urban planners and managers, concerned citizens, land owners/managers, agency personnel, citizens of South Carolina, Extension agents, municipal officials, and local community groups statewide, Extension administrators, and support staff.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	4535	34700	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	0	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	2203

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

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

O. No.	OUTCOME NAME
1	Number of people reporting knowledge gained

**Outcome #1**

**1. Outcome Measures**

Number of people reporting knowledge gained

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	2110

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

**Issue (Who cares and Why)**

This program will promote the use of Best Management Practices of natural resources to improve natural resource conservation. As landscapes become more urban it is important to educate citizens of the natural world, so that they are more inclined to protect the special places that are important to the state and its tourism industry. As state resources become more limited, it is also important to look to other sources of labor to help maintain the natural spaces and help run environmental education programs. The South Carolina Master Naturalist and Master Wildlifer Programs aim to address both of these issues. The formation of a statewide corps of volunteers providing education, outreach and service dedicated to the beneficial management of natural resources and natural areas within communities is one aim of the program.

**What has been done**

The majority (over 72%) of wildlife habitat in SC is owned by private landowners. Environmental Conservation for Wildlife programs reached over 2203 people. The Extension specialist conducted three Master Wildlifer Webinars for landowners and natural resource professionals entitled "Steps for Developing a Wildlife Management Plan for Your Property" which covered the topics of Identifying Objectives, Inventory of Resources, Mapping Your Property Using USDA Web Soil, and Management Recommendations & Assistance.

In addition, other programs were conducted by agents that included Master Wildlifer/ Master Naturalist, deer and feral hog management, and wildlife habitat improvement.

**Results**

The Master Wildlifer course had a major impact on improving lands for wildlife and other natural resources. Over 243 people reported enhanced income opportunities from natural resources.

Master Naturalist volunteers provided 4,327 hours of service, which equates to a value of \$77,886 in program support (using an \$18 value /hour of volunteer time for South Carolina).

A Clemson Extension Specialist is the southern US partner in maintaining the national web-based clearinghouse Internet Center for Wildlife Damage Management (<http://icwdm.org>).

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

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

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

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

##### Evaluation Results

Extension program evaluations revealed that of the 2,203 persons participating in environmental conservation for wildlife programs, 96% reported a gain in knowledge.

##### Key Items of Evaluation

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

**Program # 10**

**1. Name of the Planned Program**

Sustainable Forest Management

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
122	Management and Control of Forest and Range Fires	30%	0%	10%	0%
123	Management and Sustainability of Forest Resources	50%	0%	80%	0%
124	Urban Forestry	20%	0%	10%	0%
	<b>Total</b>	100%	0%	100%	0%

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	1.0	1.0	0.0
Actual Paid Professional	4.0	0.0	0.4	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
135615	0	25898	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
135615	0	25898	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**

Research was conducted. Beech Bark Disease is an insect-fungus complex that is widespread and a high profile disease throughout much of the east coast. Considering the probable spread of beech bark disease to South Carolina, it will be useful to understand the impact it may have on the state's forests. Clemson scientists have conducted ground surveys seeking evidence of disease symptoms and causal agents, specifically the predisposing beech scale insects and pathogenic fungal species.

Educational programs were conducted to teach sustainable forestry principles. Agents produced news articles and radio programs to inform landowners of the economic and environmental benefits of using Best Management Practices in all forest management operations.

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

The target audience will include private landowners, loggers, professional resource managers, foresters and other natural resource professionals, road building and site preparation contractors, family forest landowners, consulting foresters that assist private landowners, and the general public.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	5593	222912	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	1	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	3196

**Output #2**

**Output Measure**

- Disclosures

<b>Year</b>	<b>Actual</b>
2011	0

**Output #3**

**Output Measure**

- New Products, Processes, Procedures and Policies  
Not reporting on this Output for this Annual Report

**Output #4**

**Output Measure**

- Percent increase of outside funds for grants, contracts and gifts  
Not reporting on this Output for this Annual Report



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

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

O. No.	OUTCOME NAME
1	Number of people reporting increased knowledge

**Outcome #1**

**1. Outcome Measures**

Number of people reporting increased knowledge

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	3118

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

**Issue (Who cares and Why)**

This program will promote the use of Best Management Practices of forest systems and other natural resources to improve South Carolina's forest productivity and promote natural resource conservation. Farm and forest landowners in South Carolina are seeking alternate land uses, management and diversification strategies to generate additional income to mitigate the effects of declines in commodity sales and markets, as well as the maturity time required for timber investments.

