2014 Tuskegee University and Auburn University and Alabama A&M University Combined Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Agriculture, forestry and related industries are a significant sector of Alabama's economy. Combined, agricultural industries create >580,000 jobs, i.e., one in every 4.7 jobs are related to agriculture. These industries contribute >$70 billion to Alabama's economy. Research activities that support Alabama's large and broad agricultural industries are diverse ranging from very basic to highly applied and adoptive. Alabama also has three land grant universities. Therefore, we acknowledge the difficulty in reporting the complete activities of these three land grant institutions. Therefore this report, provides only a sample of some of the highlights of research conducted in 2014. In addition, because research is a continuous process, and to provide a report so different from previous years is unrealistic.

This report covers the research activities, results, and accomplishments of all three Alabama land grant universities, i.e., Alabama A&M University, Auburn University, and Tuskegee University during the 2014 fiscal year. The three universities have distinct programs 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, obesity, 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; (2) Climate Change including issues related to environment, ecosystems, and natural resources; (3) Food safety including nutrition, health and well-being, and agricultural biosecurity; (4) Childhood obesity; (5) Sustainable energy including bioenergy, bioproducts 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 marketplace, AARP supports and participates in the activities 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, natural resources and related sciences 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 2014.

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, small ruminants, 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 >$23 million in 2014. Alabama poultry industries generate >$2 billion dollars annually, and savings from the adoption of better insulated chicken houses have exceeded $10 million

dollars annually. Similarly, the industry share of hybrid catfish has increased to >20%. Hybrid catfish made from the inter-specific hybridization of channel catfish female crossed with blue cat fish male exhibit superior traits in growth, resistance to diseases, feed conversion, and processing yields. Productivity and profits are estimated to increases at least 20-30% because of the application of the hybrid cat fish. More than 200 million hybrid catfish fry are being produced per year and now more than half of the catfish industry uses hybrid catfish. Given that the catfish industry is a billion dollar industry, this technology alone can increase the catfish industry by >$100 million a year. Dissemination of several specialty crops including seven chestnut varieties and two kiwifruit varieties has generated great economic impact as well. Work at Tuskegee University on the production and marketing of selected fresh fruits and vegetables (water melons, greens and peas) to large wholesales grocery stores and out lets adaptability and marketability of ethnic Asian and African vegetable crops for production lets by limited resource farmers show very promising results. In addition, development of year round pastures for goats and silvo-pasture technologies have proven to be a great potential for income generation of limited resource farmers

The experiment stations of the three universities have been the major forces for research in the area of food safety. Auburn University established its AUFood Systems Initiative and is working to serve the nation as a "food safety hub" for the development of detection technologies, food safety testing, and 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 enhance food safety research in Alabama. Alabama A&M University is researching the survival and transmission of food borne pathogens in certain plant models. Using pine bark as a feed additive, research at Tuskegee University has shown a reduction of internal parasites in goats thus drastically reducing the use of chemical drugs in the control of these parasites.

The three universities are seriously engaged in Alabama Obesity Initiative to address the important 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 and Tuskegee University are leading efforts in obesity intervention in high risk families, particularly underserved youth, using integrated approaches.

In spite of the uncertainty, research in the areas of climate change and bioenergy has begun to gain ground; more citizens are becoming aware of the problem and engaged to make 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 germ plasm with both plants and animals, but funding levels remain low.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	85.0	68.0
Actual	0.0	0.0	98.2	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. An administrative panel to allocate continued funding evaluated programs that encompass several projects, particularly those with identified funding sources (i.e., the AAES Hatch/Multistate Funding Program). 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 and made its recommendations to the Associate Director of AAES, who worked with staff of the 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, a call for proposals was issued by the Dean and 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 Dean and Research Director. In all cases, accountability was built into each program. The RFP requires leverage of extramural funding to increase the impact of formula funds. After completion of the first phase of seeds funding, the principle investigators must provide a section of "Results from Previous Funding" that include the leverage of extramural funding, research publications, products, patents, and methods. The evaluation panel will determine if the seeds funding was used effectively in leveraging funds and in generating research output, both quantitatively and qualitatively. Lack of leverage and lack of significant research output alone is enough reason to discontinue funding. At Tuskegee University all proposals are required to be multidisciplinary and integrative and must address critical need areas based on USDA's priority and challenge areas. Proposals are initially reviewed by an internal panel. Selected proposals are corrected based on the reviewers' comments and then sent out for external reviews. Corrected final proposals are submitted to USDA/NIFA for approval. 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 that enhances multi-institutional collaborations.

