2012 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. As was noted last year, sustainable agronomic crops activities have been merged into the Global Food and Security program and biotechnology has been integrated into other sections of this report and in the annual plan update. The Master Gardener Program will be removed from the Non-food Horticultural Crops program next year and integrated into Global Food Security and Hunger. Nutrition programs were grouped under Childhood Obesity.

Research and Extension delivery through outreach of research results to the clients promote the economic growth and development of the agriculture and forestry sectors throughout the state. There were more than 115 active research projects in the reporting period. Researchers issued seven intellectual property disclosures and submitted three patent applications. Faculty also submitted 78 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.

As South Carolina faces concerns of emerging disease outbreaks, invasive plant species introduction, exotic plant pest and disease introduction, food safety, and other agroterrorism issues, there is continual emphasis on educating producers and first responders. Presentations including Equine Emergency Preparedness, Biosecurity, Foreign Animal Diseases, and Business Continuity sessions were taught to SC producers and emergency workers. The National Guard for Ag Development Training in Afghanistan included sessions by Extension on herd health, reproduction, and biosecurity. Row-crop entomologists in South Carolina have observed an average yield loss of about 20% due to the kudzu bug when untreated soybeans were exposed to naturally occurring high populations of the invasive species. If left untreated this could equal over $25 million in yield losses. Thresholds and spray techniques developed at Clemson are highly effective and can prevent over $22 million if utilized by growers. In addition, selecting the proper seed variety for the producer's environment will increase productivity and profitability. Clemson University conducts Official Variety Trials of all major crops in multiple locations across the state. The information generated from these trials is then used by growers to select the varieties that perform best in their region of the state. In 2011 South Carolina growers produced a cotton crop value at $211,848,000, a soybean crop valued at $101,700,000, a corn crop valued at 145,860,000 and a wheat crop valued at 76,140,000. If yields were increased by 5% through proper variety selection this would result in an additional $26,777,400 in revenue for South Carolina producers. In addition, growers improved production efficiency of confined animal systems and adopted grazing management practices.

Clemson Extension Specialists and County Ag Agents have carried out an aggressive training program to teach growers how to identify the optimal time to dig peanuts. With 100,000 acres of peanut in South Carolina this means over $7.5 million extra dollars for growers and the South Carolina economy.

According to public health and food safety experts, 76 million illnesses in this country can be traced

to foodborne bacteria each year. Moreover, the Food and Drug Administration estimates that two to three percent of all foodborne illnesses lead to secondary long-term illnesses. Food Marketing Institute research shows that consumers know that food safety is important and know that they personally should observe sound food-handling practices. However, it also shows either that they do not fully comprehend some of the most important messages or they fail to use food safety measures. In an effort to reduce food-borne illness, agents conductedfood safety training for managers, supervisors, and other food handlers.

The prevalence of overweight and obesity has become one of the most critical health issues in both South Carolina and the United States. Overweightness and obesity cut across all ages, economic levels, and racial and ethnic groups. In South Carolina, over 60% percent of all adults are now either overweight or obese. Nutrition education and research will focus on the topic of preventing childhood obesity.

Extension provided education to horticulture professionals, master gardeners, master naturalists and consumers on environmentally sound horticultural practices. In turn, these volunteers answered consumer gardening questions, assisted with landscapes and gardening projects at schools and in their local communities, help eradicate fire ants and other exotic invasive plants, renovated and maintained trails, restored habitats and cleaned up nesting boxes. Volunteers are involved in projects to educate and interpret nature to other audiences such as schools, assisting at parks and providing docent help for our many museums, nature centers and aquaria spread throughout the state. They also give back to our program by assisting Extension with the delivery of new courses and by taking or leading advanced training classes throughout the state.

The length of time between investments in timber production and revenue from timber sales is often long-term. Extension programs have focused on the use of alternative silvicultural systems from the traditional southern pine management and other programs to teach ways to diversify land use and management.

Economic and Community Development Programs help reduce the cost of service provision to communities and individuals and allow more communities to be better served. Specialists have determined the total combined economic impact for several local farmers markets. Graduates of Clemson Extension's senior and junior leadership programs were still involved in a responsible community project three years after graduation.

4-H programs seek to promote youth's educational success and connection to the community through a learn-by-doing approach, inclusive learning environments, and the involvement of caring adults. Gains have been reported in knowledge of civic engagement, improvement in self-esteem, new skills demonstrated, and improved connections to the community.

Efforts continued to establish an advanced plant technology center at the Pee Dee Research and Education Center near Florence. This is a multi-year initiative with infrastructure improvements and new hires expected in the current year. The research programs in forage fed beef received additional support as work in that area expanded, and the "Intelligent River" technologies developed in the last reporting period are being applied to a variety of areas involving agronomic crops.

Research and Extension activities continued to identify strategies and cultural practices to deal with one of the most recent invasive species, the Kudzu bug, which has the potential to do serious damage to the soybean crop in South Carolina as well as a wide range of ornamentals.

Clemson researchers have identified **rust-resistant soybean** plants that can be used to develop resistant varieties with the potential to improve crop yields and nutritional value. They also can reduce production costs by reducing the need for chemical pesticides. In 2011 South Carolina growers planted 370,000 acres of soybeans with a value of more than $101 million.

Glyphosate-resistant Palmer amaranth, also known as pigweed, 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. Clemson scientists are working with farmers to develop **customized, aggressive soil herbicide programs** that will cost growers about $34/acre versus $2,000/acre for hand-weeding, cultivation and crop abandonment.

Researchers have identified **proteins in alfalfa** that are involved in long distance communication and regulate the number of nodules legumes make. This may someday allow control of plant growth and limit fertilizer application.

Peach rootstock trials have produced research-based information to guide South Carolina peach growers in selecting rootstock and cultivars for replanting old orchard sites to increase their productivity and profitability. Rootstocks that induce dwarfing are also being evaluated to determine which ones are best adapted for high-density orchard systems to facilitate mechanization and reduce labor costs. In 2011 South Carolina peaches generated more than $75 million in cash receipts.

Researchers have developed environmental monitoring and data collection technologies that are providing **real-time data on water quality** and flow rate. Previous data was months or even years out of date and costly to collect from remote sites. The real-time data is critically needed to improve water resources management as demand increases for drinking water, hydroelectric power, recreation and industrial production. Coupled with GIS data layers, this technology also can be applied to management systems for agriculture, forestry and natural resources, potentially reducing costs and environmental impacts, and increasing profitability.

Anticipating grower demand for **watermelon rootstock that resists soil-borne diseases**, Clemson researchers developed new methods for grafting watermelons. This reduced the transplant grafting cost from more than $1 to less than 80 cents, with potential for further savings. These cost reductions are critical to keep the state's producers competitive in U.S. and export markets. South Carolina watermelon production is valued at more than $35 million per year.

Researchers have developed integrated gastrointestinal **nematode control methods** that decrease reliance on chemical dewormers. This has the potential to save South Carolina animal producers $186,000 in deworming costs and gain $465,000 in increased production for small ruminants. This industry contributes more than $1.5 million per year to South Carolina's economy.

New test coatings have been developed that demonstrate the ability to **protect marine ship hulls** from fouling by oyster and barnacle larvae. The new coatings use a non-toxic, naturally occurring compound instead of the current chemicals that are highly toxic. This research has the potential to create a new technology industry in South Carolina and make a significant contribution to the environmental quality of the world's seaways.

South Carolina **nursery and greenhouse** growers are increasing their production capacity and profitability by using Clemson research-based guidelines for fertilizer concentration applied to stock plants. The new guidelines improve cutting production and quality, post-harvest performance and rooting in propagation an industry that generates more than $190 million in annual cash receipts for the state.

The quality of **South Carolina's coastal environment** is challenged by population growth and urbanization. Ongoing research on wetland forests provides long-term data on southeastern bald cypress-dominated swamps that will help land managers document existing forest conditions and monitor the effects of land-use change on coastal wetlands. Thoroughly understanding the extent to which natural coastal systems can respond to environmental and human changes and continue to provide essential

services to society increases the likelihood that management efforts will be successful.

Mosquitoes spread **West Nile virus and equine encephalitis virus** that can affect both livestock and humans. Research found that different mosquito species forage for hosts at different heights. This provides an important basis for monitoring and potentially preventing diseases spread by these pests. South Carolina animal agriculture generates more than $1.5 billion a year in cash receipts.

The **needle ant**, Pachyondyla chinensis, is an invasive species whose venomous sting causes allergic reactions ranging from hives to anaphylactic shock. The species has invaded South Carolina and other southeastern states. Research discovered that the ants prefer protein as a food source, which will be useful to guide South Carolina citizens, agricultural producers and the $500 million pest control industry in selecting bait products.

An environmentally sustainable water treatment system - called a **constructed wetland** - is providing an economically feasible alternative for the state's nursery and greenhouse industry to manage water quality. The new system developed by Clemson research produces measurably cleaner water with consistently lower levels of nitrogen, phosphorus, temperature and pathogens.

U.S. laboratory production of plant material - called **micro-propagation** - is under pressure from foreign competitors. Clemson research is developing a liquid-matrix system that protects the health of woody and herbaceous plants, and can provide nutrients that are critical to plant growth in nurseries and greenhouses. The new system will enhance global competitiveness for the micro-propagation industry in South Carolina.

The 1890 Research and Extension Program continues to raise the educational consciousness and awareness of national issues that impact South Carolina residents with a special emphasis on the underserved or limited-resource clientele, in order to improve their quality of life. The 1890 Program continues to promote an organized research and extension system that incorporates stakeholders' input into the design, implementation and evaluation of programs, activities and services which address quality of life issues by providing research-based solutions for South Carolinians. Additionally, the Program, which values the integration of teaching, research and public service, provides effective stakeholder outreach programs and services in the areas of agriculture/natural resources, family life, health and nutrition, youth development, community economic development, education and technology. During the reporting period, Evans-Allen Research funded 19 research projects. The research focus areas included: sustainable agriculture, food safety and nutrition, community leadership, economic development, global food and hunger, childhood obesity, as well as youth and family development. The 1890 Research Program invests in faculty whose proposed studies aligns with the targeted research areas, show promise in providing solutions to the various complex challenges that impact communities in the state, throughout the nation and across the globe, and advance the overall research capacity of the university. Funding is awarded for up to three years with the intent to provide researchers with opportunities that would allow them to develop their project so it is better positioned to attract funding from external agencies and organizations.

As 6 research projects ended, 6 new projects were funded for the upcoming reporting period.

- The use of synthetic pheromones for mating disruption has proven to be effective for L. serricorne in stored-products' environments. Results showed significant reduction in the number of male beetles caught in traps. Commercializing mating disruption techniques would be ideal as the methods are environmentally benign, safer to non-target organisms and potentially a better alternative to fumigants that are harmful to humans and the environment. The outcome of the research will also help the private industry to manufacture and market pest management techniques that could be adopted to control L. serricorne along the stored-products chain.

• Analysis of genetic variation and behavioral testing of specific fruit fly mutants indicate that over 200 genes may be involved in the control of female receptivity to mating. Additionally, one specific gene and one strong candidate genes were identified that affect the receptivity of female fruit flies to mating and may be involved in pheromone perception. Ultimately, the discovery of specific genes that control female receptivity opens the possibility of controlling pest populations through direct interference with mating behavior. Knowledge of the genes involved allows the structure of the protein to be predicted, and potentially the development of chemical inhibitors that would disrupt mating without the toxic effects of existing conventional pesticides.

• A study of several South Carolina cities shows that community development has been disproportionate across the state, with little progress made in reducing disparities over a 30-year period. Municipal officials of the communities studied in the research provided recommendations to enhance community development. For example, officials recommend that municipalities should work with the business community to improve education and the social capital of low income communities with the intent to attract new development. The data and analysis generated from the research have policy implications for state legislatures, and can also assist 1890 Extension in its community development efforts.

• Preliminary results of study on Alzheimer's diseases and other neurodegenerative disorders show promise in aiding the advancement of early detection methods and of decelerating progression of the diseases in the brain. The National Science Foundation and SC State's 1890 Research & Extension Program funded the three-year project,which focused on inhibiting protein aggregation in Alzheimer's and on developing sensors for the detection of unusual DNA structures associated with neurodegenerative diseases. According to lead researcher Dr. Rahina Mahtab, the research outcomes have the potential to be among the arsenal of solutions used to fight Alzheimer's, the most common form of dementia.

• A team of researchers conducted tests to evaluate radon levels in wells of families and businesses in the Midlands to Low Country regions. Testing specifically targeted communities along the Edisto River Basin, which spans from the counties of Saluda to Charleston and Barnwell to Clarendon. The study found that groundwater in the Basin is generally low with the respect to natural radioactivity. However, high radon concentrations were discovered in some areas including Pomaria, Lexington, Cordova, Branchville and an isolated location in St. Matthews. Additionally, the researchers are the first to report higher radon concentrations in groundwater in Cordova than in surrounding areas. The service was funded through the 1890 Research Program as part of a study to investigate the radioactivity levels of radioactive contaminants found in groundwater.

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• Research that examined South Carolina's Chapters 7 and 13 bankruptcy filings for low income persons before and after the passage of the 2005 Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) recommends that the United States Congress should repeal or revise the law. According to the research, the law appears to be advantageous for financial corporations, offering no respite for those who have a constitutional right to seek financial relief through the courts.

The major achievements during the past year for 1890 Research and Extension include the following:

• The 1890 Extension Program made contact with over 16,915 people, during the reporting period.

• A total of 1,271 workshops/trainings were held across the State of South Carolina to assist all

participants within the State with a special emphasis on the underserved or resource-limited population onvarious topics. Workshops/Trainings were held on estate planning, land-use, alternative farm enterprises, risk education, etc. To enhance the knowledge of participants in the area of food handling, preparation and distribution workshops/trainings were provided. Educational enhancement was provided to youth on sound money management skills, financial planning and entrepreneurship in Bamberg, Calhoun, Dorchester, Anderson, Hampton and Marlboro Counties. Workshops/Trainings to explore the importance of developing and maintaining healthy lifestyles were conducted. To assist with water quality issues, workshops were held as well as environmental stewardship workshops.

• Four on-farm demonstrations were held to expose participants to emerging ideas and opportunities in agriculture.