**What has been done**

Extension agents developed and provided 77 educational programs on sustainable forest management, reaching 1926 persons. Some topics included longleaf pine management, evaluating seedling survival, weed control, Timber Taxation, Estate Planning, the TOP Logger program. A specialist conducted a Forestry Ethics webcast. Agents assisted landowners with "pay-to-shoot" information.

**Results**

Landowners reported managing 252,000 acres of forest land. In one county, landowners indicated that the Extension programs would help them save \$78,000 and earn \$325,000 in the future when managing longleaf pine on their land. These programs increased the number of acres of forests in South Carolina using sustainable forestry practices, increased biodiversity in the state, restored longleaf pine ecosystems, and facilitated the conservation of ecosystems.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources

## **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
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

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

### **Evaluation Results**

Extension program evaluations revealed that of the 3,196 persons participating in sustainable forest management programs, 98% reported a gain in knowledge.

### **Key Items of Evaluation**

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

**Program # 11**

**1. Name of the Planned Program**

Childhood Obesity

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	50%	45%	0%	55%
723	Hazards to Human Health and Safety	5%	25%	0%	10%
724	Healthy Lifestyle	45%	30%	0%	35%
	<b>Total</b>	100%	100%	0%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	12.0	3.0	0.3	2.0
Actual Paid Professional	8.0	3.5	0.0	1.5
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
221140	157196	0	220592
1862 Matching	1890 Matching	1862 Matching	1890 Matching
221140	78598	0	110296
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

Clemson University Cooperative Extension as well as 1890 Research and Extension focused on nutrition and wellness programs for youth directed towards the prevention of childhood obesity, increasing

physical activity and the development of food preparation skills that fit current nutritional needs and lifestyles. Good nutrition is important not only because it promotes a feeling of well-being, but it also has an important role in disease prevention. Activities included summer and day camps, programs through schools and childcare centers, churches and community centers were held.

Agents and specialists developed nutrition curriculum, kits, videos, and media programs to reach children. Specialists are conducting menu analysis at facilities that serve children. Partnerships were formed between the Center for Healthy Living, the Youth Learning Institute, the Department of Food Science and Human Nutrition to position Clemson University to be a national leader in addressing the obesity epidemic.

Researchers have taken on the task of investigating the problem of childhood obesity. Two research projects were developed and funded at South Carolina State University, 1890. One project looks at an integrated approach to prevention of obesity in high risk families, while another focuses on implementing physical activity and nutrition through the use of technology to combat overweight and obesity in elementary school aged children. First, interview information was collected, transcribed and translated on the expert field review of key behavioral measures purported to contribute to excessive weight gain in children aged 3-10 years old. The interview information was coded and tabulated on parent-child interactions in the targeted populations. With the second project, five undergraduate assistants were hired to help with the workload. Fitnessgrams were created to show individuals their fitness levels. Three campers reached their project goals of losing 3% weight loss each quarter. Of the 37 participants, all have reduced their intake of unhealthy snacks and increased their intake of fresh fruits and vegetables.

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

The target audience includes youth, and families and agencies that serve limited resource families.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1775	0	25176	34548

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	7	2	9

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

**Output Target**

**Output #1**

**Output Measure**

- National Media Placements

Year	Actual
2011	0

**Output #2**

**Output Measure**

- Number of educational workshops conducted

Year	Actual
2011	1586

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

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

O. No.	OUTCOME NAME
1	Number of people gaining knowledge as a result of participating in educational workshops

**Outcome #1**

**1. Outcome Measures**

Number of people gaining knowledge as a result of participating in educational workshops

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	17402

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

**Issue (Who cares and Why)**

In South Carolina, about 60 percent of the population is obese or overweight and over 20 percent of the children are obese. Overweight, obesity and the associated risk factors of unhealthy eating and inadequate amounts of physical activity increase the risk for developing other chronic conditions and diseases, such as diabetes, cardiovascular disease, certain cancers, arthritis, sleep apnea, and depression. Obesity related medical costs amount to about \$1 billion in South Carolina.

