

2011 Alabama A&M University and Tuskegee University and Auburn University Combined Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

This report covers all three land grant universities of Alabama, i.e., Alabama A&M University, Auburn University, and Tuskegee University for the research activities, results, and accomplishments during the 2011 fiscal year. The three universities have distinct programs at each institution based on clientele needs, but the administrators of the Alabama Agricultural Research Program (AARP) work closely and cooperatively to enhance partnerships among our universities in all areas of research, education, and extension. The agricultural research programs of these universities have formed a partnership, the Alabama Agricultural Land-Grant Alliance (AALGA), to better address critical issues in food, energy, environment, climate, natural resources, human health and wellbeing, and other agricultural issues in the state, region, and nation through multidisciplinary, multi-institutional, science-based teams that focus on the opportunities and the challenges facing farmers, consumers and agribusinesses. Working together, we have developed the priorities of AARP that included the following six areas of critical importance: (1) Global food security and hunger (i.e. our original research priority of "Enhancing agricultural production systems and value-added processing"); (2) Climate Change (i.e. our original priority of environment, ecosystems, and natural resources); 3. Food safety (i.e. our original priority of food, nutrition, health and well-being, and agricultural biosecurity); 4. Childhood obesity; 5. Sustainable energy (i.e. our original priority of bioenergy and bio-based economy); and (6) Industry-wide emerging issues. In recognition of the importance of international agriculture programs in promoting the competitiveness of U.S. agriculture in the global market place, AARP supports and participates in the efforts of international program offices in the three institutions. AALGA also seeks to provide quality education that prepares professionals for career opportunities in food, agriculture, environment, bioenergy, and natural resources in the state, the region, and the nation. Alabama's three land-grant universities have played key roles in the development of agricultural enterprises in Alabama. This report highlights some achievements made in 2011.

In the first program of Global Food Security and Hunger, continued research focused on evaluation and testing of various genetic stocks of plants and animals including various crops such as cotton, wheat, corn, pearl millet and peanuts, various horticultural crops such as vegetables, fruits and specialty crops, various animals including cattle, broilers, and catfish. Continued research also focused on development, refining, and adoption of agricultural best practices, economic analysis of the best agricultural practices under changed economic situation such as high costs of feed and energy as well as transportation. While many research projects are ongoing, the use of precision agriculture in Alabama led to savings for inputs of over \$22 million in 2011. Alabama poultry industries generate over two billion dollars annually, and savings made from the adoption of better insulated chicken houses have allowed savings to tens of million dollars annually. Similarly, the industry share of hybrid catfish has increased to over 20%. The hybrid catfish made from the inter-specific hybridization of channel catfish female crossed with blue catfish male exhibit superior traits in growth, resistance to diseases, feed conversion, and processing yields. Productivity and profits are estimated to be increased at least 20-30% because of the application of the hybrid catfish. Given that the catfish industry is a billion dollar industry, this technology alone can increase the catfish industry by over 100 million dollars a year. Dissemination of several specialty crops including seven chestnut varieties and two kiwifruit varieties has generated great economic impact as well.

In the area of food safety, the experiment stations of the three universities have been the major

forces for research in securing our food. Auburn University established its AU Food Systems Initiative and is working to serve the nation as a "food safety hub" for the development of detection technologies, food safety testing, food safety education and training. In 2011, a \$6.5 million grant from FDA was awarded to

Auburn to develop virtual training modules. Such grants will enhance food safety research in Alabama. Alabama A&M University is researching the survival and transmission of foodborne pathogens in certain plant models.

The three universities are seriously engaged in Alabama Obesity Initiative to address the serious issue of obesity in the state. Alabama is the second most obese state in the nation, and solutions must be generated from research, education, and extension programs. Alabama A&M University is leading efforts in obesity intervention in high risk families using integrated approaches.

In spite of the uncertainty, research in the areas of climate change and bioenergy started to gain ground with more and more citizens becoming aware of the problem and engaged for the real change. However, dealing with such major research issues, funding uncertainty is a serious problem. Two major teams involving researchers from Auburn University, Tuskegee University, and Alabama A&M University researchers were funded with a Bioenergy CAP grant, and the teams are making good progress. In the area of Climate Change, our researchers are working on selection of heat and stress tolerant germplasm with both plants and animals, but funding levels are yet very low.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	6.9	4.0	91.6	68.0
Actual	6.9	4.0	91.6	68.0

II. Merit Review Process

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

- Internal University Panel
- Combined External and Internal University Panel
- Expert Peer Review

2. Brief Explanation

Internal merit evaluations were conducted on all existing projects by a panel of faculty, department heads/chairs and administrators as appropriate. Programs that encompass several projects, particularly those with identified funding sources (i.e., the AAES Hatch/Multistate Funding Program) were evaluated by an administrative panel to allocate continued funding.

Merits of new projects were evaluated by an expert panel composed of professionals from both within and out of state. In particular, experts from nearby universities such as University of Georgia, Mississippi State University, University of Florida and Texas A&M University were selected to cover professional areas of all

six research priorities. A balanced representation was considered for various internal units, basic sciences, applied sciences, and extension. The research proposals were reviewed by all expert panelists, and a panel meeting of two days was conducted at Auburn University. The combined internal/external expert panel ranked the proposals into categories of outstanding/highest priority for funding, excellent/high priority for funding, very good/high priority for funding, good/medium priority for funding, fair/low priority for funding, and poor/do not fund. The panel made its recommendations to the Assistant Director of AAES, who work with staff of our financial office to determine the funding and funding levels, based on the panel recommendations and the availability of funds. A final recommendation was made by the Associate Director to the Director of AAES, and funding decisions made. At Alabama A&M University, call for proposals was issued by the Research Director. Proposals submitted were sent to a panel of reviewers for review, ranking and recommendations. The final recommendation and funding decisions was made by the Research Director and Dean. Our funding guidelines also require leverage of extramural funding to increase the impact of formula funds.

Similarly, with AALGA funding, the AALGA Deans of agriculture and Associate Deans for research set the funding priority areas, and the AALGA funds were distributed based on a competitive process. The proposals were peer-reviewed, and funding recommendations were made. One of the strengths of the AALGA funded projects is that AALGA requires collaboration from all three AALGA universities in order for the various

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 selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public

Brief explanation.

A number of stakeholder groups have previously been identified, and input was collected through regular meetings with discussion and feedback. In particular, AARP works closely with the 18 commodity groups through the Alabama Farmers Federation, the Alabama Cattlemen's Association, the Alabama Poultry and Egg Association, and other agricultural organizations. Commodity group committees were used to evaluate on-going research and new research proposals. Direct feedback to researchers and AARP administration was through projects that were funded and through discussions about new and emerging issues. Semi-annual meetings were held with various commodity groups. Administrators and faculty members regularly participate in commodity committee meetings and their semi-annual meetings.