• Three specific projects (Rock & Read; Fun, Food & Fitness and ServSafe) were conducted at several sites throughout the State of South Carolina. Participants were able to learn about nutrition, physical activity, safe food handling and fundamentals of reading and health activities.

• Summer Academies were conducted across the State of South Carolina to educate and enhance the occupational outlook of participants. The TechBridge Academies were held for five-weeks for rising seventh and eighth grade students in six different locations. Students were exposed to building their own computers and worked on academic enhancement in reading, math and writing through the use of technology. At the close of each Academy, youth were able to carry their computers home. A total of 89 computers were distributed across the State of South Carolina, which helped to bridge the digital divide. The Strategies in Math and Reading using Technology (SMART) Academies used innovative technology of an interactive whiteboard to teach rising third-grade students mathematical and reading comprehension standards. A total of 36 youth participated in the Academies. The Money and Business Entrepreneurship (MBE) Academy focused on middle school youth using the Network for Teaching Entrepreneurship (NFTE) curriculum to enhance their math and reading skills, in order to develop their own business plan. A total of 16 youth were able to complete the Academy.

• Technical assistance was provided to 8 Small Farm Co-operatives, which allowed the small farmers to become more efficient and productive in their work.

• Based on the surveys conducted, of the 6,351 youth who participated in the summer enrichment programs, 100% indicated an increased in their knowledge of assessing leadership styles, making healthy lifestyle choices, developing entrepreneurship skills, team building exercises and career exploration. In addition, 98% indicated they would like to participate in other 1890 programs.

• The mobile technology unit was able to take technology to the people across the State of South Carolina. The Mobile Technology Center is a stylized Winnebago equipped with a 12 station computer lab used to deliver educational programs and services to participants. Approximately 2,910 individuals were served statewide. In 2011, usage of the Mobile Technology Center was restructured. Two 1890 Extension Agents were primarily assigned to provide instruction for the Center. As a result, participation and usage increased tremendously. As the Center traveled across the State, participants acquired knowledge regarding the history of SC State University, mission and goals of 1890 Research and Extension, Cyber Safety, 4-H and youth development, testing skills, etc.

• A high school financial planning program was implemented at eight high schools with 555 participants getting involved. Knowledge gained was assessed by administering a pre-and post-test evaluation. All classes showed an average increase of 70% with some students increasing their scores by 55 points.

• According to statistical data, the Small Farm Assistance and Outreach Program noted a profit gain by their participants. As a result of training activities, participants reported they gained knowledge of sustainable agriculture practices, adopted the practices and 72% of producers reported an increase in income.

• Small livestock producers desired to reduce feed costs during the winter months, while maintaining the animal's body condition, milking ability and ability to rebreed on time. One hundred percent 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.

• As a result of technical assistance and business consultations, individuals and businesses gained knowledge in the development of business plans, grant writing, non-profit organizing and applying for grants. The Local Organizing Committee of Orangeburg, applied and obtained a 21st Century Grant in the amount of $200,000 for an after school program.

• Researchers prepared papers, articles, posters, etc. for presentations at meetings, conferences, workshops, etc. highlighting research efforts. Twelve publications were submitted to peer reviewed journals and 18 presentations were made at professional meetings.

The 1890 Program also had significant impact on the State of South Carolina. Some of the identified impacts are listed below:

• Rural communities in South Carolina are losing their human capital and intellectual capacity due to a high level of dropout rates among middle school students with undeveloped job skills. A program called "Yes Carolina" was implemented to assist 5th and 6th grade students. The program is a five week Money and Business Entrepreneurship Summer Camp. Twenty students learned the various aspects of entrepreneurship decision making, finance, economics, negotiation, marketing and public speaking. To measure the students' pre and post knowledge, a pre and post test was administered. The post test showed, at the end of the five weeks, an average of 75% of the students increased their overall knowledge of Money and Business Entrepreneurship skills with the largest improvement in negotiation (88%).

• Small farmers and agriculture producers in the South Carolina Low Country are looking for ways to reduce production costs of small scale operations. High costs of fertilizers and chemicals are devastating to producers during the present economic down times. Production practices, which reduce proper inputs because of cost factors, contribute to low quality, unmarketable and/or failed crops. Producers need to learn sustainable agriculture practices to maintain operations. The Sustainable Agriculture Project was successful demonstrating soil fertility practices to include soil sampling and analysis, pest control limiting chemical applications and providing for increased production, quality and marketability of vegetable crops. As a result of Sustainable Agriculture Practice Training Sessions/Activities, forty-five percent (45%) of active participants gained knowledge, adopted practices and applied information to their operations. Twenty percent (20%) of participants expanded operations and improved marketing activities.

• Local vegetable producers were interested in producing a high quality product with the least amount of off-farm input and higher rates of profit. Farmers, producers and community members were interested in using fewer chemicals on the vegetable products and eating healthier. Therefore, soil fertility, crop cultivation methods, marketing strategies and recordkeeping workshops were held on two different certified organic farms in the Williamsburg Cluster. As a result, 100% of the participants had taken up-to-date soil samples and began to implement the recommendations from the soil test. Increased support among community farmers to expand networking capability has been addressed. Vegetable production workshops were held to increase networking among farmers. One hundred percent (100%) of the participants walked their fields to identify beneficial insects that promote healthy growth in plants. They were also able to identify disease of the roots in its early stages.

• Small livestock producers in the Greenwood Cluster have a desire to reduce the amount of hay required and produced to increase profitability and convert land dedicated to hay production to grazing acreage. By reducing the amount of hay that must be produced, profits would increase and land dedicated to hay production could be used as additional grazing acreage and new forages and legumes could be implemented in the grazing system. A grazing management workshop was conducted in September 2012 focusing on rotational grazing, soil fertility and implementing forages and legumes that would allow as much grazing as possible throughout the year. Twenty-four (24) producers participated in the workshop and toured the demonstration plots that were planted in sudangrass and pearl millet to fill the grazing gap left by fescue during the summer months. The host farmer shared with the participants how his animals had a better appearance and a faster growth rate. The pearl millet had been grazed six times, since planting and there was excess forage available, if an emergency hay crop was needed. Ninety percent (90%) of the attending producers planted winter annual forages, legumes and small grains to reduce their hay requirements, increase animal growth rate and increase profitability.

• Small scale, limited resource livestock producers in the South Carolina Low Country experienced problems with their operations. The producers strive to keep their operations functional with little to no real profit margins. Also, they lack skills in small farm management practices as it related to production, herd health and marketing. The producers needed to get more involved in educational programs to gain knowledge of livestock to improve the quality of their herds, overall enterprise operation, become more productive and increase income and profit margin. Workshops, meetings, demonstrations and trainings were conducted to train farmers in the areas of herd health, veterinary skills, breed selection, reproductive efficiency, nutrition, feed and pasture production and management, and small farm management practices. Twelve (12) livestock producers were involved in a Livestock Production and Management Project to address identified needs contributing to small farm decline. As a result of the educational training, nine (9) participants adopted improved veterinary skill practices to control parasites, feed and provide nutrition practices to promote and maintain herd health, pasture management to include drought control and improved fencing into their farm operations. Savings realized were in the areas of feed management through improved pasture production, which reduced the costs of off-farm feed sources. Additional savings were realized through improved health herd practices and veterinary skills applied to control parasites and diseases.

• Producers and community members were concerned about healthy animal production on the small farms. Producers and community members, also, had questions about herd health management, breeding, pasture management, animal sales and making a better profit. In an effort to assist the community with improving the overall quality of the meat production within the farming community, the Williamsburg Cluster staff, in collaboration with the People's Farmers Cooperative, held a workshop

addressing herd health management and best farming practices. As a result of the workshop, 59% of the participating members have planned to put in place the knowledge and skills gained from the workshop. Of the identified percentage total, 15% have scheduled de-worming and rotational grazing as well as used a higher quality of grazing pasture.

• Adults (47) and youth (838) who were interested in being safe while using the Internet took part in a Cyber Safety 101 Project. Cyber Safety 101 benefits K5 - 12th grade students and adults of all backgrounds and levels of computer literacy through the use of technology, instructional aides and evaluations. As a result of the facilitation of the Cyber Safety 101 Project, 88.8% of the post-test respondents answered they would never meet any of their Internet friends in person and 87.3% stated they would never post or give out any personal information over the Internet.

• An estimated 25% of children in South Carolina are obese. An increasing number of children are being treated for obesity related conditions such as Type 2 diabetes and hypertension. Several factors contribute to unhealthy lifestyle issues such as limited access to healthy foods, lack of knowledge of simple ways to create healthy dishes and not being introduced to different types of foods at an early age. 1890 Extension staff, along with local community members, developed a series of educational workshops to teach the importance of eating healthy foods and being active daily. As a result of the Healthy Lifestyles Program, 91.2% of youth showed an increase in knowledge on living healthier lifestyles, while 74% stated they planned to implement the information taught in the program to their daily lives.

• The 1890 Extension Program, along with the 4-H Council, developed and implemented the National 4-H Science Day across the state of South Carolina. This annual event was intended to spark an early interest among youth in science and future science careers as well as reclaim the nation's position of leadership in scientific exploration. As a result of the program, 88% of the 1325 participants surveyed stated they learned a new scientific concept, while 46% were more interested in science and 25% would like to work in a science related field.

• The Citizenship Program is provided to youth ages 8 - 18. The 1890 Extension Program coordinated a citizenship program and implemented 6 activities (basic life skills, leadership, character education, self-esteem, conflict resolution and service learning projects) that focused on the development of citizenship. The activities were provided to at-risk youth from Anderson, Charleston, Hampton, Marlboro and Orangeburg Clusters. As a result of the project, 7000 youth were served in a combination of 449 workshops and activities. At the end of the program, 87% of the participants indicated knowledge gained. Seventy-one percent of the evaluated population indicated a willingness to adopt Basic Life Skills principles and became a leader in their community among their peers.

• The Expanded Food Nutrition Education Program (EFNEP) taught youth and families with young children how to develop healthy eating and lifestyle practices. 1890 Extension implemented an eight series program for youth and adults on the importance of eating healthy and being active daily for sixty minutes. Seventy-four percent of the participants stated they learned a new concept and were thankful for the information. Sixty-one percent of the participants planned to implement some activities and ideas in their daily lives.

• The South Carolina State University 1890 Research and Extension Program completed a 2 year review conducted by the United States Department of Housing and Urban development (HUD) and was

successful in obtaining $800,000.00 in federal funds, for the second year. The funds will be used to rehabilitate 16 owner occupied homes with an average cost of $25,000.00 per home. In addition, 15 small businesses will participate in the small business development education series. Upon successful completion the program, 15 small businesses will qualify for a $10,000 grant to expand their businesses.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	160.0	42.0	40.2	13.0
Actual	142.0	42.0	35.5	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

At South Carolina State, In order for a proposal to be accepted and forwarded for consideration for approval by the USDA/NIFA, the applying researcher (i.e., principal investigator) or team of researchers must complete the following:

A. Submission of Research Abstract/Pre-Proposal

A faculty member interested in submitting a research proposal for an 1890 Research Grant must first prepare and submit a completed abstract/pre-proposal to the Office of 1890 Research by the established deadline during the fall semester of a given academic year. The guidelines for completing an 1890 research abstract/pre-proposal are provided to the potential researcher.

B. Review of Abstracts/Pre-Proposals

Once all research abstracts/pre-proposal have been received in the Office of 1980 Research by the established deadline, each will be reviewed by staff, to determine if the project falls with the scope and objectives of the 1890 Research Program. Proposal abstracts will also be peer reviewed by a select panel of South Carolina State University faculty and staff, including: a minimum of two reviewers from University faculty, two 1890 Research staff members, one 1890 Extension staff member and one Sponsored Programs staff member. The reviewers are selected from different disciplines in response to the nature of the proposals and the disciplines involved. Evaluation criteria for proposal abstracts are provided to the reviewers. Samples of the forms to be completed by each reviewer are also provided.

C. Presentation of Select Abstracts/Pre-Proposals

Researchers whose abstracts/pre-proposals are approved via the initial peer review process are required to conduct a 15 minute presentation of their proposed research to the panel of reviewers. Upon completion of this step in the grant proposal development process, each researcher is contacted by 1890 Research staff with information concerning whether his/her abstract/pre-proposal has been approved for full proposal development.

D. Prepare Proposal According to Guidelines

A written proposal needs to address all criteria as stipulated in the Grant Application Guidelines required for 1890 Research funded projects. A detailed listing of the required sections, as well as information pertaining to what needs to be addressed in each section is identified.

E. Peer Review of Grant Proposals

After submitting a completed proposal to the Office of 1890 Research for submission to the USDA/NIFA, the proposal must be reviewed using the following procedure:

1. The proposal must be evaluated by a peer review panel consisting of University faculty as well as staff from both the Office of Sponsored Programs and the Office of 1890 Research.
2. Each reviewer must provide written appraisal and comments, which may be used in revising and improving the proposal. A copy of the forms to be completed by each reviewer is provided.

3. The principal investigator must respond to all substantive review comments and provide to the Research Administrator copies of the reviews and responses to all substantive recommendations for revision. The principal investigator is responsible for incorporating suggestions made by all reviewers into the proposal, but must give reasons for any substantive suggestions not included or addressed. All final revisions to proposals must be submitted to the review panel for final recommendations for funds approval.
4. On a case-by-case basis, proposals may be evaluated by off-campus reviewers (i.e., land grant institutions 1890 or 1862), who will determine if an additional review and/or substantive revision is necessary.

5. The Research Administrator is responsible for reviewing any revisions of the proposal and for approving its transmission to USDA/NIFA. Clemson research used a similar process.

In addition, the Research and Program Development Committee of the South Carolina State Extension Advisory Council is responsible for reviewing and commenting on new programs initiated by Clemson University. The seven-member Research and Program Development Committee is one of the Council's three committees that review the list of programs and descriptions. 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 gave input about programs. There are Extension volunteers, producers, a community center program coordinator, a public school educator and business owners. Programs are also reviewed by state Extension Program Team Leaders based on organizational capacity, relevance, and impact.