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.

Input was collected through regular meetings with discussion and feedback from various stakeholders groups. 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, Small Farmers Agriculture Cooperative, Annual Farmers Conference, 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
- Needs Assessments
- Use Surveys

Brief explanation.

Several groups have been and continue to be established. These include advisory committees that encompass producers and consumer groups. Surveys were conducted through various AAES and other institutional newsletters, and input was sought from the general public. The core stakeholders group is the commodity groups, agricultural organizations and cooperatives, producers, processors, market professionals, and consumers. 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)
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey of selected individuals from the general public

Brief explanation.

Several groups have been established and are continuing their operations. These include advisory committees that encompass producers and consumer groups. Surveys were conducted through various AAES and other institutional 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.

The AARP administrators take stakeholder input very seriously. Input was used to set program priorities that are not only used for distribution of research funds, but also for hiring of new faculty and staff to meet the long term goals. Their input is also used to identify emerging agricultural issues. In a number of cases, research funds were redirected to address urgent and emerging agricultural issues identified by the agricultural industries. 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 re-evaluated and validated for the changed situation; however 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. Agricultural research, education, and extension labor force is continually becoming smaller and could become ineffective in reaching a critical mass of information end-users. This adversely impacts agricultural research, education and extension. For instance, we can no longer fill positions that are crucially important due to budget cuts.

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	2683894

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	5125653	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	2664788

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	1714661
Actual Matching	0	0	0	2683893
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	4398554

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	4636230	0
Actual Matching	0	0	4636230	0
Actual All Other	0	0	0	0
Total Actual Expended	0	0	9272460	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	2237400
Actual Matching	0	0	0	2055723
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	4293123

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			5%	5%
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
111	Conservation and Efficient Use of Water			5%	5%
123	Management and Sustainability of Forest Resources			0%	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%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			15%	15%
206	Basic Plant Biology			5%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants			5%	5%
212	Pathogens and Nematodes Affecting Plants			5%	5%
213	Weeds Affecting Plants			2%	0%
216	Integrated Pest Management Systems			6%	5%
302	Nutrient Utilization in Animals			5%	15%
311	Animal Diseases			10%	5%
402	Engineering Systems and Equipment			5%	0%
502	New and Improved Food Products			2%	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

Auburn University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	22.0	21.5
Actual Paid	0.0	0.0	43.3	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

Alabama A&M University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	22.0	21.5
Actual Paid	0.0	0.0	0.0	17.6
Actual Volunteer	0.0	0.0	0.0	0.0

Tuskegee University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	22.0	21.5
Actual Paid	0.0	0.0	0.0	12.5
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	2891440	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	2891440	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	947395
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	1482851
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	963688
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	885381
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 understand the biology of plants and animals, understand their genome capacity and plasticity, understand genes controlling production and performance traits, and use such knowledge to develop new cultivars in plant production systems, improved animal and fish stocks, and develop management strategies. Research was conducted to develop improved production methods such as improved crop production systems; improved poultry and animal production systems, develop nutritional strategies in animal production systems. Research was also conducted to develop the best agricultural practices for growing crops and animals with minimal impact to the environment, lowest possible input, and maximal output. Examples include planting schemes, rotation, irrigation and water management, harvest, and post-harvest technologies, integrated pest and disease management systems for plants and animals, nutrition re-definition, management, feeding schemes, and other agricultural practices. Our ~~objective~~ goal was to conduct research to develop value-added foods, alternatives to pesticides and antibiotics to control disease outbreaks, and conduct economic analysis to increase profit margins.