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
- Use Surveys

Brief explanation.

Several groups have been established and are continuing, such as advisory committees that encompass producers and consumer groups. Surveys were conducted through various AAES newsletters, and input was sought from the general public. The core stakeholders group is the commodity groups, agricultural organizations, producers, processors, market professionals, and consumers. However, as modern agricultural research deals with food, environment, natural resources, energy, food safety and human health that are relevant to all citizens as well as the traditional agricultural production areas that are indirectly relevant to the general public.

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)
- Survey of selected individuals from the general public

Brief explanation.

Several groups have been established and are continuing, such as advisory committees that encompass producers and consumer groups. Surveys were conducted through various AAES newsletters, and input was sought from the general public.

3. A statement of how the input will be considered

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

Brief explanation.

Input from stakeholders was used to set program priorities that are not only used for the distribution of research funds, but also for the hiring of new faculty and staff to meet the long term goals. Their input is also used to identify emerging issues relevant to agricultural needs. In a number

of cases, research funds were redirected to address urgent and emerging agricultural issues identified by the agricultural industries. The input from stakeholders was also considered during strategic planning and whenever relevant, put into the action plans as well.

Brief Explanation of what you learned from your Stakeholders

The overall agricultural and food systems has been evolving. As a result, agricultural conditions have changed dramatically in the last decades. The best agricultural practices need to be reevaluated and validated for the changed situation, but yet funding does not exist for such research. Obesity and chronic diseases are very prevalent in rural communities particularly minority populations and require nutrition and health education programs to address these issues.

IV. Expenditure Summary

Institution Name: Alabama A&M University

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	2626537

Institution Name: Auburn University

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	5020485	0

Institution Name: Tuskegee University

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	2607400

Institution Name: Alabama A&M University

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	2626537
Actual Matching	0	0	0	2626537
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	5253074

Institution Name: Auburn University

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	4830512	0
Actual Matching	0	0	4830512	0
Actual All Other	0	0	0	0
Total Actual Expended	0	0	9661024	0

Institution Name: Tuskegee University

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	2607420
Actual Matching	0	0	0	2607420
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	5214840

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

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Climate Change
3	Food Safety
4	Human nutrition, health, wellbeing and child obesity
5	Sustainable Energy
6	Industry-wide emerging issues

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			5%	5%
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
111	Conservation and Efficient Use of Water			5%	5%
125	Agroforestry			0%	5%
132	Weather and Climate			5%	5%
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	5%
202	Plant Genetic Resources			5%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			20%	10%
206	Basic Plant Biology			5%	5%
211	Insects, Mites, and Other Arthropods Affecting Plants			5%	5%
212	Pathogens and Nematodes Affecting Plants			5%	5%
213	Weeds Affecting Plants			5%	0%
216	Integrated Pest Management Systems			5%	5%
302	Nutrient Utilization in Animals			5%	15%
311	Animal Diseases			5%	5%
402	Engineering Systems and Equipment			2%	0%
502	New and Improved Food Products			3%	0%
601	Economics of Agricultural Production and Farm Management			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

2011 Alabama A&M University and Tuskegee University and Auburn University Combined Research Annual Report of Accomplishments and Results

Plan	0.0	0.0	24.0	21.5
Actual Paid Professional	0.0	0.0	24.0	21.5
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	1340000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1340000	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	962105
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	962105
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	801828
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	801828
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

This research program was designed to develop improved production methods such as improved crop production systems; improved poultry and animal production systems, conduct research to understand the biology of plants and animals, understand their genome capacity and plasticity, develop new cultivars in plant production systems and improved animal and fish stocks, develop nutritional strategies in animal production systems, develop value-added food, alternatives to pesticides and antibiotics to control disease outbreaks, develop integrated pest and disease management systems for plants and animals, and conduct economic analysis to increase profit margins.

AAES and AALGA support research or research/extension integrated activities that boost Alabama agricultural production, lower production costs, contribute to global capacity to meet the growing food demand, and foster innovation in fighting hunger by addressing food security for vulnerable populations. The goal of this program is to enhance competitiveness and sustainability of rural community and farm economies of Alabama in the global market through development and/or application of technologies, farming approaches, or organizational strategies that ensure the sustainability of rural communities and agricultural and forestry production systems.

In 2011, agronomists continue to search for high-yielding varieties of field corn, soybean, wheat, sweetpotato, specialty vegetable crops and cotton to ensure a stable food supply. Included in this work are trials to compare the genetic potential of newly developed crop strains, crop response to weather extremes, variety competitiveness with emerging herbicide resistant weeds, efficiency under various soil fertility regimen, and ability to survive and produce economically, environmentally sustainable crops. As the U.S. population dynamics have evolved, so too the efforts of the scientists have expanded to include multiple use crops that can be utilized as food, fiber, and energy resources.

Plant pathologists and entomologists continue to search for better ways to control plant diseases and insect pests. Research included studies of molecular mechanisms of insecticide resistance, innovative methods to control pests as well as integrated pest managements. Research was conducted to evaluate new control strategies for herbicide resistant weeds. Controls measures were evaluated for control of invasive species such as cogon grass. Research was also conducted to evaluate Integrated Pest Management strategies for limited research farms.

Horticulturists have introduced new crops for farmers and economic growth in the City of Valley: The project identifies specialty crops that will expand the variety of vegetables that local farmers can provide to Farmers Markets while responding to the needs of consumers in South Central Alabama. A number of alternative fruit varieties were evaluated in Alabama for their performance including eleven banana cultivars, Pierce's Disease resistant *V. vinifera*, Pierce's Disease resistant hybrid bunch grapes and seedless table grapes, and 10 newly released blueberry cultivars.

Poultry scientists continue to work on disease control, wellbeing issues of the poultry industry, and efficient ways of producing broilers. Along with Biosystems engineers, poultry scientists have developed

newer chicken houses that have better insulation to reduce energy costs and increase profit margins for producers.

Small ruminant scientists continue to work on the evaluation of year round grazing forages for goats. Studies also continue agro-forestry and using goats for forest vegetation management.

Economic issues under the new economic structure (e.g., more expensive feed, higher costs of transportation and energy, etc) are reevaluated to develop the best agricultural practices for farmers and producers to gain profits.

Research was continued on the isolation and characterization of several stress responsive transcription factors (NAC) in *Citrullus colocynthis*, a very drought tolerant cucurbit species. Two NAC genes were isolated and cloned and their subcellular location was investigated. Investigations were conducted focused on the effects of freeze-pruf, a foliar spray designed to boost the plant's cold acclimation potential, on Satsuma seedlings. Results from experiments with different Satsuma seedlings sprayed with water or freeze-pruf followed by cold treatment did result in similar levels of cold injury and mortality. A 454 transcriptome sequencing project was initiated for *Castanea pumila* var. *pumila*, the Allegheny chinkapin, for development of species specific single nucleotide polymorphisms to detect the incidence and level of hybridization occurring American *Castanea* species in the Appalachian forest ecosystem.