The current Clemson PSA research project approval and review process is as follows:
1a) Faculty member conducting research in an area of potential interest to PSA is identified by faculty, department chair, or Experiment Station administrators, and communicated to the Associate Vice President for Public Service and Agriculture.

1b) New faculty hires meet as below to discuss research plans before submitting pre-proposal. Pre-proposals for new faculty are circulated, reviewed, and approved electronically. Renewing faculty members are asked to submit 1-2 page pre-proposal and accomplishment summary prior to meeting.

2) Faculty member meets with department chair/unit head, the appropriate college Associate Dean, REC/Institute Director (if appropriate), appropriate PSA Associate Dean, Associate Vice President for Public Service and Agriculture, to discuss four-year research objectives and potential impacts. Discussion to include (i) scientific justification, objectives and approach for the proposed project, (ii) opportunities for university-wide or broader collaboration, (iii) potential of proposed research to generate outside funding/leveraging, (iv) specific short-term outputs of research and long-term outcomes. Faculty with terminating projects should address deliverables and impact for the immediate past project in addition to the proposed project. All Experiment Station projects must address pertinent issues aligned with the five PSA goals. PSA expectations are that researcher: i) complete a REEport report annually, ii) submit research publications for PSA technical contribution numbers and iii) leverage PSA funding. Researchers are asked to provide Experiment Station with non-proprietary project reports for sponsored projects so that the leveraging impact can be included in accountability reporting.

3) Projects are presented to CAFLS (or other college) Research Associate Dean for comments and concurrence. The Associate Vice President of Public Service and Agriculture is informed of recommended projects.

4) If project concept is approved, faculty member is advised and requested to write project. All faculty members have access to the searchable REEport database online.

5) Project is peer reviewed, and reviewer comments are provided to Associate Dean, COO and faculty member. Faculty member responds to comments and revises project. COO reviews and approves project. Projects, related CRIS forms and any IRB certifications are submitted to USDA/CSREES. USDA approves project. Note: Target date for approval of projects for development of salary roles is March 1.

6) New projects are typically funded for four years with researchers submitting annual CRIS accomplishments reports.

7) Changes in Project Direction or Management. Prior approval by the Associate Vice President for Public Service and Agriculture is required for a change in objectives, scope, PI, or project effort. Examples, though not all inclusive, are as follows:

1. Change in specific aim approved at the time of project approval.
2. Any change from approved use of animal or human subjects.
3 Shifting emphasis of research from one area to another.
4. Applying a new technology from that proposed
5. Transferring the performance of substantive work to a third party (subcontractor)
6. Change in those designated as "key personnel" by the sponsor and
7. Significant re-budgeting.

Timeline

May-June: The Experiment Station advises the principal investigator (PI) via letter at least a year in advance of the scheduled termination date of the PI's project.

May-October: If the PI is asked to continue, the PI, the Associate Vice President for Public Service and Agriculture, associate deans, and department chair(s) meet to discuss the proposed project. The project must:

- Present case for relevance, capacity, impact
- Detail research/extension collaboration, as appropriate

- Determine costs associated with the project

PI conducts CRIS search in advance of writing proposal (http://cwf.uvm.edu/cris). PI writes project proposal, using the research project format. PI submits proposal to the Experiment Station and requests that the project be sent for peer review. PI submits names and addresses of four reviewers with proposal. The policy of the Experiment Station is that three of the reviewers should be outside Clemson University. These reviewers can be scientists from other universities, other institutions or organizations, private industry, etc.

- **November 1**: The Experiment Station sends the proposal to reviewers, with a questionnaire. Reviewers are also invited to write suggestions to improve the project directly on the copy of the proposal. Reviewers are given 10 working days to return the review to the Experiment Station.
- **December 1**: The Experiment Station compiles all reviewers' comments into a letter to the PI. If the reviewers have written comments on the proposal, these are included with the letter that is sent to the PI. The PI then revises the proposal and resubmits to the Experiment Station
- **January 7**: Upon approval by the Experiment Station, the PI is authorized to complete CRIS forms 416, 417, and CSREES-2008 via the REEport website. If human subjects, animal subjects, or DNA research is involved in the project, approval must be obtained from the appropriate university committee prior to final submission to this office. The project cannot be submitted to CSREES without the date of university approval on the CSREES-2008 form.
- **January 15**: The Experiment Station assigns a new project number and forwards project to CRIS (via CRIS website) for approval. CRIS office returns approved paper copy of forms CRIS 416, 417, and CSREES-2008 to the Experiment Station. Copies of these forms are sent to the PI.
- **March 1**: Budget is set up for project.
- **July 1**: Project begins.

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 remains a key to successful Extension programs. Clemson and South Carolina State have a long history and tradition of seeking stakeholder input into the Plan of Work process. The process of seeking stakeholder input included identifying stakeholders that should have input in the POW process and determining the process used in seeking stakeholder input.

Meetings with commodity groups are particularly helpful in determining research priorities and needs for on-farm Extension support. Input from participants and graduates from programs available statewide, such as the Master Gardener Program is used to upgrade and enhance

the
quality of the program and identify new participants.

Stakeholder input is considered when soliciting research programs and increasing research expertise
and research capacity

The most recent process used in seeking stakeholder input included meetings that were held in all counties in the state to identify issues and set priorities for agricultural Research and Extension. Stakeholders were identified and invited to attend a meeting. Stakeholders included those internal to the Cooperative Extension and 1890 System--administrators, extension agents,
agent associations, specialists, faculty, department chairs, associate deans and faculty, as well as,
those external to the system. External stakeholders are Extension advisory boards members, commodity group representatives, community leaders, human service providers, business/industry
representatives and collaborators (Farm Bureau, Chamber of Commerce, Farm Service Agencies,
etc).

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.

Commodity groups in the state as well as individual growers and groups representing special interests, such as water quality, food safety or economic growth in the agricltural sector are cosistently targeted for input on research issues.

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 with invited selected individuals from the general public

Brief explanation.

The advisory meetings are attended by county advisory committee members and other key stakeholders. A Nominal Group Technique (NGT) was used to garner stakeholder input for the Plan of Work process. NGT is a process that allows a group of individuals to generate a large number of ideas in a relatively short period of time. NGT is helpful in identifying problems, exploring solutions and establishing priorities.

A series of questions were identified to which stakeholders were to respond.
Annual meetings around the state are open to the general public and conducted to gain input on stakeholder interests, concerns, and needs. Participants are asked to evaluate the effectiveness of Extension programs, identify major concerns in the county and recommend topics they feel Extension can adequately address. They also give program ideas.

Stakeholder input is a natural outcome of ongoing meetings of experiment station administrators and
faculty with commodity groups.

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.

State Program Leaders identify the major programs for the new federal Plan of Work using the identified list of issues. The programs are defined using the logic model. The State Plan of Work, which includes specific initiatives and projects, is developed based on the identified programs. The process is used to identify emerging issues and to redirect Extension programs. Programs are developed, expanded or eliminated based on their quality and/or effectiveness. In addition, the priorities identified are considered when hiring staff and when establishing action plans. Through these and other efforts, the Clemson Extension Service and the 1890 system are kept current on stakeholder programs and services that have the potential to affect public policy, social, economic value and efficiency, environmental quality and individual well-being.

Brief Explanation of what you learned from your Stakeholders

Stakeholders encouraged filling positions and hiring more staff across all program areas.

There is significant interest in South Carolina's stakeholders in an increased plant breeding capacity at
Clemson, and in dealing with issues caused by climate change, particulary in the fruit and beef cattle
industries.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
5699165	1815101	4211357	2235141

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	5699165	1815101	2339908	2235141
Actual Matching	5699165	907551	4303796	1117571
Actual All Other	0	0	0	0
Total Actual Expended	11398330	2722652	6643704	3352712

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Sustainable Animal Production Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
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%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	7.0	4.4	0.0
Actual Paid Professional	11.0	12.0	3.5	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**
504218	494957	176242	262712
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
504218	247478	942947	131356
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

Activities included research on animal health and animal productivity in beef and dairy cattle through integrated resource management. The importance of grazing techniques and the introduction and testing of new forages was an expanding element of animal research initiatives, focused on the production of forage-fed beef.

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 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.

Animal Production Systems programs were conducted. The Clemson Bull test was conducted. The Clemson test received funding for a new Grow Safe feed monitoring system which allows the measurement of feed efficiency in the testing program. The Clemson test will remain a conventional grain/byproduct based feedlot test in coming years.

Master Cattleman educational series continues. In this fee-based program multiple topics are covered over a five week period for area producers. Beef Quality Assurance certification is offered as an optional program at this Master Cattleman series. The Grass Masters program is a multi-night fee-based seminar series covering the basics of forage selection, establishment, and management. Small ruminant workshops were conducted, including Goat and Sheep Seminars. Extension specialists continue to work with producers in developing cost management strategies for rations, budgets and other input costs. Multiple on farm demonstrations are in place to demonstrate controlled grazing, improved forage varieties, novel legumes etc. Livestock agents and specials also assist with youth programs by teaching livestock management and managing youth livestock activities when needed.

Confined Animal Manure Management trainings/recertifications were conducted across the state. Some 1,231 producers attended the re-certification trainings, each obtaining 2 hours of credit for this year. 100% Presentations on SC Ag Watch, including AgroTerrorism, Biosecurity, Foreign Animal Disease, Food & Business Continuity, were conducted. Specialists taught National Guardsmen for Ag Development Training in Afghanistan. Specialists conducted programs to explain upcoming changes on laws for farm vehicles and to educate producers regarding the national weather service weather program.
Agents conducted an emergency pet sheltering drill.

Specialists developed a demonstration project on using natural, closed cell foam insulation for improving the energy efficiency of animal production facilities and provided onsite assistance on ventilation and cooling of an animal production facility. Beekeepers Association meetings were conducted on the topic of bee genetics and morphology research.

The 1890 Extension Small Farm Program livestock production project was designed for socially disadvantaged small, limited resource producers owning and/or raising Beef Cattle and Meat Goats. The focus was on farm/enterprise management, production and marketing as well as providing training sessions, workshops and demonstrations to deliver research based information. Educational activities

included improving herd health practices, animal nutrition, select breeding practices, reproductive efficiency, pasture production and management.

Research is being conducted to study the use of a multi-agent framework to design and implement a computer-based epidemiological simulation model that combines the traditional herd based epidemiological methods with the role of transportation and the interferences of individual objects for herds. An agent will be able to represent any object and its behavior. The object can be an animal, a group of animals (herd), a worker or a transportation unit. The behavior of an agent is decided by the role. For example, the main role of a herd agent is to estimate the spreading of the disease based on its stochastic model in case of infection. Consequently, the behavior of the herd will be changed based on the estimation. To date, the researcher has (1) gained knowledge for the most recent simulation methods and theories, (2) researched the implementation of agent framework on multi-process environment (CUDA architecture with Tesla), researched implementation of simulation tools in CUDA architecture and (4) surveyed stochastic modeling methods and theories. The outcome is reported as a simple test version for implementation (in C/C++ language) of multi-agent framework in CUDA architecture. A more complicated version will be implemented in the next reporting period.

1890 Research was conducted on the molecular genetic analysis of responses to male pheromones in Drosophila melanogaster. Several genes were involved in the receptivity to mating of fruitfly females, which were identified on the basis of DNA microarray analysis. Mutants for six of the genes were obtained from the Drosophila stock center in Bloomington, IN. The mutations lacked any gene activity caused by insertion of a transposable element in a specific gene. Ten mutations were also obtained from the Vienna Drosophila RNAi Center in Vienna Austria. The mutations were caused by RNAi knockdowns, which significantly reduce gene activity and are specific to a single gene. They have been tested to determine whether the mutations affect receptivity to mating. Females that carry each mutation were paired with males from two laboratory strains, Tai-Y and Canton-S. Testing with two different types of males assures any effect of the mutant is general, not specific to any particular strain of male. Females with the same genetic background as the mutants were used as controls. One of the mutants was found to have a significant effect on female mating receptivity as an RNAi mutation and as a transposable element insertion.

Additionally, chemosensory gene variation was identified from the DNA microarrays. The researchers performed a careful search of the microarray data for expression differences between Canton-S and Tai-Y laboratory strain males. The analysis revealed 11 differences in chemosensory gene expression between Canton-S and Tai-Y , all in genes coding for olfactory binding proteins. Olfactory binding proteins are thought to be the first step in the pathway of chemoreception. Analysis of the protein expression by green fluorescence protein (GFP) showed that expression of these chemosensory genes was limited to the antennae and palps, morphological structures involved in pheromone perception. With the results, a strong association between variation in chemosensory genes and differences in the perception of sex pheromones in the fruitfly were shown. Another result showed an inverse correlation between courtship ability of males from a wild line of fruitflies with receptivity to mating by females. The difference was not associated with variation in male pheromones. The number of lines tested was increased from four to 14, and the statistically significant association persisted between courtship effectiveness of males and receptivity to mating of females, substantiating an earlier result.

Knowledge about genes that control receptivity to mating and pheromone perception in fruitflies will provide information about pest species such as mosquitoes and facilitate development of nontoxic pest control measures. For example, inhibitory proteins that reduce the willingness of female mosquitoes to mate could be designed, which would reduce the necessity to spray toxic pesticides in urban/suburban environments. The information from fruitflies could also be applied to Dipteran agricultural pests, and reduce the necessity for toxic pesticide use by farm workers. The project also provided student assistance so top students could gain research experience and attend graduate school. Presentations, articles and a

final bulletin were the result of the research.

2. Brief description of the target audience

Producers, Limited-Resource Farmers and Extension personnel, agency personnel, etc.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13047	9657	124	53

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	24	26

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual

2012	0

Output #2

Output Measure

- Licenses

Year	Actual
2012	0

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual
2012	7126

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.)

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Confined Animal Manure Management (CAMM) program seeks to reduce the environmental impact of animal waste in South Carolina.

The identification of genes that control pheromone recognition in Drosophila melanogaster can be used to identify homologous genes in pest species, which is beneficial to farmers.

What has been done
Two Extension publications and two presentations relating specifically to CAMM were made at conferences.

One research bulletin is being processed for publishing and dissemination dealing with responses to male pheromones in drosophila melanogaster. One journal article was published.