Research results were shared with extension personnel for further dissemination, particularly to county agents and producers. Additional dissemination of results were through direct contacts with farmers and producers (such as at field days and demonstrations, and commodity meetings), through publications (experiment station bulletins, on-line reports, press releases, as well as scientific journal articles), and

include non-traditional efforts, such as working throughout communities and use of the Internet such as web sites, YouTube videos, iTunes, and other social media.

Research was conducted to develop more effective vaccines and other control methods to manage cattle, chicken, and fish diseases. The impact of Chlamydia spp. infections on calves and dairy cattle health and productivity was determined. These infections cause direct production losses by reducing fertility by > 28% and reducing milk production in dairy cattle by 5.1%. In addition, these diseases result in > 48% reduction in weight gain in calves. In a 3,700-head commercial dairy herd, these infections highly significantly reduced fertility after first timed artificial insemination of primiparous cows by 11.7% and total milk production from 1 to 205 days in milk by 5%.

Researchers are working to identify molecular mechanisms in an effort to design new effective therapies and vaccines against a wide variety of disease-causing organisms that affect both animals and plants. For example, a novel vaccine technology was developed to protect chickens against diverse infectious bronchitis virus (IBV). A recombinant Newcastle disease virus LaSota (rLS) expressing the more conserved IBV S2 gene (rLS/IBV.S2). Chickens were completely protected against IBV. These results demonstrate that over exposing the more conserved IBV S2 to the chicken immune system by means of a vectored vaccine, followed by boost with whole virus, provides broad protection against IBV.

Researchers continue to focus on identifying the molecular mechanisms that lead to the modulation of host cell responses to infection in an effort to design new and effective therapies and vaccines against Toxoplasma gondii, an obligate intercellular zoonotic parasite in sheep and other small ruminants. In other studies, researchers have identified bioactive substances in the pine bark that when added as a feed ingredient substantially reduced the internal parasite load in goats. These same bioactive natural products has proved toxic to a wide variety of insect pests.

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), 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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	25000	111000	25000	135000

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

Patent Applications Submitted

Year: 2014

Actual: 5

Patents listed

1) MONOCLONAL ANTIBODY DETECTION KIT FOR AMBROSIA BEETLES;
2) Application of Pectin or Pectin-Derived Sugars to Enhance the Efficacy of Plant Growth Promotion and/or biological Control Due to Plant Growth-Promoting Rhizobacteria (PGPR)
3) Sunn Hemp Cultivars Capable of Producing Seed within the Continental United States
4) Novel Plant Attractants for Managing Yellowmargined Leaf Beetle, Microtheca ochroloma in Cruciferous Vegetables
5) Feed supplement products and methods of using such products for improved raising of ruminant livestock animals

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	11	425	436

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed publications

Year	Actual
2014	436

Output #2

Output Measure

- patent applications and disclosures

Year	Actual
2014	5

Output #3

Output Measure

- Products such as crop varieties, animal breeds, vaccines, methods developed and evaluated in Alabama best agricultural practices development and evaluations

Year	Actual
2014	10

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 agricultural 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 agricultural 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
2014	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Genetically modified animal stocks or plant varieties or new species need to be developed and applied to enhance production and profitability.

What has been done
Methods for production of hybrid catfish were further refined to increase the efficiency of interspecific hybridization; new varieties of peanuts were tested to determine their characteristics for applications. Meat goat breeding program using Kiko and Boer goats was established.

Results
Efficiency for the production of hybrid catfish was increased. In the last year, over 25% of the catfish industry adopted hybrid catfish as the breeds that allowed more production, greater level

of disease resistance, and more efficient feed conversion. Hybrids of Boer x Kiko goats are being tested for adaptability. Off-bottom oyster farming was proven to be economically viable. With Auburn University and partners, eight commercial oyster farms have been established in Alabama since 2010, with more than 12 acres in production. Since the aquaculture project began in 2010, over one million oysters have gone to market with a wholesale value of at least $500,000, and this is expected to more than double in the coming year. The oyster farms have created at least six long-term, part-time jobs

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

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Plant diseases and pests cause major losses of production agriculture; animal diseases cause the largest losses to animal production industries.