Efforts in Ending Child Hunger in Alabama: The goals were to (1) conduct a needs assessment to generate baseline data which will be used to develop and implement a breakfast promotion intervention in subsequent years; and (2) build a statewide network of multi-sector stakeholders to carry out the intervention. The needs assessment data, focused on children's current dietary patterns, as well as participation in, access to, and attitudes toward school breakfast and lunch programs, was collected from children, parents, and school personnel. The network of multi-sector stakeholders included representatives from both the public and private sectors.

As a part of the precision agriculture research, a subsurface drip irrigation (SDI) utilizing a conservation system with cover crops was implemented. Best agricultural practices were evaluated and developed.

Aquaculture researchers continue their efforts on genetics work to develop better genetic stocks with greater growth rate, feed conversion efficiency and disease resistance. Technologies for efficient production of hybrid catfish were refined to be more efficient for production of fingerlings.

Introduction of New Crops for Farmers and Economic Growth in the City of Valley

The project identifies specialty crops that will expand the variety of vegetables that local farmers can provide to Farmers Markets while responding to the needs of consumers in South Central Alabama.

2. Brief description of the target audience

Researchers, extension specialists, county agents, farmers and producers in the state, processors, students (both K-12 and at our institutions), ag industries, all state citizens. 48,000 people are said to be directly involved in farming.

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	20500	105000	10500	55000

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	236	246

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2011	246

Output #2

Output Measure

- patent applications

Year	Actual
2011	0

Output #3

Output Measure

- method and best agricultural practices development

Year	Actual
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2011

5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	The long term target is to increase or to sustain agricultural production as measured by market value of agricultural products (2008 = \$4.67 billion). Program success will be indicated if market value of AL ag products stay level or increase. The short term outcome target will be the number of producers who are informed of the method developed, the varieties developed, or the best practices developed; The mid-term measure will be the number of farmers and producers adopting the methods, varieties, improved genetic stocks, or adopting the best agricultural practices.
2	Development of new variety of crops, new breeds of animals and stocks of poultry or aquaculture species
3	Development of technologies for control and management of plant diseases, pests, and animal diseases
4	Development and/or application of technologies, farming approaches, or organizational strategies that ensure the sustainability of rural communities and agricultural and forestry production systems.

Outcome #1

1. Outcome Measures

The long term target is to increase or to sustain agricultural production as measured by market value of agricultural products (2008 = \$4.67 billion). Program success will be indicated if market value of AL ag products stay level or increase. The short term outcome target will be the number of producers who are informed of the method developed, the varieties developed, or the best practices developed; The mid-term measure will be the number of farmers and producers adopting the methods, varieties, improved genetic stocks, or adopting the best agricultural practices.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Development of new variety of crops, new breeds of animals and stocks of poultry or aquaculture species

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New seed stocks or animal brood stocks are extremely important in terms of agricultural production.

What has been done

New crop varieties have been introduced and evaluated in Alabama. Technologies for efficient hybrid catfish production were developed.

Results

Now the catfish industry uses over 25% of hybrid catfish. As reproduction issues are further resolved, the hybrid catfish will have a huge economic impact. It is estimated the yield was increased over 20% and the processing yield was improved 5%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

Outcome #3

1. Outcome Measures

Development of technologies for control and management of plant diseases, pests, and animal diseases

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Development and/or application of technologies, farming approaches, or organizational strategies that ensure the sustainability of rural communities and agricultural and forestry production systems.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Application of technologies can enhance agricultural production, saving costs, and increase productivities.

What has been done

Adoption of Precision agriculture practices and technologies

Results

Precision agriculture adoption in Alabama continues to increase with technology being implemented on nearly 70% of the croppable land. This project has indicated a potential 10% reduction on applied nutrients and pesticides when Alabama farmers adopt these modern tools. This reduction has led to enhancing environmental stewardship at the farm level while providing savings to Alabama farmers. In 2011, Alabama farmers saved over \$22,000,000 on inputs through the adoption of guidance systems, variable-rate technology and automatic section control.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
125	Agroforestry
132	Weather and Climate
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
311	Animal Diseases
402	Engineering Systems and Equipment
502	New and Improved Food Products
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
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Many factors affect global food security. Human population growth and the irregular climate patterns are among the major threats to world food security.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This is the largest program in Alabama involving research in the development of new crop varieties, adoption of new seed and brood stocks, new animal breeds, development of best agricultural practices, and application of new technologies in a variety of areas ranging from integrated pest management to precision agriculture.

Good progress has been made in this area. In particular, the evaluation of many germplasm stocks that were developed elsewhere in Alabama allows adoption of genetic material in Alabama, enhancing productivity. The technologies involved in hybrid catfish production were improved. Now 25% of the industry is hybrid catfish. The application of hybrid catfish alone translates into multi-million dollars of economic gains per year.

Key Items of Evaluation

Precision agriculture adoption in Alabama continues to increase with technology being implemented on nearly 70% of the croppable land. This project has indicated a potential 10% reduction on applied nutrients and pesticides when Alabama farmers adopt these modern tools. This reduction has led to enhancing environmental stewardship at the farm level while providing savings to Alabama farmers. In 2011, Alabama farmers saved over \$22,000,000 on inputs through the adoption of guidance systems, variable-rate technology and automatic section control.

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
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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.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
304	Animal Genome			10%	10%
307	Animal Management Systems			10%	15%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			10%	0%
501	New and Improved Food Processing Technologies			20%	20%
503	Quality Maintenance in Storing and Marketing Food Products			10%	10%
504	Home and Commercial Food Service			5%	5%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			10%	15%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			20%	20%
723	Hazards to Human Health and Safety			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	1.0	0.0	14.0	8.0
Actual Paid Professional	0.0	0.0	14.0	8.0
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	750000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	750000	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	341087
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	341087
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	311281
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	311281
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 under this program area included studies to reduce the incidence of food-borne illness and provide a safer food supply; eliminating causes of microbial contamination and antimicrobial resistance; educating consumer and food safety professionals; developing food processing technologies to improve food safety; development of technologies for tracing the sources of food production; development of technologies for rapid analysis and identification of food including seafood; development of technologies for rapid detection of biological and chemical contamination such as antibiotics, pesticides, and other contaminants.

Major effort is directed at development of feasible intervention strategies to reduce or eliminate Salmonella and Campylobacter on broiler carcasses at various processing steps. Additional work is targeting Listeria monocytogenes. UV treatment of further processed poultry products is being investigated. Efforts on detection methods were made. Novel feed additives to reduce salmonella colonization in broilers and breeders are being researched. E. coli isolates from broilers are being characterized.

