V(A). Planned Program (Summary)

Program # 9

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
123	Management and Sustainability of Forest Resources	100%	0%	0%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	20%	0%
402	Engineering Systems and Equipment	0%	0%	20%	10%
403	Waste Disposal, Recycling, and Reuse	0%	0%	0%	60%
511	New and Improved Non-Food Products and Processes	0%	0%	60%	30%
	Total	100%	0%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	2.5	0.5
Actual Paid	4.0	0.0	2.8	1.0
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**
124480	0	203710	183403
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
124480	0	139209	147404
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	33386	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Clemson University researchers are analyzing more than 400 varieties of sorghum grown in South Carolina to determine which are most easily converted into biofuel. 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 for traits such as drought tolerance, pest resistance and improved yields will aid producers of related crops, including corn, rice and turfgrass.

Research found that switchgrass can produce profitable yields of 3 to 9 tons per acre. A 2-day BioEnergy Summit was held on September 19-20, 2013 in Florence, SC. Approximately 300 attended over the 2 days. Representatives of several different end users of biomass presented, identifying woody, switchgrass, and sorghum biomass as the biomass most needed in the near future. A subcommittee of the SC Biomass Council and SC BESTA programs was formed to address the needs of these future end users. Since the Summit, this group met twice with the economic development association for the region (NESA) for the first time to collaborate on recruiting more bioenterprises to the Pee Dee region of SC.

Current research aims to generate and evaluate the effectiveness of genetically modified poplars for enhanced disease resistance and identify key genes that are involved in the response to S. musiva infection.

An 1890 researcher proposed to reduce the amount of plastic waste material in the Orangeburg, SC landfill. The plan is to recycle waste plastics into fuel and valuable alternatives. The researcher is looking at development in three phases: basic research, demonstration thermolysis reactor, and pilot plants. The results of the basic research were applied to build a demonstration reactor. Plastic shopping bags and other polyethylene-based wastes were thermally decomposed to liquid and gases suitable for fuel. One of the important points revealed by the research was that the recovery route of plastic waste depended on the condition and kind of material. Depending on the kind of waste, the most economically feasible process and treatment was used. Paper presentations were made at conferences, meetings, etc. Two articles were written and submitted for publication to peer-reviewed journals. Presently, a final bulletin is being written of project findings for publication and dissemination.

Switchgrass is a perennial feedstock and native grass being considered for production throughout the USA. It has many beneficial characteristics such as high yield potential, good drought tolerance, provides

good wildlife habitat, has low input costs, and can be produced and harvested using traditional hay production equipment. The Clemson Pee Dee Research and Education Center has been studying switchgrass and other feedstocks since 2007. Ongoing studies include effects of harvest timing and quality, soil type effects on management, and N fertility levels on switchgrass yield and nutrient removal.

2. Brief description of the target audience

All consumers in the state will benefit from research and education programs related to lower cost energy options. Target audience also includes producers, landowners, and tree farm inspectors.

3. How was eXtension used?

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V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4610	41173	0	0

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	7	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2014	0

Output #2

Output Measure

- License agreements

Year	Actual
2014	0

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual
2014	0

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
2014	2029

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This program promoted the use of Best Management Practices for forest systems and other natural resources to improve South Carolina's forest productivity, environmental sustainability and sustainable energy. In addition, farm and forest landowners in South Carolina were seeking management and diversification strategies to generate additional income and profitability.

What has been done
The Clemson Pee Dee Research and Education Center is continuing studies of switchgrass and other feedstocks. Ongoing studies include effects of harvest timing and quality, soil type effects on management, and N fertility levels on switchgrass yield and nutrient removal. Workshops were conducted on the topics of prescribed fire, timber harvesting, forest herbicides, forest taxation, timber income tax, the SC Tree Farm program and estate planning. Articles were published to promote the stewardship of South Carolina's urban and community forests. Resource information was made available through the quarterly Woodland Magazine, Tree Farmer Bulletin, newsletters, and webinars . A link to www.MyLandPlan.com was made available on the web to help landowners manage their property.

Results
Bales of switchgrass are being stored for future microbial degradation studies. Of the 2058 people attending programs, 99% reported that they gained knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Of the 2058 people attending programs, 99% reported that they gained knowledge.

Key Items of Evaluation