What has been done
Research in characterization of vaccines have been conducted; new disease control measures were explored

Results
New vaccines against columnaris disease of catfish were developed and tested for their efficacy and efficiency. New biological control approaches have been developed for the control of plant nematode diseases. Construction and improvement of peanut genetic map. Development of molecular and biochemical pathways of resistance of Haemonchus contortus to anthelmintic drugs for possible vaccine development. Chicken meat and eggs are the most important protein source for human consumption worldwide. In 2014, part of our work focused on increasing resistance against avian infectious bronchitis virus (IBV). IBV continues to be the most common and economically important contributor to overall disease losses in poultry despite worldwide extensive vaccination with a multiplicity of type- specific vaccines. We developed recombinant vaccines expressing virus proteins relevant in the induction of immunity and protection. We have produced evidence that one of these proteins provides broad protection against IBV strains. We have patented this approach and are currently exploring opportunities with the industry to make this product commercially available. We believe that our discovery will eliminate the need of using multiple different vaccines to protect chicken populations against IBV. We developed a biological feed additive for the control of internal parasites in goats and other small ruminants. These methods will greatly reduce the use of antibiotics and other chemical forms of internal parasites of goats and other small ruminants. We molecularly identified all the races of Fusarium oxysporum f. sp. vasinfectum the causal agent of Fusarium wilt in Alabama and confirmed that we do not have the race 4 that has invaded California. This eliminated the potential need to quarantine cotton seed produced in Alabama.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
216	Integrated Pest Management Systems
311	Animal Diseases

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
2014	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural practices need to be evaluated under the current condition to provide the best agricultural practices for production, sustainability, environment, and profit of the agricultural industries

What has been done
A number of agricultural practices have been evaluated for their suitability under the current economic condition such as irrigation, rotation, fertilization, tillage, conservation, precision agriculture, organic agriculture animal nutrition, and disease management practices.

Results
A state irrigation bill was passed to assist Alabama farmers for adoption of irrigation for crop production. Farmers has begun to adopt the technology and investments have been made in AAES substations to provide research-based recommendations on variable rate irrigation. Precision agriculture techniques were extended to a number of farms to increase profitability. State wide training in organic agriculture production implemented to increase organic crop production and marketing in Alabama. System approaches for beef, pork, poultry, and aquaculture production were adopted to gain efficiency and effectiveness in agricultural production. Irrigation systems were adopted by small scale limited resource fruits and vegetable producers that have resulted in increased yield and income. A sustainable year-round grazing system for goats and other small ruminants was developed with training programs being carried out around the state.

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
123	Management and Sustainability of Forest Resources
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 including the growth in human populations and irregular climate patterns. These factors and others 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. Marked achievements were made in the last year. In particular, the evaluation of many germ plasm 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. Major achievements were made in management of plant and animal diseases. In particular, vaccines were developed this last year against the major diseases in aquaculture. A vaccine against columnaris disease was developed that should be highly useful for the control of columnaris disease in catfish. New

feed formulations for small ruminants were developed that substantially reduced the use of chemical drugs for the control of internal parasites of goats. New methods have been developed to control plant diseases. Field studies indicated that cotton treated with strobilurin or azoxystrobin fungicide against target spot disease at a cost of $30/A results in yield increases of 100 to 300 lb lint/A, which translates into an income recovery of $60 to $180/A at the current world market price of $0.60. AAES researchers and ACES extension professionals worked with poultry producers to evaluate energy consumption and recommended retrofits for 130 Alabama poultry houses. The total value of energy saved to the poultry growers on these 130 houses is $2 million per year.