In 2011, Databases were established to secure agriculture and food in the face of bioterrorism. Such efforts focus on infectious agents of human diseases, but also include infectious diseases of animals and plants, including those of aquatic animals.

Singeing of beef carcasses, similar to what is performed for hog carcasses, was conducted to reduce bacterial load for the evaluation of singeing as a potential method for small processors to meet the regulations of Hazard Analysis and Critical Control Point (HACCP) in a cost-effective fashion.

Testing concentrations and contact time of peracetic acid for the purpose of meeting the new USDA performance standards was conducted with poultry meat products.

Microbial profile in poultry litter, specifically in regards to Salmonella and Clostridium perfringens accumulation was investigated.

Research was conducted to gain knowledge about the behavior of Listeria monocytogenes strains when exposed to UV radiation.

RNA sensors were developed to allow for detection of infectious RNAs at the source for the immediate protection of humans, domestic animals and crops. This nucleic acid-based technology, when perfected and commercialized, is expected to have a significant social impact in food agriculture, medical, national security and research industries.

Research results are shared with extension personnel for further dissemination, particularly to county agents, consumers, and community leaders. Additional dissemination of results are through direct contact (such as survey participants and community gatherings), through publications (experiment station bulletins, on-line reports, press releases, as well as scientific journal articles), and may include non-traditional efforts, such as working through community.

Through a competitive granting process, the Auburn University Food Systems Initiative received a \$6.5 million, five-year grant to create training programs through a Virtual Food Systems Training Consortium (VFSTC). Working closely with the FDA, AUFSI has already started creating several training course.

2. Brief description of the target audience

Researchers, educators, producers, food processors, super markets, consumers, and the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	30000	300000	20500	55000

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	15	43	58

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2011	58

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Decreased incidence of cases of food poisoning (AL state stats, % deaths from Salmonella and other intestinal infections in 2004 = 1.6%). Program success will be indicated by a decline or no change in this incidence.
2	New technology(-ies) developed to monitor microbial contaminants. (Medium term outcome)
3	New professionals in workforce with training in food safety and security. (Long-term)

Outcome #1

1. Outcome Measures

Decreased incidence of cases of food poisoning (AL state stats, % deaths from Salmonella and other intestinal infections in 2004 = 1.6%). Program success will be indicated by a decline or no change in this incidence.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

New technology(-ies) developed to monitor microbial contaminants. (Medium term outcome)

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food safety detection technologies need to be developed to provide rapid, sensitive, and accurate detection of any infectious agents on food products.

What has been done

RNA-based sensors were developed that provide high sensitivity and accuracy.

Results

A new class of sensors utilizing cRNA, a synthetic RNA complementary to a segment of the bacterial or viral RNA target, was developed. Two single-stranded DNA molecules, one acting as a receptor and the other as an enhancer, mediate cRNA detection. When these DNA strands are conjugated to gold nanoparticles to form DNA-AuNPs, colorimetric detection is achieved. When fluorophore-binding RNA networks function as an enhancer, fluorescence is monitored to detect cRNAs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
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

New professionals in workforce with training in food safety and security. (Long-term)

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Properly trained labor force is required in the area of food safety as dealing with issues of food safety requires high levels of knowledge, skills, and technologies.

What has been done

Students, both undergraduates and graduates, were involved in food safety research that allowed them to be trained to meet the future needs.

Through a competitive granting process, the Auburn University Food Systems Initiative received a \$6.5 million, five-year grant to create training programs through a Virtual Food Systems Training Consortium (VFSTC). Working closely with the FDA, AUFISI has already started creating several training course.

Results

15 students were trained in the area of food safety and detection, preparing them for food safety jobs.

A course on microbiology will include a stand-alone module on Listeria, the bacteria implicated in a deadly outbreak of foodborne illness traced back to cantaloupes. The course will also include a module on Vibrio vulnificus, a deadly bacterium that infects oysters raised in the warm waters of the Gulf. Also in production is a course on Oral Communications, aimed at inspectors who have to communicate bad news to plant managers and officials who have to talk about outbreaks of foodborne illness. In addition, a stand-alone Specialty Eggs module will educate both consumers and inspectors about the new kinds of eggs on the market and serve as an introduction to a course on egg safety.

A number of other FDA courses are in the works, and the VFSTC will also serve as an umbrella to create other training programs utilizing state-of-the-art technology for distance learning. To provide FDA training, AUFSI is required to become an "authorized provider" through the International Association for Continuing Education and Training (IACET). When the process is complete early next calendar year, AUFSI will be able to provide Continuing Education units for a variety of training programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
307	Animal Management Systems
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

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

The major issue in research is the lack of research funding.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Food safety is a priority program at Auburn University. Starting with AU Food Safety Initiative a couple years ago, Auburn has developed this initiative into a broader initiative of AU Food Systems Initiative. Under this initiative, researchers are working on research, training, and extension. Good results have been achieved in the initial phase of this program. Dr. Pat Curtis was appointed as the first Director for the AU Food Systems Initiative, with the intention to further develop this program with the goal for the establishment of a Food Systems Institute at Auburn.

Key Items of Evaluation

Auburn University Food Systems Initiative was established in 2011 with the focus of food safety research, training, technology development and outreach. This Initiative has made major progress with its obtaining of \$6.5 million grant from FDA. Various virtual training modules are being developed with the goal of becoming a training hub in southern US for food safety.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Human nutrition, health, wellbeing and child obesity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food			10%	10%
702	Requirements and Function of Nutrients and Other Food Components			5%	5%
703	Nutrition Education and Behavior			10%	10%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			5%	5%
724	Healthy Lifestyle			25%	25%
802	Human Development and Family Well-Being			10%	10%
805	Community Institutions, Health, and Social Services			5%	5%
806	Youth Development			25%	25%
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	12.0	10.0
Actual Paid Professional	0.0	0.0	12.0	10.0
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	600000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	600000	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	172712
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	172712
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	753850
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	753850
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

This research program was developed to include studies of molecular and cellular mechanisms of obesity, mapping of obesity-related traits in the genomes using animal models, surveys on lifestyle habits (food choice, exercise) of citizens, evaluation of underlying reasons for these habits, program development for improvement, and measuring adoption of improved diets and activity levels. Research activities also included exploration of non-traditional means of delivery of nutritive components. Research results was shared with extension personnel for further dissemination, particularly to county agents, consumers, and community leaders. Additional dissemination of results was through direct contact (such as survey participants and community gatherings), through publications (experiment station bulletins, on-line reports, press releases, as well as scientific journal articles). Specifically,

