V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			10%	5%
111	Conservation and Efficient Use of Water			5%	5%
112	Watershed Protection and Management			10%	15%
123	Management and Sustainability of Forest Resources			5%	5%
125	Agroforestry			5%	5%
131	Alternative Uses of Land			5%	5%
132	Weather and Climate			10%	10%
133	Pollution Prevention and Mitigation			10%	10%
135	Aquatic and Terrestrial Wildlife			5%	5%
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
304	Animal Genome			5%	5%
403	Waste Disposal, Recycling, and Reuse			10%	10%
610	Domestic Policy Analysis			5%	5%
903	Communication, Education, and Information Delivery			5%	5%
	Total			100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	22.0	12.0
Actual Paid Professional	0.0	0.0	22.0	12.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Auburn University

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	1290512	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1290512	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

2. Institution Name: Alabama A&M University

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	0	431778
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	431778
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

2. Institution Name: Tuskegee University

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	0	356083
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	356083
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research was conducted to develop sustainable agricultural systems emphasizing energy and resource conservation; improve understanding of the land-water interface and the urban-agriculture interface; contribute to solutions to the consequences of global climate change; provide a framework for understanding and addressing issues of water quality and quantity, water reuse, carbon sequestration, air quality, and seek economically viable practices for improved sustainability in large- and small-scale agriculture; management of agricultural waste and residues generated through the animal and poultry and crop production systems; sustainable agriculture systems to enhance soil productivity and improve water infiltration and the plant-root environment; organic agriculture ecotourism; invasive species; soil conservation, quality, and bio-indicators; rural-urban interface and environmental issues; wildlife management; restoration and best management practices; remote sensing and precision agriculture; and science-based policy development.

In 2011, plant breeders worked to identify cotton genotypes with increased levels of tolerance to high temperatures, and explore the underlying genetic mechanisms that make this possible. They have evaluated more than 1500 primitive cotton genotypes, identified a group of seven elite lines that appear to be tolerant to heat, and have made crosses between these and adapted types. They are also screening progenies from these crosses for the first time in the field this summer.

Sweetpotato germplasm was evaluated for drought tolerance. Using molecular genetic approaches, scientists are identifying genes associated with drought tolerance and storage root enlargement in sweetpotatoes.

Aquaculture researchers identified the genes associated with elevated temperature to identify the key genes involved in adaptation of high temperature. A set of hemoglobin genes are particularly interesting because they may have a greater binding and transportation capacity for oxygen under elevated temperature conditions (i.e., lower dissolved oxygen in the water). This work will continue to identify genetic stocks that harbor greater tolerance to high temperature.

Soil scientists are conducting research on land management impacts on carbon sequestration and greenhouse gas emissions in Alabama, Louisiana, Georgia, Arkansas, Lithuania, Latvia, Estonia, Kenya, Tanzania, Ecuador, and India. Soil scientists are also working on microbial diversity as impacted by different forest management systems and different cropping systems.

Animal scientists studied the impact of high ozone concentrations on the nutritional value of plants when exposed to elevated ozone for ruminants.

AU School of Forestry and Wildlife faculty were heavily involved with research related to climate change in 2011. Funding related to climate change totaled over $1.2M in 2011 and was derived from prestigious sources such as NSF, AFRI, and NASA. Much of the research was focused on investigating the carbon sequestration potential of southeastern forests for offsetting carbon dioxide emissions. In addition, faculty were involved in the development of global models to predict how agents of change such as population growth and land use changes may affect temperature and precipitation patterns throughout the world.

2. Brief description of the target audience

Farmers, producers, land owners, industry leaders, policy-makers, citizens, and related federal agency personnel.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5500	25000	4500	45000

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	10	55	65

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- publications

Year	Actual
2011	65

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Reduced carbon footprint by adopting improved agricultural practices
2	Increased carbon sequestration by adoption of technologies and improved agricultural practices.
3	Identification of crop varieties and animal stocks that can adapt to a changing environment.

Outcome #1

1. Outcome Measures

Reduced carbon footprint by adopting improved agricultural practices

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Increased carbon sequestration by adoption of technologies and improved agricultural practices.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Reducing the footprint of carbon is very important in the long run considering that carbon dioxide affect the climate and may be the cause of global warming.