Results
New technical publications based on CAMM projects:
Massey, H.F., J.P. Chastain, T.O. Owino, R.F. Polomski, and K.P. Moore. 2011. Chemical and Physical Properties of Potting Media Containing Varying Amounts of Composted Poultry Litter. Presented at the 2011 ASABE Annual International Meeting. Paper No. 1110935. ASABE, 2950 Niles Rd., St. Joseph, MI 490859659.

Chastain, J.P. 2011. Hindered Settling of Animal Manure. Presented at the 2011 ASABE Annual International Meeting. Paper No. 1111188. ASABE, 2950 Niles Rd., St. Joseph, MI 490859659.

CAMM Presentations during conferences:

Chastain, J.P., and W. Ferreira. 2011. Does Production of Fuel Crops to Make Biodiesel Provide An Opportunity for Animal Producers? Presentation at Southern Region Water Conference Innovations and Partnerships for Clean Water, September 1316, The Georgia Center, Athens, GA.

Chastain, J.P., H.F. Massey, T.O. Owino, R. F. Polomski, and K. P. Moore. 2011. Chemical and Physical Properties of Potting Media Containing Varying Amounts of Composted Poultry Litter. Presentation at Southern Region Water Conference Innovations and Partnerships for Clean Water, September 1316, The Georgia Center, Athens, GA.

Scott D., Shields A., Straker M., Dalrymple H, Dhillon PK, et al. (2011). Variation in the Male Pheromones and Mating Success of Wild Caught Drosophila Melanogaster. PLoS ONE 6 (8): e23645. doi: 10.137/journ.pone.0023645.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #2

1. Outcome Measures

Number of people reporting increased knowledge

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	5310

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Extension program aims to improve the 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

Some 7,126 people participated in Animal Production Systems programs. The Clemson Bull test received funding for a new Grow Safe feed monitoring system which allows the measurement of feed efficiency in the testing program. The Clemson test will remain a conventional grain/byproduct based feedlot test in coming years.

Producers and community members were concerned about healthy animal production on the small farms. Producers and community members, also, had questions about herd health management, breeding, pasture management, animal sales and making a better profit. In an effort to assist the community with improving the overall quality of the meat production within the farming community, the 1890 Extension staff, in collaboration with a Cooperative, held workshops addressing herd health management and best farming practices. One workshop dealt with rotational grazing, soil fertility and implementing forages and legumes to allow grazing throughout the year.

Programs such as Master Cattleman classes were offered in Clemson and the Pee Dee region via polycom. Beef Quality Assurance certification is offered as an optional program at this Master Cattleman series; the Grass Masters program, a fee-based seminar series covers the basics of forage selection, establishment, and management. Basic concepts of rotational grazing are also covered along with weed management; goat and sheep seminars were attended by producers from across the state; Extension specialists continue to work with producers in developing cost management strategies for rations, budgets and other input costs; multiple on-farm demonstrations are in place to demonstrate controlled grazing, improved forage varieties, novel legumes etc. We also assist with youth programs by giving livestock management information and help with managing youth livestock activities;Confined Animal Manure Management (CAMM)trainings/recertifications were conducted.In addition, specialists presented to poultry, dairy, cattle producers for CAMM on Biosecurity, Foreign Animal Diseases & Business Continuity. Presentations on SC Ag Watch, including AgroTerrorism, Biosecurity. Specialists taught National Guardsmen for Ag Development Training in Afghanistan. Specialists conducted presentations to explain upcoming changes on laws for farm vehicles, to educate producers regarding the national weather service program, and for an emergency pet sheltering drill. They developed a demonstration project on using natural, closed cell foam insulation for improving the energy efficiency of animal production facilities, and provided onsite assistance on ventilation and cooling of an animal production facilit; evaluated a broiler farm to test air-to-air heat exchanger technology. Beekeepers Association meetings were conducted on the topic of bee genetics and morphology research.

Results

Over 73% reported gained knowledge. Producers reported improved breeding, health and reproduction methods. They implemented recommended grazing management systems. Eighteen producers marketed 932 calves in truckload lots. All calves were vaccinated for respiratory disease, preconditioned for a minimum of 45 days and were source and age verified through USDA Process Verified Program (PVP). Of the 1,010 calves sold, 681 were sold directly off farm and 329 were sold in commingled truckloads comprised of cattle from small farmers. Cattlemen selling on the commingled loads averaged 22 head per farmer, allowing small producers the opportunity to maximize profitability by selling in truckload lots. This year source and age verified

truckload lots sold for $0.11 per pound more than traditional weekly livestock auctions resulting in $78,780 in additional income for area cattle farms ($4,376 per farm).

Bulls at the Clemson Edisto REC are actively grazing small grains/ryegrass pastures and have gained well 28 days into the official test. Interest in this forage only program continues to grow and consignment costs continue to be about 60% lower than in previous years.

Some 1,231 CAMM producers attended the re-certification trainings, each obtaining 2 hours of credit for this year. 100% reported knowledge gain.

As a result of the 1890 workshops, 59% of the participating members planned to put in place the knowledge and skills gained from the workshops. Of the identified percentage total, 15% have scheduled de-worming and rotational grazing as well as used a higher quality of grazing pasture. Ninety percent of the producers who received training planted annual forages, legumes and small grains to reduce their hay requirements, increase animal growth rate and increase profitability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

It was determined that the work in forage-fed beef had the potential currently to benefit approximately 10% of the growers in the state, based on that product capturing 10% of the market, regionally.

Bulls at the Clemson's Edisto REC are actively grazing small grains/ryegrass pastures and have gained well 28 days into the official test. Interest in this forage only program continues to grow and consignment costs continue to be about 60% lower than in previous years.

After providing educational information to farmers, they were able to plant winter annual forages, legumes and small grains to reduce their hay requirements, increase animal growth rate and increase profitability.

Knowledge about genes that control receptivity to mating and pheromone perception in fruitflies provided information about pest species such as mosquitoes and facilitate development of nontoxic pest control measures. The information from fruitflies could also be applied to Dipteran agricultural pests and reduce the necessity for toxic pesticide use by farm workers. The information from fruitflies could also be applied to Dipteran agricultural pests, and reduce the necessity for toxic pesticide use by farm workers. The information from fruitflies could also be applied to Dipteran agricultural pests, and reduce the necessity for toxic pesticide use by farm workers. The information from fruitflies could also be applied to Dipteran agricultural pests, and reduce the necessity for toxic pesticide use by farm workers. The information from fruitflies could also be applied to Dipteran agricultural pests, and reduce the necessity for toxic pesticide use by farm workers.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Agriculture Production for (non-food) Horticultural Crops

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	10%	0%
202	Plant Genetic Resources	20%	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	10%	0%	20%	0%
601	Economics of Agricultural Production and Farm Management	5%	0%	5%	0%
	Total	100%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	22.0	7.0	9.3	3.0
Actual Paid Professional	24.0	0.0	5.6	0.0
Actual Volunteer	5.0	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**
787391	0	563879	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
787391	0	930414	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

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.

New management strategies for insect pests of cotton have saved South Carolina cotton producers millions of dollars and resulted in additional profit due to optimal timing of insecticide use. Results from research to develop treatment thresholds for bollworm in transgenic cotton suggest that available transgenic technologies will likely require different pest management strategies.

New methods developed for detecting pathogens in plants, soil, and water are being used for national regulatory issues involving the organism that causes Ramorum blight on numerous ornamental plant species shipped all over the country and Sudden Oak Death in the coastal forests of California and Oregon and. These new strategies should enhance detection of this quarantined pathogen and limit its spread and ultimately result in improved plant health, increased profitability for ornamental crop producers and retailers, and more sustainable landscapes and forests.

Turfgrass researchers have determined that by switching golf greens to bermudagrass, from bentgrass, a golf course can realize a $7,000 savings in maintenance costs per acre. Work continued to determine BMPs for growing desirable turfgrassses with minimal inputs to support the SC golf course industry.

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.

In Extension, programs such as Turfgrass and Landscape Maintenance, Professional Turf School, Tree Planting, and designing and constructing sustainable landscapes were conducted. Meetings were held with the Southern Region Integrated Pest Management group to discuss a smart-phone app that the group is developing. Agents conducted media programs and made information available through websites.

Research focused, using techniques available through biotechnology, on ways to eradicate, contain and manage viral diseases impacting fruit in SC as well as increaseing the capacity to manipulate and control pest species such as the fruitfly.

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 investigated the dispesiral of L. serricorne among habitats by defining food resource use pattern and dietary history.

2. Brief description of the target audience

The audience will include producers, small farmers and Extenson 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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13382	1742809	103	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	13	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2012	1

Output #2

Output Measure

- Licenses

Year	Actual
2012	0

Output #3

Output Measure

- Number of people completing horticultural educational workshops

Year	Actual
2012	13382

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

Year	Actual
2012	2839

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
Master Gardener and Jr. Master Gardener trainings were conducted. Master Gardeners received certification and contributed service in their communities. One example of MG activities was work done by the Lexington County Master Gardener Volunteers. They designed and installed an educational memorial garden at the Lexington County Extension Office for the purpose of beautifying county property, educated the residents of Lexington County about horticulture by labeling plant material, and remembering those LCMGV who have faithfully served the South Carolina Master Gardener Program in Lexington. Other MG projects included collecting and sending out weekly soil samples, conducting plant clinics, native plant tours, and school garden programs.

Clemson Extension and The City of North Charleston, Department of Recreation partnered with support from SCDHEC/ACHIEVE/ Keep North Charleston Healthy, completed the installation of three community gardens in North Charleston. A Junior Master Gardener Club was started in October. Students have applied the knowledge that they have learned about plants that grow in the Charleston area. They hand delivered 60 potted plants that they painted to Twin Oaks Nursing Home patients and entertained patients. During the Carolina Yard and Animal Tour, students painted bird houses and pots for Carolina Yards. Students now have three community gardens in North Charleston. A fall crop of lettuces, broccoli, mustard and herbs was planted on September 9th, the National Day of Caring with the help of Trident United Way volunteers. The community garden has provided vegetables for students at each JMG meeting and community members continue to harvest for their use.

Results
Master Gardeners reported adopting sound horticultural practices and they are improving their communities through beautification projects and community service. Some 57,525 hours of service was contributed, which represents a value of $1,035,450 in program support.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	12851

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 1,696 horticultural programs were conducted reaching 13,382 persons. Programs this year included Turfgrass and Landscape Maintenance, Professional Turf School, Tree Planting, and designing and constructing sustainable landscapes. Meetings were held with the Southern Region Integrated Pest management group to discuss a smart-phone app that the group is developing. Agents conducted trainings for Master Gardeners and community organizations.

A total of 12,672 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.

In addition, South Carolina growers produced a cotton crop valued at $211,848,000. Over 40,000 acres of sod and nursery/field grown floriculture were affected by Extension programming. A Tobacco Research and Demonstration Plot Tour was conducted during the summer.

Results

Of the 13,382 persons participating in horticultural programs, 96% reported a gain in knowledge. In addition, 176 people were certified as new Master Gardeners.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

- Economy
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Local government and non-profit partnerships created)

Brief Explanation

Clemson Extension and the North Charleston Department of Recreation partnered with support from SCDHEC/ACHIEVE/ Keep North Charleston Healthy. .... .

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Of the 13,382 persons participating in horticultural programs, 96% reported a gain in knowledge.

Key Items of Evaluation

Turfgrass researchers have determined that by switching golf greens to bermudagrass, from bentgrass a golf course can realize a $7,000 savings in maintenance costs per acre .

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Water Quality and Water Quantity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	30%	0%	35%	30%
112	Watershed Protection and Management	20%	0%	20%	20%
131	Alternative Uses of Land	0%	0%	15%	20%
133	Pollution Prevention and Mitigation	30%	0%	30%	20%
134	Outdoor Recreation	20%	0%	0%	10%
	Total	100%	0%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	1.0	3.3	1.0
Actual Paid Professional	13.0	0.0	4.1	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
388471	0	295146	204282
1862 Matching	1890 Matching	1862 Matching	1890 Matching
388471	0	334049	102142
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.

Researchers have developed remote monitoring and real-time data acquisition technologies that 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 environmental impacts. It also could be possible to meet the challenge of producing adequate and healthful food, and to enhance energy production through biofuels. Based on the patented Intelligent River™ research, the technology is being adapted and transferred to create Intelligent Farm, Intelligent Forest and Intelligent Aquaculture applications. This technology consists of a hardware/software infrastructure engineered to support real-time monitoring and management of natural resources across large spatial and temporal scales.

The fate of metals and pharmaceuticals in aquatic ecosystems has been a topic of ongoing research. It has been determined that the antidepressant Venlafaxine causes 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 that is able to accurately predict the toxicity of copper in various water scenarios. The US EPA and several states are now using this tool 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. The research identified 301 sites in three upstate South Carolina counties that demonstrated sediment pollution and carbon transport.

An 1890 Research Project completed its findings on the groundwater radionuclides in the Edisto River Basin in South Carolina. The researcher built up an environmental laboratory with the capability of measure natural radionuclides including U-238, U-235, U-234, Ra-228, Ra-226, Ra-224, Ra-223, Rn-222, Rn220, Ac-228, Po-210 and artificial radionuclides including I-131, Cs-137, Sr-90, H-3, etc. A full fledge environmental laboratory was established for the study of the radionuclides in air, water and soil in the environment. The lab and the research activities helped promote the well-being of the local citizens and protected the natural environments of South Carolina.

Twenty-two undergraduates majoring in Chemistry/Radiochemistry, Chemistry, Biology, and Nuclear Engineering worked on the project. The students gained experience by taking part in research activities: going to field samplings, composing reports and presentation slides and presenting at conferences more than 20 times. The experience they gain in the activities was significant to their academic careers and pursuing advanced degrees.

Over 60 well water samples were collected from the Edisto River Basin with the help of the personnel from SCDHEC and OC Tech College. The volume of the groundwater samples from each well was 60 liters. Therefore, in last three years, over 100 hours were spent in the field and sampled about 3600 liter samples of groundwater in the Edisto River Basin. About 85% of the groundwater samples were

collected from private wells, while the rest were from public wells. At the conclusion of the research, a bulletin was produced to capture all of the work involved in the study.