- Research has been conducted to address the causes of obesity. Among many factors, dietary behaviors that may promote overeating among different population segments was studied.
- Research was conducted to document children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) and their performance during the daytime.
- Research was conducted to study the relationship between quality of young children's relationships with caregivers and all aspects of their lives far into the future, from cognitive performance and friendships in preschool to psychological well being and physical health in late adulthood.
- Research was conducted to study the relationship between Quality of Life among the Elderly Community and the Internet Technology Adoption
 - Seniors are increasingly finding the necessity to engage in Internet technology (e.g., online healthcare management, banking, shopping, and trading). Despite its usefulness, the adoption of the Internet among a large majority of the older population has been limited. Dr. Kwon's AAES research projects have allowed for discovery of the physical, cognitive, and social issues which lead to impediments in technology usability among older users. Further, Dr. Kwon and her collaborators have developed web-based interfaces incorporating innovative intelligent virtual agent technology that significantly reduces older users' physical, cognitive, and social barriers to Internet adoption. This research have significant implications for quality of life among the elderly community by fostering greater independence and empowerment, facilitating social interactions and communications, and bolstering self-efficacy and morale among seniors.
 - Research was conducted to Address Body Weight, Composition, Size and Shape. 3D Body Scan Technology was used in the Study of Obesity. Auburn researchers are currently working with the Chambers County School System to explore the use of an innovative technology which allows interface of body measurements captured by 3D whole body scanning with software to build 3D avatars with 9 year old 4th graders. Personalized morphing avatars are being used to study the impact of virtual visualization on maintaining healthy eating habits and increasing physical activity.
 - Scientists are working with selected head-start programs in three counties to educate the teachers on food choices and exercise activities to reduce childhood obesity.

2. Brief description of the target audience

All state citizens, particularly targeted groups of children and high-risk citizens. Students (K through 12; college groups). Food producers and marketers.

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	50500	105000	5500	30000

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	75	85

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- publications

Year	Actual
2011	85

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Optimal nutritional recommendations made available to citizens
2	Public awareness of the relationship of healthy food and wellbeing and obesity
3	Reduction in obesity and overweight rate (66.6% in 2008) in population and children, and reduction of the level of obesity
4	health care cost will be lowered as a result of obesity reduction.

Outcome #1

1. Outcome Measures

Optimal nutritional recommendations made available to citizens

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Public awareness of the relationship of healthy food and wellbeing and obesity

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	250000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Public need to be aware that their health, wellbeing and happiness are directly related with the food they consume. Improper consumption of food (quantities and quality as well as the manners of consumption) lead to obesity.

What has been done

Research has been conducted to address the causes of obesity. Among many factors, a dietary behavior that may promote overeating among different population segments was studied.

Research was conducted to document children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) and their performance during the daytime.

Research was conducted to study the relationship between quality of young children's relationships with caregivers and all aspects of their lives far into the future, from cognitive performance and friendships in preschool to psychological well being and physical health in late adulthood.

Research was conducted to study the relationship between Quality of Life among the Elderly Community and the Internet Technology Adoption

Seniors are increasingly finding the necessity to engage in Internet technology (e.g., online healthcare management, banking, shopping, and trading). Despite its usefulness, the adoption of the Internet among a large majority of the older population has been limited. Dr. Kwon's AAES research projects have allowed for discovery of the physical, cognitive, and social issues which lead to impediments in technology usability among older users. Further, Dr. Kwon and her collaborators have developed web-based interfaces incorporating innovative intelligent virtual agent technology that significantly reduces older users' physical, cognitive, and social barriers to Internet adoption. This research has significant implications for quality of life among the elderly community by fostering greater independence and empowerment, facilitating social interactions and communications, and bolstering self-efficacy and morale among seniors.

Research was conducted to Address Body Weight, Composition, Size and Shape. 3D Body Scan Technology was used in the Study of Obesity. Auburn researchers are currently working with the Chambers County School System to explore the use of an innovative technology which allows interface of body measurements captured by 3D whole body scanning with software to build 3D avatars with 9 year old 4th graders. Personalized morphing avatars are being used to study the impact of virtual visualization on maintaining healthy eating habits and increasing physical activity.

Results

Associations between individuals' frequency of eating occasions (meals and snacks) and their total energy intake were found. The prevalence of obesity has been found to be especially high among those individuals with low-incomes and subsequently having a low-income is one of the most important determinants of food insecurity (the absence of access at all times to enough food for an active, healthy life).

Children in full-day preschool/daycare programs are (on average) suffering a sleep deficit during the work week (i.e., when they would be attending the child care program) and this deficit is not made up by daytime naps. Children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) are significantly correlated (that is, children with less optimal night time sleep tended to have less optimal daytime sleep as well). Importantly, sleep disturbances (either in duration or in overall sleep quality and organization) interfere with children's adaptive functioning in the preschool setting. Children whose sleep quality-sleep organization is disturbed at night were less able to organize story narratives in a coherent and meaningful way than were children whose night time sleep was less disturbed. Children who had less overall night time sleep received lower scores on standard tests of vocabulary knowledge, were less accepted by their peers, understood less about the causes of emotion states in others, and were described by their teachers as less well adjusted in the classroom, in comparison to children who had relatively more night time sleep.

Children who experience harsh or insensitive care are at greater risk for development of social, psychiatric, and physical health disorders. A key to understanding the long reach of early relationships appears to be activity of the stress-response systems, including the hypothalamic-pituitary-adrenal (HPA) axis and its primary end product in humans, cortisol. Poorer quality care in early childhood leads to dysregulation of the HPA axis, which in turn triggers a wide range of maladaptive processes. This work is likely to have high impact because the most salient sources of stress in the lives of young children are poor quality relationships with care givers. Decades of research document increased risk for children who grow up in persistent poverty or with harsh or insensitive parents, particularly if those adverse circumstances are present very early in the child's life. Only now, however, are researchers beginning to identify the biological processes that link early adversity to life-long health. Research linking parent-child and teacher-child relationships with key components of the stress response will be key in understanding of biochemistry and social success.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
724	Healthy Lifestyle
802	Human Development and Family Well-Being
805	Community Institutions, Health, and Social Services
806	Youth Development
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Reduction in obesity and overweight rate (66.6% in 2008) in population and children, and reduction of the level of obesity

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

health care cost will be lowered as a result of obesity reduction.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The economic down turn may have had a negative impact on human health, wellbeing, and happiness, which may have increased the level of obesity.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Research in this area has allowed a better understanding of the factors that influencing human health, wellbeing, and happiness. Other than nutrition, a number of social factors are also very important to child development and their eventual success. In particular, a number of studies have documented the impact of stress, child relationship with day care, sleep and other factors on success of the children.

Seniors are increasingly finding the necessity to engage in Internet technology (e.g., online healthcare management, banking, shopping, and trading). Despite its usefulness, the adoption of the Internet among a large majority of the older population has been limited. Dr. Kwon's AAES research projects have allowed for discovery of the physical, cognitive, and social issues which lead to impediments in technology usability among older users. Further, Dr. Kwon and her collaborators have developed web-based interfaces incorporating innovative intelligent virtual agent technology that significantly reduces older users' physical, cognitive, and social barriers to Internet adoption.