**What has been done**

Over 1,586 educational programs were conducted reaching approximately 25,176 children. Children of all ages from elementary, middle, and high school were reached through Healthy Lifestyles, Healthy Snacking, My-Veg-Olympics, Color Me Healthy, and MyPyramid. One specialist taught nine lessons in nutrition and physical activity for the children whose mothers are participating in the nutrition education program in Spanish Celebrating Health. Some of the topics covered included - introduction to healthy eating and physical activity behaviors, increase awareness of physical activities that increase heart rate, overcome barriers to physical activity, portion sizes, and eating more fruits & vegetables.

The delivery of lesson was conducted by seven undergraduate students from the Department of Food Nutrition and Packaging Sciences working on a bachelor's degree in Nutrition and Food Science.

A series of Expanded Food and Nutrition Education Programs were conducted for 1854 limited resource families to improve nutrition, food safety, food resource management, food security, and physical activity practices. More than 7,280 volunteer hours were contributed for the project.



### Results

Pre and post evaluations were conducted and indicate that 95% of the participants indicated that they gained knowledge. Ninety percent of participants showed improvement in one or more nutrition practices; 84% showed improvement in one or more food resource management practices (i.e., planning meals, comparing prices, using grocery lists, or not running out of food); 70% percent showed improvement in one or more food safety practices; and more than 54% of participants increased their physical activity levels.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

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

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

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

##### Evaluation Results

Of the 25,112 youth that participated in educational programs, 69% gained knowledge on pre-post evaluations.

Three participants in the research project reached their project goal of losing 3% weight loss for 4 quarters. All participants have reduced their intake of unhealthy snacks and have increased their intake of fresh fruits and vegetables, according to the homework data sheets.

#### Key Items of Evaluation

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

**Program # 12**

**1. Name of the Planned Program**

Climate Change

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	0%	0%	20%	0%
112	Watershed Protection and Management	0%	0%	30%	0%
132	Weather and Climate	0%	0%	30%	0%
205	Plant Management Systems	0%	0%	20%	0%
	<b>Total</b>	0%	0%	100%	0%

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.5	1.0
Actual Paid Professional	0.0	0.0	0.5	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	27129	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	27129	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**

Research was conducted. Climate change and global warming will affect food supply. South Carolina is the No. 2 peach-producer in the nation and growers are concerned. Many fruit and nut trees need sufficient chilling hours to make fruit. The trees, also, need to be hardy enough to withstand a late frost. In response to climate change, work is being directed towards improving the economic and environmental sustainability in tree fruit production through changes in rootstock use. The genetic and cellular signals that begin dormancy and the developmental events involved in bud formation and non-growth seasonal phases are being examined. This research is also an integral component of the sustainable agriculture production for horticultural crops.

Plants are shown to produce a diverse array of secondary metabolites under various environmental conditions. Research on plant secondary metabolites (PSMs) and their ecological roles will help understand the patterning of plant species in present and future ecosystems and for use in agriculture for better crop productivity. This will involve characterizing how warming and precipitation alterations due to climate change will alter soil nutrient cycling via changes in plant secondary metabolite composition. Research will examine how climatic changes alter secondary metabolite profiles of plants which will directly affect nutrient cycling and soil microbial community, composition and thus dictated composition of future plant communities. Results will advance understanding of how climate change will affect phytochemical composition of plants and plant litter, with direct implications for food and fodder quality and herbivory.

Research is underway to understanding the effects of population growth and climate change on greenhouse gas emissions and carbon cycling in coastal regions. The first step towards understanding the impacts of sea level rise and population growth in coastal ecosystems is to determine the salinity, water chemistry, characteristics of natural organic matter, and other environmental factors that are representative parameters of environmental quality. Controlled laboratory studies will make it possible to identify the controlling factors of the greenhouse gas emissions and pollutant productions in different environmental settings.

Sugars are primary products of photosynthesis that function in metabolism and as regulators of gene expression. Researchers are examining the expression of key genes in order to refine the understanding of glucose signaling mechanisms and could improve plant engineering for growth in a future world with increased carbon dioxide.

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

The target audience will include regulatory agencies, resource managers, local county and municipal officials and public works staff.