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	17302	498585	0	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	13	13

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2012	1

Output #2

Output Measure

- Licenses

Year	Actual
2012	0

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual
2012	15092

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
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	14921

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Water resources are vital to communities in South Carolina, especially in tourist regions. While water resources seem to be abundant in these regions of the state, many of the rivers and beaches are suffering from impaired water quality largely from non-point pollution from urban runoff. This program will promote the use of Best Management Practices for water quality and quantity.

What has been done

Some 485 programs were conducted reaching 15,092 people. Over 6,000 different forms of water quality and stormwater educational materials have been developed and distributed throughout Horry and Georgetown counties, which included educational posters, postcards, magnets, the new CWSEC website and Carolina Clear Frisbees. From Seeds to Shoreline (S2S) is a school program in which students learn about the saltmarsh ecosystem and actively contribute to saltmarsh restoration efforts.

Results

Of those persons completing programs, 14,921 (99%) gained knowledge. The municipal attendees indicated that the information they acquired will be used in amendments to regulations, practices, and zoning ordinances.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
134	Outdoor Recreation

Outcome #2

1. Outcome Measures

Number of people using practices learned

2. Associated Institution Types

- 1862 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	7101

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the US Environmental Protection Agency nonpoint source pollution or stormwater pollution, is the leading threat to water quality in the United States. Most people are not aware of the cumulative impacts that their waste can have on water quality in their community and downstream.

What has been done

In efforts to educate residents about stormwater pollution, the Carolina Clear program coordinated events such as workshops and demonstration projects, including rain water harvesting, green car wash campaigns, beach and river sweeps, and storm drain marking. Agents and Master Gardener volunteers conducted rain garden workshops to help York County communities meet EPA stormwater mandates called 1000 Rain Gardens of York County. The goal is to certify 1,000 rain gardens.

Results

One river sweep resulted in 620 pounds of trash collected. Seven rain gardens have been certified so far. Over 175 storm drains were marked by students to indicate pathways leading directly to our ocean. Hopefully the markings will prevent people from littering in these areas.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

Support was gained from the South Carolina Sea Grant Consortium, the S. C. Department of Natural Resources, the Ocean Conservancy's International Coastal Cleanup and the City of Sumter.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Of those persons completing Extension programs, 14,921 (99%) gained knowledge.

The groundwater radionuclides project created an environmental laboratory with the capability to measure natural radionuclides including U-238, U-235, U-234, Ra-228, Ra-226, Ra-224, Ra-223, Rn-222, Rn220, Ac-228, Po-210 and artificial radionuclides including I-131, Cs-137, Sr-90, H-3, etc. A full fledge environmental laboratory was established for the study of the radionuclides in air, water and soil in the environment. The lab and the research activities helped promote the well-being of the local citizens and protected the natural environments of South Carolina.

Twenty-two undergraduates majoring in Chemistry/Radiochemistry, Chemistry, Biology, and Nuclear Engineering worked on the project. The students gained experience by taking part in research activities: going to field samplings, composing reports and presentation slides and presenting at conferences more than 20 times. The experience they gain in the activities was significant to their academic careers and pursuing advanced degrees.

Over 60 well water samples in the Edisto River Basin were collected, with the help of the personnel from SCDHEC and OC Tech College. The volume of the groundwater samples from each well was 60 liters. Therefore, in last three years, over 100 hours were spent in the field and sampled about 3600 liter samples of groundwater in the Edisto River Basin. About 85% of the groundwater samples were collected from private wells, while the rest were from public wells.

The analysis of Rn-222 radioactivity in all the groundwater water samples was carried out. RAD7 and Liquid Scintillation Analyzer (Perkin-Elmer) were used to conduct the radioactivity counting. The radon activity in groundwater ranges from 50 to 2960 pCi/L in

the Edisto River Basin, SC. The groundwater radon radioactivity in the Edisto River Basin was generally as low as that in the city water. However, isolated wells with high radon radioactivity were found also in Pomaria, Cordova and Branchville.

Conducted the measurement of the detection efficiency of the RaDeCC systems for Ra-224 and Ra-223 radionuclides. It was found that the Ra-223 efficiency measured with the MnO_2-fibers absorbed with Ac-227 decreases slowly with time. While the Ra-224 efficiency measured with the MnO_2-fibers with Th-232 maintains constant in a period of 1 and 1/2 year. The decrease of the Ra-223 efficiency with time was considered due to the backscattering accompanied with the alpha decay. A unique sample with Ac-227 electrodeposited onto a stainless steel planchet was prepared and tested to verify the theory. It was found that the Ra-223 efficiency of this sample does not decrease as quickly as the Mn-fiber sample, indicating that backscattering theory is correct.

Conducted the analysis of basic properties such as temperature, pH, alkalinity, hardness, [Cu2+], [Fe3+], [Cl-], [NO3-], [SO42-] in all the groundwater samples. Counted the radioactivity of Ra-223 and Ra-223 in all the groundwater samples with the RaDeCC systems. The MnO2-fibers samples were leached with hydroxylamine hydrocholoric acid and precipitated with barium nitrate for the further gamma analysis of Ra-226 and Ra-228. All the groundwater samples were submitted for ICP-MS analysis at USC. The contents of heavy metals including U-238, U-235, Hg, Zn, Cd, Pb, and Ti were measured.

About 20 L of water from each well was passed through cation/anion exchange resins to collect radioisotopes for gross alpha/beta analysis. It was discovered that the loaded resin can be turned into a very small amount of ash, which facilitates for the gross alpha/beta to investigate the contents of artificial radionuclides such as H-3, Sr-90, and Cs-137.

Completed the separation of radioactive black minerals from the natural sand samples found in in Red Bank Park, Lexington County, SC. The sand particles were separated by size and density. The black mineral particulates separated from the sample shows a radioactivity of several hundred times higher than that of original sample. The sample was first separated into different size by sieves with the mesh size of #80, #120, #200, #230 and #270. Then, the black minerals were separated with Cleric solution for multiple times. A portion of the particles with even higher density than the black minerals were further separated and named heavy sand. The densities of the heavy sand, black mineral, and normal sand are >4, ~3.5, and 2.7 g/ml, respectively. From the microscopic view, the initial conclusion is that the radioactive mineral particulates are silica crystals tinted with heavy metals including U and Th. While the normal sand particulates are mostly silica crystals. This is the reason the black particles were so radioactive.

The separated sand samples were further analyzed by scanning electron microscopy. The results showed normal sand is mostly made of SiO2. Black mineral particles have high contents of Ti and Fe. The heavy sands were a mixture silicon oxides and platinum oxides. In addition, some sand particles were mixtures of many rare earth, thorium and uranium elements. This type of sand particles should make the major contribution to the radioactivity of the sample.

The sand samples were also analyzed by RAD7, which can measure the evolution of radon gas from the sample using silicon barrier detector. A special setup was built to conduct the measurement. Both Rn-222 and Rn-220 were observed in the samples. All

the data was summarized in tables.

Key Items of Evaluation

It has been determined that the antidepressant Venlafaxine causes fish to reduce food consumption, which is significant since the drug is a common contaminant in surface waters impacted by domestic sewage effluents.

Overall, the survey service from the groundwater radionuclides was designed to measure the radon gas levels in the indoor air and drinking water at homes and help people understand the hazardous properties of radon gas. Eventually, 15 homes were surveyed and results sent together with a pamphlet on the knowledge of radon gas and protection methods. Both the public and project benefited from the activity.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
503	Quality Maintenance in Storing and Marketing Food Products	5%	15%	5%	10%
703	Nutrition Education and Behavior	30%	30%	30%	30%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	30%	15%	30%	25%
723	Hazards to Human Health and Safety	30%	15%	30%	25%
724	Healthy Lifestyle	5%	25%	5%	10%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	3.0	4.2	2.0
Actual Paid Professional	4.0	2.5	2.9	2.5
Actual Volunteer	5.0	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**
387679	89866	164449	457963
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
387679	44934	315064	228982
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

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. Food-borne illnesses were defined and conditions discussed that encourage bacteria growth. Most common food-borne pathogens, additives, preservatives and basic kitchen safety techniques were taught. Participants increased knowledge and skills in safe handling of food. Managers and supervisors were certified to train food handlers in safe food handling techniques. Food handlers practiced safe food handling techniques. Specialists assisted in the development of new food businesses.

Research is proceeding on the DNA of a bacterium widely used as starters in yogurt and cheese. By understanding its genetic characteristics of this bacterium, scientists can improve the commercial usefulness, such as fermentation rate, flavor and sweetness.

Experiments with cottage cheese showed that as the numbers of bacterium increased, the numbers of spoilage organisms decreased. The results indicate that bacterium could help control spoilage in cottage cheese, potentially extending its shelf life. Related research also may lead to health benefits. Unlocking the genetic code may uncover DNA fragments that can be used to make proteins that attack bacterial infections. The proteins, called bacteriocins, are potentially more effective than antibiotics. Disease-causing bacteria can become res. Finding ways to make food healthier, safer and less expensive is a priority around the world. Clemson research in this area can benefit both food producers and consumers.

During the 2011 - 2012 reporting period, 1890 Extension EFNEP was being restructured. The program is a nutrition education program that focuses on simple messages related to food and nutrition. It gives participants an opportunity to apply new information through interactive activities. A food sampling, small incentive and physical activity are included with each lesson.

1890 Research is finalized on the development of nanomaterials based sensors of unusual non B-form DNA with emphasis on DNA sequences that are implicated in human diseases. Synthesized colloidal semiconductor nanomaterials were activated by cationic surface groups and characterized spectroscopically. The research was very productive resulting in the development of quantum dot biosensors with demonstrated capabilities of selectively sensing the unusual DNA structures implicated in a number of neurodegenerative diseases, as well as a normal double stranded DNA sequence. The quantum dots were synthesized by "Arrested Precipitation" technique, by the reaction of cadmium nitrite with sodium sulfide in presence of sodium polyphosphate at a pH of 10.3. The synthesized quantum dots were surface activated with zinc, magnesium and cadmium cations. All quantum dots were characterized by UV absorption spectroscopy and by Transmission Electron Microscopy(TEM) for size. The DNA structures selected, because of their relation to neurodegenerative diseases, were, stem looped, cruciform, and tetraplex DNAs. Disorders Caused by Stem-Looped DNA:Schizophrenia, Cornelia de Lange syndrome, FG syndrome. Disorders Caused by Cruciform DNA:Bloom's Syndrome, Werner's Syndrome, Fanconi Anemia(FA). Disorders Caused by Tetraplex DNA: Huntington's Disease, Mytonic Dystropy, Fragile X Syndrome. A research bulletin was prepared documenting the findings.

Also, for this reporting period, two more food safety research projects were added. One project studies the determination of the presence of food-borne pathogens in poultry products to enhance food safety in Orangeburg County, while another project looks at the development of a food safety laboratory

meat. Project I: two objectives are: 1) Build the infrastructure for a food safety laboratory designed to conduct investigations on the presence of food-borne pathogens in poultry and meats. 2) Develop a novel and cost effective approach to control bacterial contamination in poultry and meats, by using a number of antimicrobial treatments such as ozone, probiotics and their combination. One graduate student and three undergraduate students were hired and trained to work on the project. Equipment was purchased and set up in the laboratory. Paperwork was submitted to purchase the Ozone Generator. Start-up supplies were ordered and received as well as poultry and beef samples. Experiments were performed to test the effects of lactic acid (a byproduct of probiotics) on the growth of E. coli. Project II: Investigates the prevalence, antibiotic resistance susceptibilities and use of biotechnology for quick detection of food pathogens on retail poultry products from retail frood stores with the Orangeburg County Area. Supplies and equipment were purchased to start the research project.

Another 1890 Research Project was designed to examine the effects of three different resistance exercise regimens on the diabetic profile of a Type 2 diabetes mellitus patient. The researcher used innovative signal processing techniques to study kinetic patterns of muscular fatigue. The overall project goal is to reduce the incidence of and/or better the handling of the disease diabetes mellitus. Specifically, the researcher will attempt to investigate whether the type of resistance exercise a person trains with will significantly attenuate diabetes complications and/or quality of life for the diabetic. A series of pilot data collection sessions were conducted to determine the learning curve required with the exercise equipment. Also, the studies will help discover appropriate effect size and sample size determination.

2. Brief description of the target audience

The target audience includes community leaders, agencies, policy makers, general public, , 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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1295	1949114	476	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	1	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Licenses

Year	Actual
2012	0

Output #2

Output Measure

- Disclosures

Year	Actual
2012	2

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual
2012	1713

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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1050

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 agents conducted educational programs for the general public reaching 1,126 adults. Carolina Canning is an example of an educational program that equips consumers with science-based knowledge to produce safe, high quality canned, dried, or frozen foods. Extension staff members have recruited experienced home canners as volunteer Canning Coaches and have developed training materials to update their knowledge so they can provide or assist with home food preservation programs. Forty-three volunteers from 23 counties currently have been trained as Canning Coaches. A 4-lesson canning curriculum tailored to South Carolina?s specialty crops (but broadly applicable to other foods) has been produced. Workshops have been marketed by multiple means including a new Facebook page. Food Safety & Nutrition agents have delivered 47 hands-on canning workshops to audiences that included 438 members of the general public, youth and limited resource individuals.

Food Safety media activities were conducted, which included newspaper, magazines, other external publications and radio and television.

Results

Of the adults participating in the educational programs, 93% reported a gain in knowledge. Food Safety and Carolina Canning web activity: http://www.facebook.com/carolinacanning http://www.facebook.com/#!/pages/Food-Safety-Nutrition-and-Health- http://www.clemson.edu/extension/food_nutrition/canning/index.html

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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	243

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 243 food service employees received a course completion certificate, representing 110 food establishments. These food handlers can potentially affect thousands of 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 $8,250,000 by preventing outbreaks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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)

Not Reporting on this Outcome Measure

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

Year	Actual
2012	28

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 process development, including HACCP planning. 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

Twenty-eight new or improved food products were analyzed and entered the market as a result of adopting recommended practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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

- Economy
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The purchase of the Ozone Generator had to be submitted through the University bidding process. Awaiting process to be completed

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Based on questionnaires and evaluations, participants' preservation of local fruits and vegetables will increase and they now have the knowledge to preserve South Carolina food products safely.