This research have significant implications for quality of life among the elderly community by fostering greater independence and empowerment, facilitating social interactions and communications, and bolstering self-efficacy and morale among seniors.

- Associations between individuals' frequency of eating occasions (meals and snacks) and their total energy intake was found. The prevalence of obesity has been found to be especially high among those individuals with low-incomes and subsequently having a low-income is one of the most important determinants of food insecurity (the absence of access at all times to enough food for an active, healthy life).
- Children in full-day preschool/daycare programs are (on average) suffering a sleep deficit during the work week (i.e., when they would be attending the child care program) and this deficit is not made up by daytime naps (El-Sheikh et al., in press). Children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) are significantly correlated (that is, children with less optimal night time sleep tended to have less optimal daytime sleep as well). Importantly, sleep disturbances (either in duration or in overall sleep quality and organization) interfere with children's adaptive functioning in the preschool setting. Children whose sleep quality-sleep organization is disturbed at night were less able to organize story narratives in a coherent and meaningful way than were children whose night time sleep was less disturbed. Children who had less overall night time sleep received lower scores on standard tests of vocabulary knowledge, were less accepted by their peers, understood less about the causes of emotion states in others, and were described by their teachers as less well adjusted in the classroom, in comparison to children who had relatively more night time sleep.
- Children who experience harsh or insensitive care are at greater risk for development of social, psychiatric, and physical health disorders. A key to understanding the long reach of early relationships appears to be activity of the stress-response systems, including the hypothalamic-pituitary-adrenal (HPA) axis and its primary end product in humans, cortisol. Poorer quality care in early childhood leads to dysregulation of the HPA axis, which in turn triggers a wide range of maladaptive processes. This work is likely to have high impact because the most salient sources of stress in the lives of young children are poor quality relationships with care givers. Decades of research document increased risk for children who grow up in persistent poverty or with harsh or insensitive parents, particularly if those adverse circumstances are present very early in the child's life. Only now, however, are researchers beginning to identify the biological processes that link early adversity to

life-long health. Research linking parent-child and teacher-child relationships with key components of the stress response will be key in understanding of biochemistry and social success.

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Key Items of Evaluation

• Research at Auburn in this program area has focused on the relationship of a number of factors affecting human health, wellbeing, and obesity. In particular, researchers have focused on eating habits such as individuals' frequency of eating occasions (meals and snacks) and their total energy intake, sleep patterns and health, stress and social development, and the adoption of the Internet communications with the happiness and wellbeing of the elderly. The following are some of the key findings:

• The prevalence of obesity has been found to be especially high among those individuals with low-incomes and subsequently having a low-income is one of the most important determinants of food insecurity (the absence of access at all times to enough food for an active, healthy life).

• Children in full-day preschool/daycare programs are (on average) suffering a sleep deficit during the work week (i.e., when they would be attending the child care program) and this deficit is not made up by daytime naps (El-Sheikh et al., in press). Children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) are significantly correlated (that is, children with less optimal night time sleep tended to have less optimal daytime sleep as well).

Importantly, sleep disturbances (either in duration or in overall sleep quality and organization) interfere with children's adaptive functioning in the preschool setting. Children whose sleep quality-sleep organization is disturbed at night were less able to organize story narratives in a coherent and meaningful way than were children whose night time sleep was less disturbed. Children who had less overall night time sleep received lower scores on standard tests of vocabulary knowledge, were less accepted by their peers, understood less about the causes of emotion states in others, and were described by their teachers as less well adjusted in the classroom, in comparison to children who had relatively more night time sleep.

• Children who experience harsh or insensitive care are at greater risk for development of social, psychiatric, and physical health disorders. A key to understanding the long reach of early relationships appears to be activity of the stress-response systems, including the hypothalamic-pituitary-adrenal (HPA) axis and its primary end product in humans, cortisol. Poorer quality care in early childhood leads to dysregulation of the HPA axis, which in turn triggers a wide range of maladaptive processes. This work is likely to have high impact because the most salient sources of stress in the lives of young children are poor quality relationships with care givers. Decades of research document increased risk for children who grow up in persistent poverty or with harsh or insensitive parents, particularly if those adverse circumstances are present very early in the child's life. Only now, however, are researchers beginning to identify the biological processes that link early adversity to life-long health. Research linking parent-child and teacher-child relationships with key components of the stress response will be key in understanding of biochemistry and social success.

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Seniors are increasingly finding the necessity to engage in Internet technology (e.g., online healthcare management, banking, shopping, and trading). Despite its usefulness, the adoption of the Internet among a large majority of the older population has been limited. Dr. Kwon's AAES research projects have allowed for discovery of the physical, cognitive, and

social issues which lead to impediments in technology usability among older users. Further, Dr. Kwon and her collaborators have developed web-based interfaces incorporating innovative intelligent virtual agent technology that significantly reduces older users' physical, cognitive, and social barriers to Internet adoption. This research have significant implications for quality of life among the elderly community by fostering greater independence and empowerment, facilitating social interactions and communications, and bolstering self-efficacy and morale among seniors.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
125	Agroforestry			5%	10%
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	5%
202	Plant Genetic Resources			5%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			15%	15%
211	Insects, Mites, and Other Arthropods Affecting Plants			5%	5%
212	Pathogens and Nematodes Affecting Plants			5%	5%
216	Integrated Pest Management Systems			10%	10%
402	Engineering Systems and Equipment			5%	0%
405	Drainage and Irrigation Systems and Facilities			5%	0%
601	Economics of Agricultural Production and Farm Management			10%	10%
603	Market Economics			5%	5%
605	Natural Resource and Environmental Economics			10%	10%
607	Consumer Economics			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	10.0	9.0
Actual Paid Professional	0.0	0.0	10.0	9.0
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	550000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	550000	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	332151
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	332151
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	334378
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	334378
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

The goal of this program is to increase our knowledge of bioconversion of feedstocks to bioenergy and bioproducts, bioprocessing systems, biomass production, and conversion of byproducts into value-added products and to enhance understanding of the long-term sustainability of feedstock production and bioconversion systems including economics, social issues, land use policies, and energy security and the environment. Specific areas of research include, but are not limited to: alternative crops for efficient production of bioenergy feedstocks, biotechnology of bioenergy crops to enhance production or to enhance its utilization as an energy source, and technology development for bioenergy conversion. The ultimate goal of this program is to address issues related to renewable energy using bio-based feedstocks that ultimately contribute to the relief of energy dependence on foreign sources.