What has been done
Research was conducted to understand Crop-ENSO phase climate-soil interactions at different locations throughout Alabama via field experiments and crop simulation

Historic data (1982-2010) from the Alabama wheat variety trials collected at various research stations were used to identify the impact of ENSO (El Niño/Southern Oscillation) on wheat production.
Research was conducted to Understand the relation between climate and weather variability with plant diseases, e.g., Aflatoxin contamination in corn.
Research was conducted to understand microbial diversity as affected by environmental conditions and crop management systems.

Results

Enhance understanding of Crop-ENSO phase climate-soil interactions at different locations throughout Alabama via field experiments and crop simulation

Historic data (1982-2010) from the Alabama wheat variety trials collected at various research stations were used to identify the impact of ENSO (El Niño/Southern Oscillation) on wheat production. Results showed that independently of the region, wheat yield was higher during La Niña phase of ENSO but decreased with El Niño phase.

Understanding the relation between climate and weather variability with plant diseases. Case: Aflatoxin contamination in corn. In 2011, an Aflatoxin risk model based on a drought index was developed and evaluated. Logistic regression analyses indicated that Agricultural Reference Index for Drought (ARID) can be used to predict aflatoxin contamination about the threshold value of 20 ppb. The ARID values for month of June had the highest level of significance among the months tested for predicting aflatoxin contamination threshold the value of 20 ppb. Therefore, ARID values for the month of June could be used as early risk indicators.
A second study to evaluate how weather variables such as rainfall and maximum temperature are related to aflatoxin contamination and how that relation differ by El Niño Southern Oscillation (ENSO) phases was also conducted. Using the MEI and Niño 3.4 ENSO classification indices, yearly deviations of rainfall and maximum temperature for the month of June (silking stage with high susceptibility for aflatoxin contamination) were classified into different ENSO phases. Results showed that there was a significant relationship between corn aflatoxin contamination and deviations of rainfall and maximum temperature. Lower rainfall and higher temperature than the normal during corn reproductive stage increases the likelihood of having aflatoxin contamination above the set threshold. Results showed during El Niño years there is a lower likelihood of aflatoxin level above the threshold compare to both La Niña and Neutral years.

Enhanced understanding of microbial populations shifts under different land and crop management system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
125	Agroforestry
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
403	Waste Disposal, Recycling, and Reuse
610	Domestic Policy Analysis
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Identification of crop varieties and animal stocks that can adapt to a changing environment.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the face of global climate change, it is important to identify plant and animal germplasm that can adapt or tolerate to various extreme weather conditions including high temperature and drought.

What has been done
The plant breeders are working to identify cotton genotypes with increased levels of tolerance to high temperatures, and explore the underlying genetic mechanisms that make this possible. They have evaluated more than 1500 primitive cotton genotypes, identified a group of seven elite lines that appear to be tolerant to heat, and have made crosses between these and adapted types. They are also screening progenies from these crosses for the first time in the field this summer. Initial molecular biological studies were conducted in catfish to identify the key genes involved in heat resistance. Several sweetpotato progenies derived from open pollinated crosses were evaluated for drought tolerance in the greenhouse.

Results
More than 1500 primitive cotton genotypes were evaluated. A group of seven elite lines were identified that appear to be tolerant to heat, and have made crosses between these and adapted types. Progenies from these crosses are being screened for the first time in the field this summer. A set of heat related genes have been identified from catfish that may be candidate genes for heat tolerance.

4. Associated Knowledge Areas

KA Code	Knowledge Area

112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
304	Animal Genome
403	Waste Disposal, Recycling, and Reuse
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program was named climate change (and starting this year, to be changed to Natural resources, environment sustainability and climate change) covers a broad range of research activities. It is the second largest program. Researchers work in the areas of natural resource conservation, management and utilization, environmental sciences, and climate change. This is perhaps the most active research area in Alabama under the umbrella of AAES and AALGA.

Key Items of Evaluation

To be prepared for a changing climate, greater funding opportunities are essential. In spite of the very active research in this area in Alabama, funds are limited.