Three research projects are in their infancy stage. One 1890 research bulletin was published. The researcher was invited to, and has given a lecture on the research work at the 34th Annual Conference of the Bangladesh Chemical Society held in Dhaka, Bangladesh. Also, a research poster was presented at a Undergraduate STEM and Behavioral Science Research Symposium. The poster was awarded the third place prize. An informative poster including research findings on neurodegenerative diseases was developed for the general public.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Community, Leadership, and Economic Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	14.0	5.0	3.0	2.0
Actual Paid Professional	15.0	6.0	3.0	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**
503232	255823	173565	478421
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
503232	127911	164013	239211
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

Currently, a highly toxic antifouling coating dominates the world market to protect marine ship hulls from adhesion of oyster and barnacle larvae. Researchers have developed new test coatings that demonstrate the ability to deter the adhesion of both types of larvae, using a non-toxic naturally occurring compound. This research has the potential to place a new technology on the market and make a significant contribution to the environmental quality of the world's seaways.

Research is underway to investigate the biology, ecology, colony relatedness, geographic range and control of the invasive species Pachyondyla chinensis, the needle ant. The venom in the sting causes a broad range of allergic reactions from hives to anaphylactic shock. This species has been documented in Virginia, North and South Carolina, and Georgia, and unpublished records exist for Tennessee and Alabama. Research discovered that the ants prefer protein as a food source more than carbohydrate or lipids, which will be valuable in selecting bait products.

Extension's Institute for Economic and Community Development staff supported the state and local agribusiness community. They facilitated projects under the Pee Dee Agritourism initiative such as establishing and maintaining the Conway Farmers Market Association (CFM) and organizing the coastal farm-to-chef initiative focused on the distribution of local agriculture products in coastal restaurants. A local food guide was developed for the CFM. Work in this area also included an economic impact of agriculture and forestry for selected counties in the state and analysis of the direct contribution by major agribusiness sector separately for all 46 S.C. counties. The CIECD staff worked with local agents to provide workshops and support for numerous businesses seeking USDA-Rural Development and other sources of funding with an emphasis on agriculture in places such as Lower Richland County. For example, we have assisted numerous agricultural producers with energy and value added agriculture grants and rural communities with facilities grants.

The 1890 Adult Leadership and Economic Development Program provides individuals and communities with technology enhanced personal and professionaldevelopment, leadership training, financial management, small business development and family and consumer education. Within the Community, Leadership and Economic Development Program, three activities are conducted; Introduction to Keyboarding, Money and Business Entrepreneurship (MBE) and Technology Education. The keyboarding class teaches basic computer skills to the community residents. Participants gain computer knowledge through hands-on experience at a guided pace. The Technology Education project promotes computer literacy, internet safety and knowledge to youth and adults through the use of technology, instructional aides and evalautions. MBE motivates students to succeed in school and in life by taking advantage of their educational opportunities and starting their own business. The project teaches

students: business planning, economices, legal structure, financial literacy, negotiation, presentation and marketing skills.

In 1890 Research, data about the influence of the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) of 2005 was collected. US and the District of South Carolina bankruptcy filings were compiled from surveys, interviewing bankruptcy filers, attending court proceedings and retrieving bankruptcy data from the Public Access to Court Electronic Records (PACER) system on lion. A lot of raw data collected over the life of the project was analyzed and its patterns and trends assessed. Data groups gathered included loss of jobs, medical bills, mortgage problems and credit cards, as well as other consumer debts. It was clear medical expenses caused most of bankruptcy filings. It was observed that filings were going up steeply until the law was implemented on October 17, 2005. Then, filings plummeted in 2006 and 2007. After those two years, filings began to inch up. But had not reached pre BAPCPA levels by 2011. A research bulletin was published as a result of the findings as well as papers and presentations.

Another 1890 Research Project determines the economic impact of changes in domestic and international trade policies on the competiveness of Southern agriculture, as well as the economic impact of international institutions (WTO, IFM, World Bank, free trade agreements on the competiveness of Southern agriculture. The researcher specified and estimated a Generalized Gravity Model of international trade for the following vegetables: melons, beans, soybeans, tomatoes, cucumbers and potatoes. The models were adjusted to account for the unique characteristics of vegetable production, exports and trade. The econometric techniques of random and fixed estimation models required for panel data analysis (RATS, 2009) were used. The models were used to compute potential import trade creation and export diversion effects. As a result, the researcher identified economic and noneconomic factors affecting the flows of trade in the above vegetables; has evaluated the impacts of the exchange rate volatility on flows of specific vegetables; and has addressed and separated the impacts of short term exchange rate volatility from the effects of long term exchange rate volatility.

The impact of changes in trade policy affecting the crops should be timely known to the farmers, trade officials and policy makers. The factors affecting trade flows in the vegetables and fruits have been identified. The impact of exchange rate volatility is a hotly debated issue. Empirically, some answers are provided related to the effects of exchange rate uncertainty of vegetable trade. Also, the impacts of both short and long run exchange rate changes on the vegetable trade flows were addressed. Multistate research would help agribusiness and agricultural economists share more efficient research methods and results. The information would be beneficial and useful to agricultural producers, policy makers and trade officials, farmers, agribusiness leaders and rural communities. A comprehensive database was set up. The database and trade matrix can be re-estimated and results updated when new data is released. The aim is to create a depository vegetable trade data matrix with impacts of free trade agreements and period updates.

1890 Research is examining the distribution of municipal services in small towns in South Carolina. It focuses on public services that small towns generally provide. This includes basic public infrastructures like roads, streets and water and sewer systems. Public services include law enforcement, fire protection, recreational facilities, and sanitation services. The services and facilities are offered to all community residents. The study seeks to discover the environmental and political determinants of local officials' responsiveness to group demands, mayoral leadership, and local officials' perception of the distribution of public services. As such, the study employs five environmental variables: town size, per capita income, class composition, educational attainment, and racial diversity and nine political variables; party competition, election method, form of government, voter turnout, group organizations, racial diversity on city council, and participation in public hearings. A refined Nvivo database with both city council meeting minutes and documents for five city governments and an undated Endnotes database with more recent articles on municipal services, small towns and urban politics and public policy were

prepared. During this period, the content analysis of the minutes and the coding system was developed for the questions for the interviews to be conducted with municipal officials and community activist in small towns in South Carolina. 151 documents from the Municipal Association webpage were imported. The census data for the cities in South Carolina have been expanded and updated. The number of articles in the database have been increased.

1890 Research is focusing on small scale agribusiness enterprises and aims to improve the state's export competitiveness by examining the factors that hinder the ability of the businesses to export, as well as the adequacy of extant federal and state export assistance. The main goals of the project are: to formulate an improved export model for each county in South Carolina and to develop a set of best practices for potential agribusiness exporters; to increase the export competitiveness of South Carolina's agribusiness enterprises by identifying and lowering barriers to trade; as well as to increase capacity at SC State University by increasing student and faculty participation in research activities. To date, an initial survey instrument was developed based on the literature and established scales. A list of agribusiness exporters of South Carolina was acquired from the Department of Commerce. A judgment sample of 50 firms was drawn from the population of South Carolina's agribusiness exporters to test the instrument. Representatives from 20 agribusiness export firms were consulted through a structured interview method to test the survey instrument. The survey was refined and mailed to 50 export firms representing all counties in South Carolina.

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	8918	617725	1029	60

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	6	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications, business plans and housing grants

Year	Actual
2012	2

Output #2

Output Measure

- Total number of people completing educational workshops

Year	Actual
2012	7304

Output #3

Output Measure

- Number of board members trained

Year	Actual
2012	38

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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	6298

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Community, Leadership and Economic Development (CLED) Program will promote engagement and community enhancement and improvement that are linked to community image, sustainable economic development and improved quality of life for the citizens of South Carolina.

What has been done

CLED regional agents worked closely with state Extension specialists, practitioners, and researchers to provide expertise in topics ranging from agribusiness and other leadership development, to strategic planning, 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. Palmetto Leadership, Senior Leadership and Junior Leadership programs were conducted. Palmetto leadership programs were conducted at the county level in cooperation with either local county governments, such as in Dillon County or local chambers of commerce. The Institute for Economic and Community Development staff working with a group of Clemson Undergraduate Students conducted several strategic planning sessions and surveyed community members in the towns of McClellanville resulting in a group working to develop a green economy focused charter school and in Saluda County facilitated a strategic planning effort for local agribusiness development. We provided assistance to determine the economic impact of the Women and Children Succeeding (WACS) Program for Anderson Interfaith Ministries. A new community computer lab and classroom was opened in a poverty stricken area of North Charleston. So far, classes have been conducted for basic computer skills (in Spanish and English), English as a Second Language, Graduate Equivalency Degree (GED) and Work Key classes, and information technology (IT) skills. Over 1,000 individual users have signed in to the lab since its opening in March of 2012. This is the fifth such computer lab that has been opened in the area with the support of Clemson University Community and Economic Development Extension.

An outreach-based study was conducted concerning prescription drug abuse at several South Carolina high schools. This research will help support policy and outreach efforts working with State Department of Alcohol and Other Drug Abuse Services Epidemiology Outcomes Workgroup on a state abuse and treatment plan.

In response to the need for direct assistance in planning for certification audits for Good Agricultural Practice and Good Handling Practice, Extension collaborated with SCDA to develop an online Farm Food Safety Plan website @http://cufan.clemson.edu/GAP/ This site allows producers to use online tools to develop a Farm Food Safety Plan with the direct assistance of Extension personnel. A pilot program has also been established in the Charleston area working with a local produce farm in helping farmers become GAP certified.

Also,the 1890 Extenson Program conducted Yes Carolina, which is a money and business entrepreneurship camp for students in 5th and 6th grades. The 20 students learned various aspects of entrepreneurship decision making, finance, economics, negotiation, marketing and public speaking. Pre-test, mid-term and post-test were conducted.

Results

Working with a local non-profit group, our local agriculture agent and a local farm, CD agents helped to establish South Carolinas first farm incubator. Our CD agent is helping with farm layout, economic strategies, and entrepreneur education supporting this effort. 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. Over 99% reported knowledge gained as result of participation in Extension CLED programs. Participants reported that they strengthened their community awareness and ability to access community resources, built partnerships, and strengthened their capacity to respond to future issues and opportunities. Participants have a greater knowledge about the county in which they live and/or work including education, economic development, health care and social issues. The Palmetto Leadership program provides participants with a venue to give back to their community through a class service project experience. Participants grow their professional and personal networks. All participants engaged successfully in new collaborations for more efficient and effective community service.

Each student was able to utilized their learned skills by preparing business plans and opening their own business for the summer. An average of 75% increased in knowledge of money and business entrepreneurship skills, while there was an 88% improvement in negotiation follow by 82% financial decision making, 78% business legal structure, 75% marketing and 70% presentation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
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

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	838

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Adults and youth are interested in being safe, while using the Internet. SC Department of Education Standards based internet safety instruction benefits K5 - 12th grade students and adults of all backgroungs and levels of computer literacy through the use of technology, instructional aides and evaluations.

What has been done

SC Department of Education Standards based internet safety instruction was provided. All inclusive information on session topics such as "what is the Internet?", recognizing the difference between real and virtual, Internet etiquette, sharing personal information, scams, recognizing predatory behavior and identity theft were provided through the Cyber Safety 101 Project.

Results

A post-test of respondents surveyed (87.3%) answered they should never post or give out any personal information over the Internet. The post-test also revealed 88.8% of the respondents answered they should never meet any of their Internet friends in person.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #4

1. Outcome Measures

Number of participants engaged in community promotion projects

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	69

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Community, Leadership and Economic Development (CLED) Program will promote engagement and community enhancement and improvement that are linked to community image, sustainable economic development, and improved quality of life for the citizens of South Carolina.

What has been done

Some programs that were conducted include: Community Pride strategic planning, Storm Drain Marking, Main Street Manning Promotions (Fall Fest, Snowball Drop, Roundtable on Bad Checks for Downtown Merchants), Promotions Training for the Pickens revitalization association, the coordination of a training, "Mid-Century Alterations to Historic Buildings," and assistance with clean campus grading for schools. Specialists developed a three to five year strategic plan for the Fine Arts Cultural Enrichment Teaching Studios. Agents assisted with the Military Gap Research Study on Youth and Prescription Drugs Risk Survey.

Working with the City of North Charleston, the Charleston, SC Linux Users Group (CSCLUG), SCLabs.org, Teleco Charleston, a local philanthropist, and ECPI, the Extension Agent, coordinated a new plan to create a public computer lab in the heart of the Latino community. The lab offers classes in Spanish for software use, English as a Second Language (ESL), and entrepreneurship. Within the first three weeks of opening, over 200 separate users have signed into the lab for general computer use. Our IT professionals (CSCLUG) now have a platform for

creative experimentation with computer and software systems. Tests and experiments are run on a near daily basis. Clemson has trained two classes of volunteers and has taught 6 regular Internet and document classes during the first three weeks of opening.

Results

Over 60 residents, who had no Internet access or computer experience, now have access to vast resources available on the World Wide Web. They are learning ESL and entrepreneurship. Communities interested in reaching out to the Latino population will find that working with Latino community leaders is a method to gain easier access to the people. Working with local Latino leaders, the City of North Charleston has asked Clemson University's Institute for Economic and Community Development to identify new strategies to help this formerly isolated community. In addition, the City has asked that we begin investigating a site for a new lab. The computers used in this lab would have been sent to a landfill. Instead, they are enriching the lives of people in formerly isolated communities. Businesses are reporting increased atendance during community events and responses from the public of improved community image.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Participants reported that they strengthened their community awareness and ability to access community resources, built partnerships, and strengthened their capacity to respond to future issues and opportunities. Participants have a greater knowledge about the county in which they live and/or work including education, economic development, health care and social issues.

Research bulletin, presentations and articles were published, developed and presented at various conferences, workshops, meetings, etc.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

4-H Youth Development and Families

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	5%	10%	0%	10%
802	Human Development and Family Well-Being	15%	20%	0%	15%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	30%	20%	0%	20%
806	Youth Development	50%	50%	0%	55%
	Total	100%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	16.0	0.0	2.5
Actual Paid Professional	31.0	15.5	0.0	1.0
Actual Volunteer	4.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
928459	690021	0	201565
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
928459	345011	0	100782
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.