## **3. How was eXtension used?**

eXtension was not used in this program

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

### **1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	0	2	0

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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

Year	Actual
2011	0

**Output #2**

**Output Measure**

- Licenses

Year	Actual
2011	0

**Output #3**

**Output Measure**

- National Media Placements  
Not reporting on this Output for this Annual Report

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

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

O. No.	OUTCOME NAME
1	Provide knowledge to policy makers to assist in coping with the effects of climate change, particularly in the coastal region.

## **Outcome #1**

### **1. Outcome Measures**

Provide knowledge to policy makers to assist in coping with the effects of climate change, particularly in the coastal region.

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

- 1862 Research
- 1890 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2011	0

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

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

<b>KA Code</b>	<b>Knowledge Area</b>
132	Weather and Climate

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

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

**Evaluation Results**

Research in the climate change program is relatively new, and individual projects in this program have not concluded and reported final outcomes. Two technical contributions were produced.

**Key Items of Evaluation**

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

**Program # 13**

**1. Name of the Planned Program**

Sustainable Energy

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	20%	0%
205	Plant Management Systems	0%	0%	30%	0%
402	Engineering Systems and Equipment	0%	0%	40%	0%
511	New and Improved Non-Food Products and Processes	0%	0%	10%	0%
	<b>Total</b>	0%	0%	100%	0%

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	1.6	0.0
Actual Paid Professional	0.0	0.0	2.4	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	185762	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	185762	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**

Research was conducted. Researchers are analyzing over 400 varieties of sorghum grown in South Carolina, seeking the ones most easily converted into fuel. They are also using genetics and bioinformatics to find sorghum genes that maximize sugar release from the whole plant (not just grain and juice) enabling sorghum plant breeders to naturally engineer next-generation bioenergy feedstock to improve the crop-to-fuel conversion process. In addition, discoveries of genetic control in sorghum, such as drought tolerance, pest resistance and improved yields, will aid producers of related crops, including corn, rice and turfgrass.

Processed switchgrass - a biofuel easily grown in South Carolina - is being tested to make bioethanol. It is considered the most promising bioenergy crop for the state, based on research results related to biomass yield, drought tolerance and low input requirements. The research is focused on freeing the plant sugars from cellulose, which plants use for cell walls. A company in South Carolina, based on research results, has begun contracting with farmers for switch grass production, which will be shipped overseas as a coal replacement.

Switchgrass research is also underway to evaluate the efficiency of various bacteria to convert switchgrass to biofuels and bioproducts. One of these bacteria, *Thermotoga neapolitana*, produces hydrogen. Another would provide an enhanced capability to convert switchgrass to fermentable carbohydrates. These carbohydrates would then be converted to ethanol and butanol in lab scale fermenters to assess ways to improve the efficiency of conversion of switchgrass to biofuels.

One of the current issues in producing biofuels from poplar is lignin degradation, and research is underway to explore ways to break down lignin more efficiently. Researchers will characterize cinnamyl alcohol dehydrogenase genes from tulip poplar and their promoters, to test a novel approach to facilitate lignin digestibility.

A marine algal biomass production process, with the potential to produce ethanol and biodiesel, is being examined. This process would potentially eliminate the need for large areas of high quality farm, forest and/or pasture land and subsequent harvest related costs, the need for intensive inputs of fertilizers, pesticides and energy inputs, and avoid the need to produce large quantities of low value solid fuels. The process would also eliminate a number of negative environmental impacts from nutrient loss and greenhouse gas that would result from the production and degradation of synthetic fertilizers.

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

All consumers in the state will benefit from research and education programs related to lower cost energy options.

## **3. How was eXtension used?**

eXtension was not used in this program

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

### **1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 2

**Patents listed**

- 1. Articles of manufacture from renewable resources
- 2. Packaging materials derived from renewable resources and including a cyclodextrin inclusion complex

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	0	1	0

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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

Year	Actual
2011	0

**Output #2**

**Output Measure**

- License agreements

Year	Actual
2011	0

**Output #3**

**Output Measure**

- National Media Placements

Not reporting on this Output for this Annual Report

**Output #4**

**Output Measure**

- Number of educational workshops conducted

<b>Year</b>	<b>Actual</b>
2011	0

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

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

O. No.	OUTCOME NAME
1	Number of people participating gaining knowledge as a result of participating in educational workshops

## **Outcome #1**

### **1. Outcome Measures**

Number of people participating gaining knowledge as a result of participating in educational workshops

Not Reporting on this Outcome Measure

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

#### **Brief Explanation**

{No Data Entered}

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

#### **Evaluation Results**

Research on processed switchgrass focused on freeing the plant sugars from cellulose was utilized by a South Carolina company, and contracts have been written with state growers for production, which will be shipped overseas as a coal replacement.