Key Items of Evaluation

The hybrid catfish is a major development. The application of the hybrid catfish by the entire industry is regarded to be revolutionary. In spite of the inability to produce sufficient numbers of hybrid catfish for the entire industry, now >25%-30% of the catfish industry uses hybrid catfish.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Natural resource conservation and management, environmental sustainability and climate change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			10%	5%
111	Conservation and Efficient Use of Water			10%	5%
112	Watershed Protection and Management			5%	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			5%	5%
133	Pollution Prevention and Mitigation			5%	5%
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%
402	Engineering Systems and Equipment			5%	5%
403	Waste Disposal, Recycling, and Reuse			10%	10%
601	Economics of Agricultural Production and Farm Management			5%	5%
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

Auburn University

Year: 2014	Extension		Research	
	1862	1890	1862	1890

Plan	0.0	0.0	20.0	12.0
Actual Paid	0.0	0.0	33.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

Alabama A&M University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	20.0	12.0
Actual Paid	0.0	0.0	0.0	3.0
Actual Volunteer	0.0	0.0	0.0	0.0

Tuskegee University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	20.0	12.0
Actual Paid	0.0	0.0	0.0	6.7
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	892949	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	892949	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	163741
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	256312
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	516433
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	474498
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 program was originally titled Climate Change, but was expanded to include environment, natural resources, and ecosystems. 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 frame work 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 ;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. This priority is aligned with the USDA research priority area of Climate Change with Alabama's long-term goal of best conservation and utilization of natural resources while sustaining the environment.

In the third of a multiple year project, a $1.8 million grant awarded to Auburn University from the U.S. Department of Defense, helps to develop a plan for sequestering carbon in longleaf pine forests on military bases - thus reducing the amount in the atmosphere. This project is led by Auburn's School of Forestry

and Wildlife Sciences, and includes as collaborators the USDA Forest Service's Southern Research Station and the University of Florida. Conservation practices (e.g., cover cropping, strip tillage, rotation with perennial grasses) continue to increase soil carbon with or without cattle grazing even 10 years following initiation of conservation practices.

Long-term studies on land use and water quality were conducted in two watersheds in the Alabama River basins. Using the PLOAD method, results show that both watersheds had total Nitrogen and Phosphorus values that exceeded the EPAs' limits for rivers and streams. A study was conducted to quantify interactions between introduced yellow perch and resident sport fishes in two lake ecosystems. Results indicated that negative effects from competition were essentially nonexistent, while yellow perch actually provided potential positive effects as prey for piscivores during a short time in the spring. Researchers have also shown a dynamic microbial diversity in soils with different management strategies using soil enzyme activities and a correlation between soil enzyme activity and soil heath. In addition, research at Tuskegee University has resulted in the development of methodologies for recovering of phosphorus from poultry litter.

Studies are being conducted at Alabama A&M University for a better understanding of the processes responsible for the development of redoximorphic features in soil, and to improve our knowledge to use such soil features as well as climatic data to identify flood vulnerable soils.

A comprehensive nine year study was conducted to assess ecosystems interactions of largemouth bass in the Mobile-Tensaw Delta of Alabama that face a complex set of challenges and advantages in the coastal environment. Salinity can represent a stressor for fresh water fish, but the diversity of prey that can be found in low salinity waters is actually beneficial for young bass. Largemouth bass in the Delta live shorter lives and reproduce earlier in life than their fresh water counter parts.

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	12500	55000	25000	110000

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

Patent Applications Submitted

Year:	2014
Actual:	1

Patents listed
Recovery of Phosphorus from poultry litter

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	10	280	290

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- publications

Year	Actual
2014	0

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.

Not Reporting on this Outcome Measure

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
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop varieties and animal breeds more adaptable to elevated temperature need to be developed in the face of climate change and extreme weather.

What has been done
Breeding work was conducted to select for drought and high temperature resistant cotton and peanut varieties; initial gene expression work was conducted to assess molecular responses of catfish to elevated temperature. Breeding work was conducted to select sweet potato varieties

adaptable to drought conditions.