Our program on bioenergy and bioproducts includes all three land-grant mission areas (research, instruction, and extension). Overall the program employs a systems approach to developing a biorefining industry in the southeast U.S. that is based mainly on utilizing biomass resources. Within the various types of biomass, most emphasis is currently being placed on woody biomass (both pine and short-rotation hardwoods) to compliment long-running research on herbaceous biomass (e.g. switchgrass) production. Auburn's program includes all aspects of the supply chain that produces woody biomass and converts it to liquid fuels, renewable electrical power, and other high value chemicals and biobased products. In general, our work emphasizes the thermochemical conversion of biomass to these various products. Specific projects underway currently include:

- Production systems for short-rotation hardwoods. We are in the initial stages of establishing research and demonstration plots for hybrid poplar and eucalyptus on marginal lands (in collaboration with Arborgen, Inc.). This research and extension project will examine genetic, silvicultural, and harvesting system factors in the effectiveness of short-rotation hardwood systems.
- New harvesting and transportation systems for southern pine energy plantations. Our research and extension work has developed and is field testing a new track-type, shear-head feller buncher; new wheeled skidder; high-capacity whole tree chipper; and high-capacity trucks for harvesting and transporting woody biomass to liquid fuel producers. Additional components of this research are expanding our understanding of the effects of harvesting and processing on biomass quality.
- Harvesting systems for short-rotation hardwoods. We are beginning new research and extension work to identify the optimal systems for harvest of short-rotation hardwoods as grown in the southeast U.S.
- Safety of woody biomass production systems. One component of our logistics system research is the examination of safety and health issues for forest workers, with particular emphasis on workers operating forest harvesting machines.
- Biomass fractionation. Research underway is utilizing biomass fractionation to separate biomass into the basic chemical constituents (cellulose, hemicellulose, and lignin) and subsequent production of higher value chemicals such as polylactic acid.
- Biomass gasification and synthesis gas cleanup for electrical power generation. Research is developing models to predict synthesis gas quality as a function of biomass characteristics and gasifier operating parameters. Also, this work is examining strategies for syngas cleanup.
- Biomass gasification and electrical power generation. Long term research on the use of downdraft gasification and electrical power generation has examined the economic potential of various low-cost residue feedstocks such as urban biomass, pecan shells, forest residues, recycled plastics, and municipal sewage sludge.
- Biomass gasification, syngas cleanup, and liquid fuel production. Research is examining the relationships between biomass compositions, gasification parameters, syngas cleanup, and Fischer-Tropsch conversion to be able optimize liquid fuel production systems.
- Biomass pyrolysis. Research is examining catalytic methods for stabilizing and upgrading pyrolysis

oils.

- Fischer-Tropsch synthesis for production of liquid fuels and chemical. Development of unique, super-critical phase Fischer-Tropsch synthesis has opened the door to new pathways to produce diesel and aviation fuels along with aldehydes and oxygenates.
 - Community impacts of the bioeconomy. Research is examining social and economic considerations for developing a biorefining industry in the southeast U.S.
 - Graduate education in biorefining. We have embarked on a program of graduate education centered around biorefining. New graduate courses and graduate research will focus on multidisciplinary projects in biorefining.
 - Undergraduate fellowships in biorefining. We are leading the development of a new undergraduate fellowship program on biorefining and production of liquid fuels. New courses and concentrated multidisciplinary undergraduate team experiences will foster the solution of biofuel industry problems.
- The School of Forestry and Wildlife Sciences (SFWS) was very active in bioenergy research during 2011 with approximately \$1.3M brought into the School from prestigious funding sources such as AFRI and NSF. Most of the research was focused on refining methods to facilitate the conversion of small diameter trees and logging residues into ethanol and related byproducts. In addition, related research explored the socioeconomic factors across rural areas in the southeastern United States which could either facilitate or slow biofuel crop production.
 - Scientists continue research on alternative crops such as miscanthus, sweetpotato, sugarcane and sweet sorghum as biomass feedstock for bioethanol production.

2. Brief description of the target audience

Researchers, educators, extension personnel, community leaders, educators, 4H, youth centers, energy consumers, general public.

3. How was eXtension used?

eXtension is 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	2100	45000	2500	55000

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

Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	17	17

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2011	17

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Development of efficient bioenergy crops
2	Increased acreage of bioenergy crops such as corn, switchgrasses, sweetpotatoes, and canola.
3	Increased percentage of bioenergy in the overall consumption of energy

Outcome #1

1. Outcome Measures

Development of efficient bioenergy crops

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)

Bioenergy crops need to be identified, evaluated, and tested for their productivity.

What has been done

Our program on bioenergy and bioproducts includes all three land-grant mission areas (research, instruction, and extension). Overall the program employs a systems approach to developing a biorefining industry in the southeast U.S. that is based mainly on utilizing biomass resources. Within the various types of biomass, most emphasis is currently being placed on woody biomass (both pine and short-rotation hardwoods) to compliment long-running research on herbaceous biomass (e.g. switchgrass) production. Our program includes all aspects of the supply chain that produces woody biomass and converts it to liquid fuels, renewable electrical power, and other high value chemicals and biobased products.

Results

Woody plants such as pine and short-rotation hardwoods have been identified as the major bioenergy feedstock species for Alabama. In addition, switchgrasses and sweetpotatoes have also been identified as a suitable bioenergy crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
125	Agroforestry
201	Plant Genome, Genetics, and Genetic Mechanisms

202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
405	Drainage and Irrigation Systems and Facilities
601	Economics of Agricultural Production and Farm Management
603	Market Economics
605	Natural Resource and Environmental Economics
607	Consumer Economics

Outcome #2

1. Outcome Measures

Increased acreage of bioenergy crops such as corn, switchgrasses, sweetpotatoes, and canola.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increased percentage of bioenergy in the overall consumption of energy

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Research funding limitation is the bottleneck to conduct extensive research in the area of bioenergy and bioproducts.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Good progress was made, but major research funding is needed to make a difference. A number of activities are ongoing and it takes years before meaningful results can be achieved. In 2011, Auburn faculty completed a feasibility study for collection of urban biomass to generate renewable electrical power for a municipality. The study was conducted for the City of Fultondale, Alabama. Fultondale collects approximately 1800 dry tons of biomass per year from urban sources and places it in a construction and demolition waste landfill. The goal of the study was to determine if it would be feasible to use this biomass as a feedstock for a biomass gasification and renewable power generation facility. The results of this project indicate that there are significant seasonal variations in biomass availability. The total annual amount of biomass available was slightly over 3.6 million pounds (dry weight), or 1,810 dry tons. This amount is significantly less than what was projected to be available before the project started. The properties of the biomass make it well suited for use in gasification and power generation systems. Gasification test results showed the urban woody biomass is a feedstock that has the potential to be converted very efficiently to syngas and subsequently used for power production. Insufficient data were available to develop and validate geospatial models to predict urban biomass production for Fultondale. The plant economics of heat and electricity production from urban biomass waste collected in Fultondale were analyzed by using a modular economic model with drying, chipping, gasification and power generation modules. Three gasification systems (fluidizedbed, downdraft and updraft) and three power generation systems (internal combustion, steam turbine and gas turbine) were assessed resulting in nine plant configuration scenarios. The fluidizedbed reactor and internal combustion engine plant configuration resulted in the lowest cost of electricity of \$0.15/kWh for an installed capacity of 257 kWe. Overall, while technically feasible, a biomass gasification system designed to use urban biomass wastes from the City of Fultondale will have limited economic feasibility due to the limited amount of biomass available and the resulting small scale of the system.