It has been determined that the bacteria, *Thermotogata neapolitana*, produces hydrogen when used to convert switchgrass to biofuels and bioproducts.

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

It has been determined that the bacteria, *Thermotogata neapolitana*, produces hydrogen when used to convert switchgrass to biofuels and bioproducts.

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

**Program # 14**

**1. Name of the Planned Program**

Global Food Security and Hunger

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	5%	10%	5%
204	Plant Product Quality and Utility (Preharvest)	25%	15%	10%	0%
205	Plant Management Systems	25%	20%	5%	10%
212	Pathogens and Nematodes Affecting Plants	25%	10%	5%	5%
213	Weeds Affecting Plants	10%	15%	5%	0%
216	Integrated Pest Management Systems	5%	10%	0%	5%
301	Reproductive Performance of Animals	0%	0%	10%	5%
302	Nutrient Utilization in Animals	0%	0%	5%	5%
303	Genetic Improvement of Animals	0%	0%	10%	10%
304	Animal Genome	0%	0%	10%	0%
305	Animal Physiological Processes	0%	0%	5%	5%
307	Animal Management Systems	0%	0%	10%	15%
311	Animal Diseases	0%	0%	5%	0%
601	Economics of Agricultural Production and Farm Management	5%	10%	5%	15%
604	Marketing and Distribution Practices	5%	15%	0%	15%
701	Nutrient Composition of Food	0%	0%	5%	5%
	<b>Total</b>	100%	100%	100%	100%

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	3.0	11.9	0.0
Actual Paid Professional	26.0	7.5	1576.0	3.5
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
1543072	344098	1239548	592469
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1543072	172046	1239548	296234
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**

Educational workshops were conducted focused on programs and activities related to integrated crop management, integrated pest management, water resources, risk management, and marketing. Field trials were conducted and demonstrated.

Research was conducted. Researchers have been able to determine proteins that interact during the process that regulates nodulation of legumes such as peas, soybeans and alfalfa, and this will allow the manipulation of genes involved in nodulation and general plant growth, for agricultural benefits. Such benefits include increased yield of crop legumes and potential reduced fertilization in non-legumes, which would result in reduced pollution from fertilizer run off.

Applied research has been ongoing to evaluate strategies for managing lepidopterous insect pests of cotton. Recommendations for using internal boll injury levels as treatment triggers for boll-feeding bugs in cotton should be refined to reflect the importance of weeks 3 through 5 as critical times for increasing control of bugs and maximizing yields. Research has been ongoing to reduce the amount of pesticide usage by using novel techniques to apply pesticides more efficiently. A sensor array was developed to identify and monitor the presence of damaged cotton-and stink bug emitted VOCs. This makes it possible to determine pest density, which will help cotton producers make decisions regarding control of stink bugs, while minimizing pesticide usage.

Sustainable, profitable cotton production practices are being developed and evaluated on all soil types in the region. Weather conditions, especially the timing and amount of rainfall are critical in the region, since most of the cotton produced in the Carolinas is grown without supplemental irrigation. The development and release of new cotton varieties by seed companies has greatly accelerated since the development of transgenic technologies such as Bollgard, Roundup-ready, and Liberty-Link cottons. To accommodate the need for additional information on the performance of these new varieties in the soil types and weather conditions of the Carolinas, twenty four field trials were conducted in 2010 to compare performance of these varieties.

A number of reduced risk chemical, cultural, and biological methods are being considered to improve the management of vegetable diseases, because bacterial blight costs SC growers from \$900k to \$1.7 million each year in direct losses of diseased crops plus increased costs of purchasing and shipping replacement products to meet contractual obligations. When inoculated with the selected bacterial blight

pathogen, brassica PI lines , kale, Top Bunch collard, and Southern Curled Giant mustard had the highest percentages of healthy leaves.

Clemson's new site specific nematicide placement technology (SNP) was tested on three commercial cotton fields to evaluate its performance and effectiveness. Before testing, an affordable map-based switch was developed to replace the existing manual on-off switch on growers' equipment to allow them to apply fumigant nematicides site specific.