The Youth and Family Development Program at SC State University provided youth with skills needed to become well-rounded students. The lessons covered included leadership, conflict resolution, stress and financial management, gardening, citizenship, healthy lifestyles, social skills and diversity. Also, programs were offered to adults that would assist them with their overall well-being. Some of the offerings included basic computer skills, nutrition information and opportunities for volunteering.

An 1890 Research project dealing with the effectiveness of community action research and professional development activities on classroom roles and partnerships of rural pre-service and in-service teachers was finalized. All participating teachers completed a Teacher Effectiveness Survey before training. The same scale was repeated at the end of training. The instrument was designed to determine the level of current knowledge of instruction the teachers brought to the setting. They were engaged in collaborative research and discussed digital video cases of exemplary activities in diverse rural settings. As a community of learners, all teachers were engaged in the following activities: 1) Developed culturally relevant lessons that included the use of the CARPD Intervention Model. Specific guidelines were required of teachers to describe evidence-based practices and activities including rural learners' needs, goals, assessment methods, resources and technology activities and their effects on rural low-achieving students in the I-95 Corridor Schools; 2) Discussed and applied classroom problems and also used the strengths and weaknesses of the solutions as community action research partners; 3) Used evidence-based instruction that created classroom artifacts related to skills, knowledge and dispositions using the Intervention Model; 4) Engaged in reflective discussion with partners to describe the group and individual experiences; and 5) Completed the Teacher Effectiveness and Teacher Utilization Survey.

2. Brief description of the target audience

The target audience includes:
a) All youth between the ages of nine and nineteen
b) All youth between the ages of five and eight
c) Parents and other adults interested in the development of South Carolina youth.
d) 30-44 parent and young adult
e) 45-64 Mature volunteer
f) 65+ Grandparent and Senior Volunteer.
g) Adult learners (college students)
h) Teachers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1006	498585	75959	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people participating in educational workshops conducted

Year	Actual
2012	75554

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.

Year	Actual
2012	1006

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 project 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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1006

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, 1006 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

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

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	7191

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. Youth were empowered to actively engage in their communities and the world through a series of workshops on leadership, self-esteem, 4-H and conflict resolution. Over 6,000 youth were served in a combination of 449 workshops and activities.

1890 Extension coordinated a Citizenship Program which implemented 6 activities that included basic life skills, leadership, character education, self-esteem conflict resolution and service learning projects.

Results

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

Eighty-seven percent of those in the 1890 Citizenship Program gained knowledge, while 71% indicated a willingness to adopt basic life skills principles and become a community leader among their peers. Several of the youth were involved in the Citizenship Washington Focus in Washington, DC.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
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

Year	Actual
2012	3146

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

Over 3146 youth provided leadership in service learning community projects.

Results

Examples of activities included: 4-H organized an effort for 123 girls to receive gowns and accessories to wear to prom, which was a saving of approximately $24,000 for parents. Another group sewed caps and baked and distributed 125 loaves of quick bread for the homeless. Youth also collected for and donated food to DSS. Youth in the Historical 4H club collected World War II stories from veterans for the Library of Congress. Five veterans shared their war stories.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

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

Year	Actual
2012	2305

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 694 Plants and Animals programs were conducted reaching 2,305 youth. Youth in Clemson Extension 4-H programs are involved in hands on nature based programs such as Jr. Master Gardener, 4-H20, Dairy Heifer, Livestock, Barrow, Swine, Sheep, Beef, Poultry, Gardening, Goat, Horse, Rabbit and other plant and animal projects.

Results

4-Hers, through the 4-H Small Garden Project, earned some extra summer cash by selling tomatoes and other produce they raised at a local produce market. They planted and successfully cultivated three heirloom tomato varieties. They gained valuable skills as they kept financial records and collected samples for soil analysis. The youth were able to experience gardening, from soil and seed and from the market to the table. They learned about their community and were contributing members of it.

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

KA Code	Knowledge Area
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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3347

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 in the 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

Youth and adults engaged in the engineering design process of renewable wind energy technology through a program made available through a partnership with Orangeburg and Calhoun 4-H, Orangeburg-Calhoun Technical School and Lake Marion High School Technology Center. In this three-part experiment, teams of youth designed and built their own wind turbines. Youth discussed energy consumption and ways to reduce dependence on traditional energy sources.

Results

Teachers noted that students increased their enthusiasm for hands-on science projects and their curiosity in other educational opportunities. As a result of the program, 88% of the participants stated they learned a new scientific concept.

4. Associated Knowledge Areas

KA Code	Knowledge Area

806 Youth Development

Outcome #6

1. Outcome Measures

Number of youth gain knowledge in nutrition and fitness

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	15972

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 1081 Nutrition, Fitness, and Safety programs were conducted reaching 15972 youth. Youth participated in programs such as Kids in the Kitchen, Healthy Lifestyles, Think Your Drink, 4-H Zest Quest; Back to School Bash Health Fair and 4-H Health Rocks. A Global Food Web Train the Trainer Program was coordinated with Pickens County Career Center's Ag Special Projects Class. The students will then go on to teach the program to elementary and middle school students.

Results

Ninety-four percent of the youth participating in 4-H nutrition and fitness programs reported that they gained knowledge and 74% stated they planned to implement the knowledge gained into their daily lives.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

Year	Actual
2012	3223

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 3,274 persons. Youth participated in hunting safety programs, natural resource clubs, Jr. Naturalists and Fisheries, Food and Cover Establishment for wildlife programs.

Results

Ninetly-eight percent of the youth participating in natural resource and shooting sports programs gained knowledge. 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

KA Code	Knowledge Area
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

Year	Actual
2012	1849

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

Fifteen programs were conducted reaching 1849 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. Youth researched various topics and presented information.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Based on evaluations conducted at the end of programs/activities, participants indicated a willingness to adopt Basic Life Skills principles and to become leaders in their communities among their peers. Survey Monkey evaluation tool was used to collect evaluation data.

As a result of the classroom roles and partnership of rural pre-service and in-service teachers research, a center was developed and designed to enhance highly qualified teachers along the I-95 Corridor schools in South Carolina. The center focused on the development and modeling of state-of-the-art strategies as well as serving as a catalyst for changing pre- and in-service teachers' practices in the education of rural students in low-achieving schools. Additionally, the center's activities directly support one existing educational program and outreach activities through 1890 extension services and schools in the communities. The center demonstrated clearly defined benefits to community rural low-achieving students and their families. For example, the center designed activities were consistent with ongoing related current trends to in-service teachers' development activities; created community action research and professional development activities that empowered teachers to change from complainers to a collaborative community of problem solvers in the rural I-95 schools; demonstrated a sustained integration of appropriate usage of evidence-based techniques into both the teaching as well as in the learning activities for teachers and their student in the area schools; designed continuous professional development opportunities of practicing K-12 teachers was provided related to enhance their quality of teaching and to increase rural students' achievement in the area schools; and assisted future, new, and experienced teachers with deeper understanding of academic content in educating rural students in low-achieving schools using Community Professional Development Action Research strategies. Results of the research were published in a bulletin for dissemination.

Through all the innovated training, activities, professional development, discussions and collaboration, the project teachers reached the goal of academic success and were recognized by board of trustee of the Orangeburg Consolidated School District 5.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Environmental Conservation for Wildlife

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	0.0	0.0
Actual Paid Professional	5.0	0.0	0.0	0.0
Actual Volunteer	10.0	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
140139	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
140139	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

Training was conducted for volunteers to become Master Naturalists. Agents educated clientele on cogongrass, feral hog management, and wildlife habitat improvement and management, aquatic weed

Control, pond management, wildlife nuisance control, and native warm-season grasses for enhancement of wildlife habitat. Agents published news articles pertaining to nuisance wildlife.

Agents and specialists presented results of a wildlife habitat improvement demonstration practices project to the Annual SFI Conference in Burlington, VT, conducted conference Wildlife Considerations in Managed Forests at Madren Center for landowners and natural resource professionals, presented to the National Fish and Wildlife Conservation Congress at Ottawa, Canada on wildlife considerations in managed forest and demonstration project on the Clemson forest and conducted an Insect Biodiversity class at Wildlife Action Pioneer Camp .

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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, youth, municipal officials, and local community groups statewide, children in school, after-school, summer and 4-H, programs, 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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6347	0	0	0

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people completing educational workshops

Year	Actual
2012	2662

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

Year	Actual
2012	2623

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 conduct 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

Training was conducted for volunteers to become Master Naturalists. SC Master Naturalists have participated in nationwide citizen science projects such as monarch watch, the backyard bird count, monitoring loggerhead sea turtle nest, eradicating fire ants; renovating and maintaining trails; restoring habitats and cleaning up nesting boxes. They give back to the program by assisting in the delivery of new courses and by taking or leading advanced training classes throughout the state. Agents educated clientele on cogongrass, feral hog management, and wildlife habitat improvement and management, aquatic weed Control, pond management, wildlife nuisance control, and native warm-season grasses for enhancement of wildlife habitat. Agents published news articles pertaining to nuisance wildlife.

Extension Specialists developed a management plan for local communities on deer conflicts, worked on the Sustainable Forestry Initiative grant project on the Clemson forest where we are demonstrating wildlife habitat improvement practices that can be integrated in to forest managed

for timber, and worked with Kings Mountain National Park to demonstrate re-establishment of early successional stage habitat for bobwhite quail and songbirds.

Results

Master Naturalist volunteers provided over 6,347 hours of service, which equates to a value of $114,246 in program support.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Of the 2,662 persons attending workshops, 99% indicated knowledge gained.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Sustainable Forest Management

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
122	Management and Control of Forest and Range Fires	30%	0%	20%	0%
123	Management and Sustainability of Forest Resources	50%	0%	70%	0%
124	Urban Forestry	20%	0%	10%	0%
	Total	100%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	1.0	1.5	0.0
Actual Paid Professional	5.0	0.0	0.7	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
178431	0	64949	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
178431	0	64949	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 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.

Research was conducted on Beech Bark Disease, symptoms and causal agents with a focus on disease prevention in South Carolina. Research also continued into options for preventing reproduction in grey squirrels which cause wide spread damage in South Carolina.

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4488	246540	0	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	6	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people completing educational workshops

Year	Actual
2012	1732

Output #2

Output Measure

- Disclosures

Year	Actual
2012	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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1720

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 and specilaists developed and provided 168 educational programs on sustainable forest management, reaching 1732 persons. Topics included longleaf pine management, prescribed fire burning, the future of local timeber markets, evaluating seedling survival, weed control, herbicide and timber taxation webcasts, recognizing tree hazards, and the TOP Logger program.

Results

Landowners reported managing 40,000 acres of forest land. In one county, landowners indicated that the Extension programs would help them save $136,000 and earn $326,000 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

KA Code	Knowledge Area
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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Of the 1,732 persons attending programs, 99% reported tha they gained knowledge.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food	0%	0%	0%	10%
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	0%	10%
703	Nutrition Education and Behavior	50%	50%	0%	40%
723	Hazards to Human Health and Safety	5%	10%	0%	10%
724	Healthy Lifestyle	45%	40%	0%	30%
	Total	100%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	12.0	3.0	0.3	2.0
Actual Paid Professional	23.0	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
435225	194568	0	291297
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
435225	97284	0	145648
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 .

Associations will be explored between family domain factors and child physical activity and eating behaviors. Measures of family domain factors associated with child physical activity and eating behaviors will be developed and refined. This program will delineate the strength and direction of the relationships between family domain factors with the greatest potential for change through community based interventions. A pilot test will be conducted of an intervention targeted towards family factors that mediate child physical activity and eating behaviors.

Educational workshops will be conducted with youth and families of general and limited resources to improve their health and well-being. Health assessments on participants and their families will be conducted. Daily recreational activities will be incorporated into the summer and after-school programs.

An 1890 Researcher conducted a study on implementing physical activity and nutrition through the use of tecnology to combat overweight and obesity in elementary school-aged children. The research provided a Physical Activity And Nutrition (PAAN) Camp that continuously researched the effects of technology on physical activity and nutrition in the reduction of weight of children who were overweight or obese. The research targeted up to 75 children in grades 3-5 who are severely overweight or who were obese as identified by BMI index charts. The Departments of Family and Consumer Sciences and Health and Physical Education at South Carolina State University partnered to research how the negative views of technology used by youth can ultimately be transformed into positive instruments to combat childhood obesity. The project utilized the Diet Analysis Plus technological computer program to develop individual nutritional plans and used the Wii Gamming System, along with the Trikke body driven vehicles, to develop an activity program for each participant. Health and physical education teachers of the tri-county area of Orangeburg, Bamberg, and Calhoun counties were interviewed for fitness test results of children attending school in the districts of the targeted counties to obtain data on activities and nutrition as a basis for creating individual plans for participants.

Another 1890 Researcher concluded the study of an integrated approach to prevention of obesity in high risk families. An expert field review of key behavioral measures purported to contribute to excessive weight gain in children 4-10 yrs of age was conducted. Data collection instruments were designed, peer reviewed and pre-tested. A data analysis training session was conducted and designed. Education practices were identified in SNAP-Ed towards obesity prevention, outcomes, success stories, healthy eating and physical activity. Papers, presentations and articles were developed from the research. A research bulletin was written for documentation and dissemination.

2. Brief description of the target audience

The target audience includes agencies that serve all income levels, including limited resource families and youth. Children ages 3 - 12 years old.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7799	0	19531	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	4	2	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Output #2

Output Measure

- Number of people completing educational workshops

Year	Actual
2012	24428

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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	17049

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 2,989 educational programs were conducted reaching approximately 24,428 children. Agents reached youth and adults in schools, summer camps, community centers, and health fairs. Some of the topics taught by agents covered included basic nutrition, the importance of daily physical activity, how to make healthy food choices and food safety in preparation and storage. Agents taught Veg-Olympics, Team Nutrition, What's Cookin, and Health Summit at Cafe Cultura. Lessons in nutrition and physical activity were taught to the children whose mothers are participating in the nutrition education program in Spanish Celebrating Health. Topics covered with the older children were: Portion distortion, mindless eating, dairy products, the importance of eating breakfast, and making healthful snacks. Nutrition programs include working in community-based participatory research to improve educational materials for Hispanic population in the Upstate region of South Carolina Celebrando la Salud.