This project characterized urban biomass collected from a city in the southeast U.S. The results from the biomass characterization research showed that urban biomass is very suitable for use in gasification and power generation facilities. These results are important for public private partnerships by demonstrating that the quality of urban biomass feedstocks is sufficient for renewable energy projects. The project also showed that for a single municipality, it may not be economically feasible to generate renewable electrical power using the biomass from a single municipality. However, if multiple groups can join together and pool biomass resources, the economic feasibility of a power generation facility may improve while also reducing loading on local landfills.

Key Items of Evaluation

NIFA's approach of funding Bioenergy research is through the large CAP projects. While multi-institutional collaborations are positive, the dilution of funds is serious. It may appear that millions are poured into a single project, but at the end, the available funds for each researcher are so limited, which may not achieve the intended objectives. In addition, whoever received the funding can continue the research. However, many others who are not successful in funding may no longer be able to continue research activities without funding.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Industry-wide emerging issues

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			5%	0%
112	Watershed Protection and Management			5%	0%
202	Plant Genetic Resources			0%	10%
211	Insects, Mites, and Other Arthropods Affecting Plants			0%	10%
212	Pathogens and Nematodes Affecting Plants			0%	10%
215	Biological Control of Pests Affecting Plants			0%	10%
216	Integrated Pest Management Systems			0%	30%
302	Nutrient Utilization in Animals			20%	0%
303	Genetic Improvement of Animals			20%	0%
308	Improved Animal Products (Before Harvest)			10%	0%
402	Engineering Systems and Equipment			10%	0%
403	Waste Disposal, Recycling, and Reuse			10%	0%
601	Economics of Agricultural Production and Farm Management			20%	30%
	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	1.0	0.0	2.0	1.5
Actual Paid Professional	0.0	0.0	5.0	1.5
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	300000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	300000	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	386704
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	386704
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	50000
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	50000
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 and extension projects were done to meet the industry's needs and address their immediate and urgent concerns. In 2011, we continued the project of Pond to Plate, working with the catfish industry. The catfish industry was facing serious challenges. The Pond to Plate project was developed to address system-wide issues for the catfish industry.

A program to assist limited minority farmers to supply selected fresh produce to Wal-Mart was initiated in 2011.

2. Brief description of the target audience

The agricultural commodity groups, industry groups, the producers, educators, researchers, extension specialists, agents, and the general public. In 2011, the major effort was devoted to the catfish industry.

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	1100	5500	1050	5500

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Industry concern is addressed.

2011 Alabama A&M University and Tuskegee University and Auburn University Combined Research Annual Report of Accomplishments and Results

Year	Actual
2011	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Concerns of the industry under consideration are addressed satisfactorily.

Outcome #1

1. Outcome Measures

Concerns of the industry under consideration are addressed satisfactorily.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The catfish industry was facing unprecedented challenges due to international competition and increases in costs of feed and energy. If left unattended, the catfish could have already been out of business entirely.

What has been done

- Yield verification trials using best management practices on three catfish operations in West Alabama to determine efficiencies and lower cost of production.
- Biological and economic analysis of the in-pond raceway catfish production system that shows much promise as it provides much more control of the fish from start to finish than the traditional multiple-batch pond production systems that are the current standard practice.
- Several efforts are concentrated toward consistent high quality products and particularly our research efforts are focusing on the off-flavor and off-coloration issue in catfish fillets. The white fillet is most prized and the fillet with yellow streaks is less favored in the fresh market place. i) We have a data collection effort of farm pond management for harvested fish and an associated yellow fillet enumeration at the processing plant to determine the percentage of yellow fillets coming from the pond. This should provide us with clues as to how management affects yellow color collection in the fillet and allow us to plan research and trials to change management recommendations to reduce the yellow fillet issue at the farm level. ii) Laboratory analysis of causes of yellow coloration continues as well, where we are trying to experiment with several different washes to remove the yellow color through "washes". iii) Digital photographic measurement of color in catfish fillets continues and will allow us to discuss with catfish producers the potential of mechanization of the identification and sorting of fillet processes according to color ranges.
- A three prong approach attacking the virulent *Aeromonas hydrophila* infection using epidemiology investigations into the causes of this disease's spread and management to reduce

its transmission, diagnostic tool and vaccine development.

e) Retail scanner data analysis of fish and seafood products in 52 US cities is allowing us to understand the substitutability and complementarity between fish species in the market place and elasticity estimation so we can discuss with catfish processing companies how they can best place and price their products in specific US markets.

Scientists and outreach personnel worked with Wal-Mart representatives to organize limited resource in selling selected fresh produce to Wal-Mart warehouse in Alabama

Results

Each project fits together in the pond-to-plate concept as they will fill our knowledge gaps and aid the US catfish industry in its transformation into a modern livestock industry that provides products that are competitive with imported fish products and meet high consumer expectations and standards. Major achievements include:

Demonstration of in-pond raceway system, implementation of best aquaculture practices, management and control of *Aeromonas* bacterial disease, and control of yellow flesh disease. Several truck loads of watermelons, peas and greens were sold to Wal-Mart by limited resource farmer groups to promote locally grown produce.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
202	Plant Genetic Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
308	Improved Animal Products (Before Harvest)
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
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
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Competing cheaper international supplies)

Brief Explanation

International competition was very keen for the catfish industry. Catfish imports were significantly up in recent years, placing huge pressure to catfish producers and the catfish industry as a whole.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Auburn university's research was the basis of the catfish industry. In recent years, the catfish industry has had many challenges because of increased feed prices, energy costs, and fierce international competition. Through the Pond to Plate project, the system wide measures were evaluated and implemented.

Minority limited resource farmers were able to form farmer groups/cooperatives that enable them to provide volume for the produce sold to Wal-Mart

Key Items of Evaluation

Auburn University's research and extension efforts were the source of the start of the catfish industry in early 1980's. In recent years, the keen international competition, particularly cheap imports from China and the Vietnam, has placed huge pressure to the catfish industry. In the last a few years, Auburn University's research and extension effort is a direct force to save the industry. Through this Pond to Plate project, the catfish industry has gone through the hardest period of its history, and now getting out of the crisis becoming a stronger industry.

Trough the Wal-Mart initiative minority farmers will be able to have market access for their produce..