The results of these tests showed that it is possible to accurately match nematicide rate with the spatial distribution of nematodes to reduce chemical inputs and expenditures. It was also determined that a soil electrical conductivity meter can be used successfully to measure soil texture and predict the distribution of nematode species.

Glyphosate-resistant Palmer Amaranth has emerged as one of the most severe threats to crop production in South Carolina. Research has shown that herbicide options will become more limited in cotton and soybeans. Soil residual herbicides become the most adopted method to manage herbicide resistant Palmer amaranth. An aggressive soil herbicide program costs the grower up to \$85/ha, however, hand weeding, cultivation, and crop abandonment will cost SC growers up to \$5,000/ha in lost revenue/increased costs.

Stink bugs and associated boll injury in cotton were sampled, using a grid of locations in commercial cotton fields. GPS coordinates of locations allowed the use of GIS software to map spatial patterns. The relationship between the mean and variance of densities showed that stink bugs had an aggregated distribution within the field. Sampling of stink bugs can be difficult, as injury can be seen on bolls often without finding stink bugs. The concentration of stink bugs along the edge of cotton fields and the decrease in abundance as distance from the edge of the cotton field increased was quantified. This will help develop a better understanding of stink bug spatial patterns and will lead to improved sampling plans. The ability to better estimate stink bug densities will help growers improve their management, potentially reducing pesticide applications.

The identification of soybean plant introductions which are resistant to soybean rust disease is providing parental material and enhancing efforts by soybean breeders to develop improved soybean cultivars resistant to this destructive disease. Resulting new varieties have the potential to improve crop yields, improve human nutritional value of crops and provide an increased level of resistance to economically damaging disease, insect and nematode pests. Researchers were proactive in dealing with the threat of Asian Soybean Rust (ASR) with the use of Sentinel and monitoring plots across the state. Experiments were conducted with seed applied nematicides and with three different fungicides. Indications are that over 75% of the fields in South Carolina have plant parasitic nematodes. Researchers believe that precision application of nematicides based on soil types will help target specific nematode species in specific soil types. Researchers are working to breed new high yielding multiple pest resistant soybeans for South Carolina. In the southeast, double-cropping, planting soybean in late June or early July, following wheat harvest, has proven to be a viable economic enterprise. In this cropping regime, however, conventional cultivars may have reduced seed yields due to limited vegetative growth and premature flowering, induced by short photoperiods. The identified long-juvenile genetic trait may increase the yields of these cultivars, and increase grower profitability.

The demand for disease resistant rootstock by watermelon growers to avoid soil borne diseases has increased. New methods developed in South Carolina for grafting watermelons has reduced the cost of the grafting transplant from over one dollar to less than eighty cents, with the potential of reducing it even further. These cost reductions are critical to keep the state's producers competitive with the US and export markets.



Three small hive beetle traps currently marketed in the US were compared for their trapping efficiency in the 2010 season. Of the three traps the Freeman traps were the most effective, and the levels of control achieved with the traps generally suggests that trapping beetles is an integrated management tool that beekeepers can safely use to control this pest inside bee hives without the use of pesticides.

Research on the use of sub-lethal doses of pesticides and the effect on honey bee health has revealed initially that it will be practically impossible to prevent all pesticide residues in honeybee colonies, even when bee keepers do not use pesticides or use no contaminated beeswax foundation.

Three different approaches to on farm composting of food waste were evaluated; the static pile, the tumbler system and the vermicomposting system. It was determined that the static pile was most effective, primarily because it was able to produce temperatures high enough to produce finished compost. The static pile was subject to Bermuda grass and fire ant infestation. The tumbler system did not achieve sufficiently high temperatures, and the vermicomposting system was not effective because of poor worm survival, due to low pH and high salt content.

Bacterial wilt is an extremely damaging disease of flue-cured tobacco in South Carolina, causing losses of up to \$2.7 million in the state between 2008-2010. This bacterium is easily spread by mechanical topping machinery. An experimental topper was constructed where a disinfectant solution can be applied to the undersurface of the blade as the blade spins. This topping system allowed for the mechanical removal of flowers with minimal spread of the bacterium.