Results

Evaluation data shows the following: 69% of the youth reported eating a variety of foods; 95% increased their knowledge of human nutrition; 87% increased their ability to select low-cost, nutritious foods; and 84% improved practices in food preparation and safety.

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

- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation data shows the following: 69% of the youth reported eating a variety of foods; 95% increased their knowledge of human nutrition; 87% increased their ability to select low-cost, nutritious foods; and 84% improved practices in food preparation and safety.

The overweight and obesity project has sponsored an awards program for participants and families to encourage and motivate participants to continue trying to reach their goals as an incentive. All students were to show effort in participating in all activities and increasing steps. The steps count has increased to 8,000 steps. Several abstracts/proposals to present the research at state and national conferences have been submitted.

A final bulletin on the integrated approach to prevention of obesity in high risk families has been submitted for publication and distribution.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Climate Change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%	0%	30%	0%
132	Weather and Climate	0%	0%	45%	0%
135	Aquatic and Terrestrial Wildlife	0%	0%	25%	0%
	Total	0%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.6	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	26044	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	195117	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

Controlled laboratory studies made it possible to identify the controlling factors in greenhouse gas emissions and pollutants production in different environmental settings. Gas, soil and water samples were collected for greenhouse gas, natural organic matter and hyocabon analysis.

A multi-species phylogeographic survey of wide taxonomic breadth, was conducted, highlighting species whose contemporary ecological interactions have been extensively characterized.

A web-based GIS floodwarning system was developed. Data was collected on selected flood areas, and articles and presentations were presented.

Work continued on identifying peach varieties that can be productive in the changing climate in South Carolina.

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, which could improve plant engineering for growth in a future world with increased atmospheric carbon dioxide.

2. Brief description of the target audience

The target audience included 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

2012	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:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total

Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2012	0

Output #2

Output Measure

- Licenses

Year	Actual
2012	0

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

Year	Actual
2012	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
132	Weather and Climate
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
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This is a required entry

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%	0%	20%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	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%
	Total	0%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	2.1	0.0
Actual Paid Professional	0.0	0.0	2.5	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	194206	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	520727	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

One of the current challenges in producing biofuels from the poplar tree is lignin degradation. Research is underway to explore ways to break down lignin more efficiently. Scientists will characterize cinnamyl alcohol dehydrongease genes from tulip-poplar and their promoters to test a novel approach to facilitate lignin digestibility.

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

In addition, the following activities were implemented:
1. Introduced sorghum feedstock as a source of material for the SC biofuel industry.
2. Identified ways to optimize switchgrass growth in the Southeastern coastal plain.
3. Identified ways to enhance the conversion of swichgrass to biofulels using cellulose systems in microbes.
4. Developed and conducted workshops to teach sustainable forestry principles.
5. Produced media programs on forest management.
6. Informed landowners of the economic and environmental benefits of using BMPs in all forest management operations.
7. Worked with established groups within the forestry community to support and promote appropriate training and outreach programs related to sustainable forest management.
8. Utilized the TOP Logger and other logger education programs to train loggers on sustainable forestry and alternative silvicultural systems.

2. Brief description of the target audience

All consumers in the state benefited 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

2012	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:	2012
Actual:	1

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	7	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2012	2

Output #2

Output Measure

- License agreements

Year	Actual
2012	0

Output #3

Output Measure

- Number of people completing educational workshops.

Year	Actual
2012	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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Researchers are analyzing more than 400 varieties of sorghum grown in South Carolina, seeking the ones most easily converted into fuel. They also are 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 controls in sorghum--such as drought tolerance, pest resistance and improved yields--will aid producers of related crops, including corn, rice and turfgrass.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	25%	10%	10%	20%
204	Plant Product Quality and Utility (Preharvest)	0%	20%	15%	10%
205	Plant Management Systems	25%	25%	15%	20%
212	Pathogens and Nematodes Affecting Plants	25%	5%	5%	10%
213	Weeds Affecting Plants	10%	5%	5%	0%
216	Integrated Pest Management Systems	5%	5%	10%	10%
601	Economics of Agricultural Production and Farm Management	5%	25%	10%	20%
604	Marketing and Distribution Practices	5%	5%	0%	10%
701	Nutrient Composition of Food	0%	0%	30%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	3.0	12.9	0.0
Actual Paid Professional	35.0	2.5	13.9	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**
1445920	89866	681428	338901
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1445920	44933	836516	169450
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 and activities were conducted that focused on integrated crop management, integrated pest management, water resources, risk management, and marketing. Field trials were conducted and demonstrated.

Research was conducted to improve global capacity to meet growing food demand. Researchers developed and tested technologies for site-specific detection and control of plant-parasitic nematodes either to lower the use of high-risk pesticides, such as carbamates and soil fumigants, or to optimize nematicide utilization in cotton production in the southern U.S.

Researchers have identified proteins that interact during the process that regulates nodulation of legumes such as peas, soybeans and alfalfa. This discovery will allow the manipulation of genes involved in nodulation and plant growth. Benefits include increased legume crop yields and potentially reduced fertilization in non-legumes, thereby reducing the risk of water pollution from fertilizer run-off.

Bacterial blight costs South Carolina vegetable growers from $900,000 to $1.7 million each year in direct losses of diseased crops, in addition to increased costs of purchasing and shipping replacement products to meet contractual obligations. Researchers are investigating a variety of reduced-risk chemical, cultural and biological method to improve the cost-effective management of vegetable diseases. 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.

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 growers up to $85/ha. However, hand weeding, cultivation and crop abandonment will cost growers up to $5,000/ha in lost revenue/increased costs.

The identification of soybean plant introductions that are resistant to soybean rust disease is providing parental material and enhancing efforts by soybean breeders to develop soybean cultivars resistant to this destructive disease. Resulting new varieties have the potential to improve crop yields and human nutritional value, and increase resistance to economically damaging diseases, nematodes and insect pests.

Researchers were proactive in dealing with the threat of Asian Soybean Rust by using sentinel and

monitoring plots across the state. Experiments were conducted with seed applied nematicides and with three different fungicides. Indications are that more than 75% of South Carolina fields 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. Double cropping--planting soybean in late June or early July following wheat harvest--has proven to be a viable economic enterprise in Southeastern states. However, in this cropping regime conventional cultivars may have reduced seed yields due to limited vegetative growth and premature flowering induced by short photoperiods. Researchers identified a long-juvenile genetic trait that could increase the yields of these cultivars and increase grower profitability.

Grower demand has increased for disease-resistant watermelon rootstock to avoid soil-borne diseases. South Carolina research developed new methods for grafting watermelons that reduced the cost of the grafting transplant from more than $1 to less than eighty cents, with the potential of further savings. These cost reductions are critical to keep the state's producers competitive in U.S. and export markets.

Three small hive beetle traps currently marketed in the U.S. were compared for trapping efficiency in the 2010 season. Freeman traps were found to be the most effective. The levels of control achieved suggests that using beetle traps is a tool that beekeepers can safely use to control this pest inside bee hives without using pesticides.

Initial results of research on the use of sub-lethal doses of pesticides and the effect on honeybee health revealed that it could be practically impossible to prevent all pesticide residues in honeybee colonies, even when beekeepers do not use pesticides or use no contaminated beeswax foundation.

Researchers evaluated three different approaches to on-farm composting of food waste: static pile, tumbler system and vermicomposting system. Results determined that the static pile was most effective, primarily because it was able to produce temperatures high enough to produce finished compost. However, 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.

Rootstock trials have been used to develop research-based information to guide South Carolina peach growers in selecting which 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.

In this current economic downturn, the small socially disadvantage farmers and ranchers are looking for ways to cut production costs of their small scale farm business enterprises. The 1890 Extension small farms sustainable agriculture production practices are designed to assist small scale socially disadvantaged landowners and producers to minimize their off-farm input, while maximizing on-farm output the projected activities such as importance of soil fertility, insects scouting practices, post harvest handling, food safety and marketing strategies were successful in reducing application of chemicals used for pest control, improve food safety and increased products marketability.

The 1890 Extension small farm program is involved with vegetable and fruit production. Due to

higher consumer demand for high quality and locally produced vegetable crops, the 1890 small farmers were introduced to sustainable agriculture practices, specifically integrated pest management, which improved their production and marketing of vegetable products. There was less chemical application or use in agriculture practices. Commercial producers and home gardeners were taught updated agriculture practices and techniques to include sustainable agriculture practices nd IPM to render their small farm and gradening projects productive, profitable and sustainable. Activities included production meetings, workshops, field demonstrations, farm tours and one-on-one training.

One 1890 Research project focuses on automatic identification technology usage for farm produce traceability. The study concerns the proper implementation and usage of traceability technology as an important aspect in allowing the attainment of Good Agricultural Practices (GAP) certification for South Carolina farmers. Attainment of this certification can consequently increase the number of potential customers for the farmers and producers, therefore creating a more level field of competition. This pilot project proposes 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.

To date, the researcher has begun data collection. The Radio Frequency Identification (RFID) Technology to track the normal harvesting and selling processes that occur within the farm supply chain was used. One glaring area of vulnerability in terms of food protection from the perspective of both consumers and growers is the inability to identify more precisely the location on a farm from which possibly contaminated food was harvested. The absence of precision creates greater penalties for farmers and increased concerns about the reliability of food suppliers from the general public. The method that is being implemented by the research is to utilize RFID technology to allow the farm to be segmented into multiple zones in order to facilitate a more accurate identification location of harvest for the food that is being tracked. The methodology could potentially provide a more efficient process for ascertaining causes of food contamination in cases of food recalls. It could also potentially facilitate a reduction in penalties assigned to farmers during instances of food recalls.

Presentations were made at conferences/workshops before various farmers, agricultural government and private sector employees, current faculty and researchers from institutions across the nation that have an interest in work related to agriculture and students majoring in agriculture. The presentations were used to highlight the current security vulnerabilities that are present in the domestic food supply chains and the work that the research is doing to determine the ability of traceability technology applications within the supply chains to minimize some of the security vulnerabilities.

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	47679	364097	1044	390

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

Patent Applications Submitted

Year: 2012

Actual: 2

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	21	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2012	1

Output #2

Output Measure

- Licenses

Year	Actual
2012	0

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual

2012	16122

Output #4

Output Measure

- New Variety Releases

Year	Actual
2012	2

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 Integrated Crop Management and Integrated Pest Management 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

Year	Actual
2012	12962

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Sustainable agronomic crop production programs will develop and implement agricultural production systems in South Carolina that are economically sustainable, safe and environmentally sound.

What has been done

Over 683 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. Other workshops included best management practices for fall vegetables, installation of a drip irrigation system, record keeping and marketing strategies.

THE ASIAN SOYBEAN RUST MONITORING PROJECT was conducted in 14 counties. Reporting is done through an international web site which receives over 350,000 visits annually. We were able to accurately document the arrival of rust in South Carolina and to provide growers with advice on when sprays targeting rust needed to be applied to optimize control.

Results

Over 800,000 agronomic acres were affected by ICM. A monitoring and early notification system by Extension and Regulatory Services saves state soybean producers $25 million by limiting losses to Asian soybean rust and reducing the number of fungicide sprays in the state's $139 million crop. South Carolina growers produced a cotton crop valued at $211,848,000, a soybean crop valued at $101,700,000, a corn crop valued at $145,860,000, and a wheat crop valued at $76,140,000. Clemson University conducts Official Variety Trials of all major crops in multiple locations across the state. The information generated from the trials is then used by growers to select the varieties that perform best in their region of the state. If yields were

increased by 5% through proper variety selection this would result in an additional $26,777,400 in revenue for South Carolina producers. In addition, over the past eight years, peanut production in South Carolina has increased from 8,000 acres to around 100,000 acres. Clemson Extension Specialists and County Ag Agents have carried out an aggressive training program to teach growers how to identify the optimal time to dig peanuts. The impact for growers was at least 250 lbs of peanuts per acre this past year which harvest was worth 30 cents per pound or $75 per acre. With 100,000 acres of peanut in South Carolina this means over $7.5 million extra dollars for growers and the South Carolina economy.

By utilizing insect and disease control recommendations presented at Extension trainings to control aphids and loose head smut of oats, Colleton County oat producers can be expected to increase yields by eight bushels per acre. There was a potential economic impact of $91,224.00 for oat producers from information and knowledge gained by attending Extension training, applying recommendations and selecting top-yielding varieties in Colleton County.

1890 Extension held soil fertility, crop cultivation methods, marketing strategies and recordkeeping workshops on two different certified organic farms. As a result, 100% of the participants had taken up-to-date soil samples and began to implement the recommendations from the soil test. Increased support among community farmers to expand networking capability was addressed. Vegetable production workshops were held to increase networking among farmers. One hundred percent (100%) of the participants walked their fields to identify beneficial insects that promote healthy growth in plants. They were also able to identify disease of the roots in its early stages.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

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 Integrated Crop Management and Integrated Pest Management programs.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3032

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Small vegetable growers in the 1890 Extension Program want to maximize fall vegetable production without purchasing unwanted or unnecessary amounts of herbicides and insecticides and increase their knowledge on soil fertility, proper planting techniques and scouting for disease and insects.

What has been done

Vegetable production workshops were held for producers interested in fall vegetable production and participating in the IPM project. Topics discussed included proper planting techniques, soil fertility, best management practices for fall vegetables and the installation of a drip irrigation system was demonstrated. Field demonstrations and farm tours were also held.

Results

As a result of the workshops, individuals decided to participate in the IPM collard and cabbabe project. Individuals followed the project guidelines and produced an outstanding crop of fall vegetables as a result of the trainings in soil fertility, proper planting techniques and best management practices.

As a result of Sustainable Agriculture Practice Training Sessions/Activities, forty-five percent (45%) of active participants gained knowledge, adopted practices and applied information to their operations. Twenty percent (20%) of participants expanded operations and improved marketing activities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)

205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
601	Economics of Agricultural Production and Farm Management

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

Over 96% of the persons completing sustainable agronomic production programs reported a gain in knowledge and skills.

Key Items of Evaluation