Rootstock trials have been used to develop research based information for South Carolina peach growers to use when selecting rootstock and cultivar to use in replanting old orchard sites. Information is available on the productivity of cultivars and the resistance to peach tree short life and other diseases. Other rootstocks that induce dwarfing are also being evaluated to determine which ones are best adapted for high intensive orchard systems to facilitate mechanization and reduce labor costs.

Research has determined that the invasive species, Kudzu, has a significant impact on soil chemical properties by increasing nutrient supply in the highly eroded agricultural soils of the Piedmont regions of the southeast.

Research is being conducted to help a selected group of South Carolina farmers and value-added producers to purchase, implement and utilize the RFID equipment necessary to provide traceability throughout their food product supply chains. More research is on innovative, reduced-risk management strategies for anobiidae pest in store products environments. Finally, research on the characterization and application of Sphingomonas PAH utilization mutants is being conducted.

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

Research in this program has the potential to benefit growers, state, federal and international agencies dealing with food production and distribution and with end users in countries around the world. The target audience includes producers, Limited-Resource Farmers and Extension personnel, agency personnel.

## **3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	26868	16565	165	80

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	9	9

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

**Output Target**

**Output #1**

**Output Measure**

- Disclosures

Year	Actual
2011	0

**Output #2**

**Output Measure**

- Licenses

Year	Actual
2011	0

**Output #3**

**Output Measure**

- National Media Placements

<b>Year</b>	<b>Actual</b>
2011	0

**Output #4**

**Output Measure**

- Number of people completing educational workshops

<b>Year</b>	<b>Actual</b>
2011	14743

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

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

O. No.	OUTCOME NAME
1	Number of people reporting increased knowledge
2	Number of publications authored or co-authored (fact sheets, papers presented at national meetings, etc.)
3	Number of acres affected by ICM programs

**Outcome #1**

**1. Outcome Measures**

Number of people reporting increased knowledge

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	13124

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

**Issue (Who cares and Why)**

This program will develop and implement agricultural and horticultural production systems in South Carolina that are economically sustainable, safe and environmentally sound. As a result, commodities and communities will be protected, which will result in abundant, high quality supplies of food and fiber products and improved quality of life.

**What has been done**

Over 462 educational workshops were conducted. Programs included such topics as Pesticide Applicator trainings, Soybean, Tobacco, Corn and Cotton production meetings, Fruit and Vegetable Meetings, Beekeepers Meetings, and Soil Fertility Management for Organic Farming.

In addition, the County Variety Trials, such as for cotton have been popular with both farmers and cotton industry representatives because they generate local data, and because they are done under farmer control and conditions. The Trials allow farmers to get to look at the industry's top varieties, side by side, and cotton industry representatives to put their best products on the line. The cotton industry gains by showcasing their varieties. Clemson gains by increasing farmer interaction in field research, and farmers gain by having access to information that helps them make better decisions.

Through the first two years of peach trials and demonstrations conducted by Extension agents and specialists, it has been proven that early fruit or bloom thinning by machine, can increase the size distribution of harvested fruit.

Producers, agricultural lenders, crop insurance companies, land owners, county agents, FSA officers, and/or other government officials request access to the department website for extension software applications, enterprise budgets and distance education.

<http://www.clemson.edu/extension/aes/software/index.html>  
<http://www.clemson.edu/extension/aes/budgets/index.html>  
<http://www.clemson.edu/extension/aes/development/index.html>

## Results

Over 800,000 acres were farmed using integrated pest management. IPM strategies were used on 500,000 acres of soybeans, 300,000 acres of cotton, and 60,000 acres of peanuts.

When considering the total acreage of cotton in Calhoun, Orangeburg, and Richland counties (49,490 acres) and assuming that the information provided by the County Cotton Variety Trials helps farmers make variety decisions that gain them 50 pounds of cotton per acre, then the value of this effort to the farmers in these three counties alone is worth \$1,410,465 at the cotton loan rate of 57 cents per pound. Considering the current cotton price received by farmers this year averaged 90 cents per pound; that value increases to \$2,227,050.

The gross value of Soybean Production in S.C. is \$139 million. The potential yield loss due to Asian Soybean Rust is \$13,900,000. Based on CU recommendations, South Carolina growers spray less than 25% of the total acreage for rust only once at a cost of less than \$8 per acre = \$1,180,000. Less than 1% of the South Carolina soybean crop is lost to rust = \$1,390,000. (Cost of needed protective sprays is \$1,180,000; rust cost S.C. soybean industry is \$2,570,000; cost of original projected 20% yield loss in South Carolina is \$27,800,000. The savings to growers is \$25,230,000.) The research on selected soybean seeds showed that the seeding rates can be reduced by 40% (from 137,500 to 82,500 seeds per acre) if soybeans are planted during the optimum planting window. With this reduction, the savings would be \$18 per acre. With high anticipated soybean acreage this year (about 560,000 acres), South Carolina growers would save about \$10 million. Therefore, the profitability of soybeans can be significantly increased with reduced seeding rates.

In peach grower trials this year, percent increase in fruit size of 2.75 inch fruit ranged from 12-19% of total harvested fruit. In one trial, there was a significant increase in the amount of marketed fruit. The advantage proved to be in reduction of labor costs. Labor costs associated with fruit thinning were reduced from \$165 to \$93 per acre giving the added advantage to overall gross revenue per acre to an automated or mechanical process. South Carolina's peach industry represents approximately 17,000 producing acres with potential significant savings. Results of this and other research efforts are given to growers attending regular production update meetings and regional conferences.

Downy mildew of collards is common in the southeastern United States, particularly during fall, winter, and spring. Foggy weather puts collard at risk of developing downy mildew. The applied research project was started to demonstrate which fungicides provided economical control of downy mildew. For growers, a potential increased economic return can be realized after the cost of potassium phosphite at \$66 per acre for 6 applications was subtracted from the crop value. Based on the average yield of collards from the South Carolina collard production budget, adding potassium phosphite would increase profits by \$555 per acre, a potential statewide impact of \$1.3 million. A majority of the acres of collards grown in South Carolina were treated with several applications of potassium phosphite in 2010.

Strawberry has replaced apple as the second most important fruit crop behind peaches in South Carolina. Improved strawberry production practices have been stressed and demonstrated around the state beginning the early 1990s resulting in plasticulture (plastic mulched beds with

western varieties and drip irrigation) acreage growing from only a few acres in the late 1980's to over 500 acres now. The initial yield on plasticulture strawberry was ~18,000 lb/A with a total value to the state of \$825,000. As result of these educational efforts and demonstrations, the current yield has risen to 22,000 lb/A, which, with the increased acreage and price, adds \$10,725,000 to the South Carolina economy.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

#### **Outcome #2**

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

Number of publications authored or co-authored (fact sheets, papers presented at national meetings, etc.)

Not Reporting on this Outcome Measure

#### **Outcome #3**

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

Number of acres affected by ICM programs

Not Reporting on this Outcome Measure

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

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

### **Evaluation Results**

1. It was determined that when kale, Top Bunch collard and Southern Curled Giant mustard were inoculated with the selected bacterial blight pathogen, brassica P1 lines, they had the highest percentages of healthy leaves. they had the highest p

2. The identification of soybean plant introductions which are resistant to soybean rust disease is providing parental material to help soybean breeders develop improved cultivars resistant to this disease.

3. New methods developed for grafting watermelons has reduced the cost of the grafting transplant from over one dollar to less than eighty cents.

4. Research determined that the Freeman small hive beetle traps were the most effective of those available in the US that can be safely used to control the beetle inside beehives without the use of pesticides.

5. Rootstock trials have developed information on the productivity of different cultivars and their resistance to peach tree short life.

6. Research has determined that the invasive species, Kudzu has a significant impact on soil chemical properties by increasing nutrient supply in highly eroded agricultural soils.

7. A long-juvenile genetic trait has been identified which has the potential to increase grower productivity of soybeans when double cropped after wheat in late June, early July.

8. Extension program evaluations revealed that of the 14,743 persons participating in global food security and hunger programs, 90% reported a gain in knowledge.

### **Key Items of Evaluation**

1. The identification of soybean plant introductions which are resistant to soybean rust disease is providing parental material to help soybean breeders develop improved cultivars resistant to this disease.

2. New methods developed for grafting watermelons has reduced the cost of the



grafting transplant from over one dollar to less than eighty cents. Rootstock trials have developed information on the productivity of different cultivars and their resistance to peach tree short life.

3. Rootstock trials have developed information on the productivity of different cultivars and their resistance to peach tree short life.