Results

No new varieties have been released yet, but progress is being made in the development of drought resistant peanut varieties. Many catfish genes have been identified that respond to heat, and further analyses of associated genome markers are underway. Drought tolerant sweet potato varieties have been selected for further field testing.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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. NIFA should have long term sustainable funding in this area. It may seem to be remote, but climate is quietly changing. If we are not prepared, climate change may threaten the very existence of the human kind.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program was initially named climate change (and, starting this year, was changed to Natural resources, environment sustainability and climate change) and 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.

We have many different research projects under this area with traditional environmental research and the more climate change oriented projects. Overall, research is very active in this area. Our recent research summary in the retreat indicated that we have the largest number of faculty who works in this area.

Key Items of Evaluation

The development of improved methodologies and new crop and animal species that are adaptable to climate change will ensure environmental sustainability and food security. 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. NIFA should have long term sustainable funding in this area. It may seem to be remote, but climate is quietly changing. If we are not prepared, climate change may threaten the very existence of the human kind.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Systems and Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
304	Animal Genome			10%	15%
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%	15%
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

Auburn University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	13.0	8.0
Actual Paid	0.0	0.0	8.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

Alabama A&M University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	13.0	8.0
Actual Paid	0.0	0.0	0.0	3.8
Actual Volunteer	0.0	0.0	0.0	0.0

Tuskegee University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	13.0	8.0
Actual Paid	0.0	0.0	0.0	3.1
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	352710	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	352710	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	205747
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	322067
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	200000
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	183817
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

Specific areas of research include reducing 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. This priority is aligned with the USDA research priority area of Food Safety and with the needs of Alabama to ensure the safety and well-being of its citizens, and with the economic interest of Alabama in the global economy. Alabama A&M University is undertaking studies on the survival and transmission of food borne pathogens in some plant models.

In 2014, AU Food Systems Institute has been active in integrating all research, education, and outreach activities in food safety and food systems. For example, AUFSI works with the university's aquaculture program, the National Center for Asphalt Technology, the Detection and Food Safety Center, and even the Auburn University hotel and restaurant program to address food system concerns. Communicating researchers' food-related findings through proper training and outreach are also part of AUFSI's plan. AUFSI strives to maximize Auburn's existing internal strengths in the food systems arena as well as facilitate external collaborations with industry and government agencies. The Auburn University Food System Institute organized the core faculty who are a part of working groups consisting of researchers from different disciplines. Core faculty members share common interests pertinent to food systems and communicate their respective research to one another. Some of the highlights of AU Food Systems Institute include:

- Established Virtual Food Systems Training Consortium (VFSTC) Advisory Board;
- Established IACET (International Association for Continuing Education and Training) committee to complete accreditation process for AUFSI to become IACET provider;
- Established partnerships with three universities through collaborative grant efforts;
- Expanded core faculty membership, who attended and/or presented at numerous conferences(ranging from regional to international) and established HAACP, AFDO, and AF-DOSS connections;
- Established social networking avenues: web page, Twitter, Facebook;
- Developed training needs assessment and administered assessment to state inspectors in four

- Became partner in FDA-approved lab and entrepreneur food-testing lab;

Efforts at Tuskegee University continue in identifying weak strains of Salmonella that can be used as possible vaccine candidates against salmonella infections. Studies are also being conducted on sustainable food packaging systems derived from renewable biomass.

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	30000	150000	50000	200000

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

Patent Applications Submitted

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	5	130	135

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2014	135

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
2014	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New technologies for food safety is needed to ensure that our food is safe. Effective education need to be conducted with the general public and citizens of the state to allow them to understand food safety related issues and procedures to reduce food poisoning and food- related illness. Technologies need to be transferred to increase the level of food safety and detection of food related sources of infection or incidents. Producers particularly, limited resource producers need to be aware of the pre- and post-harvest food safety issues and concerns.

What has been done
Auburn University has established an Institute of Food Systems. This institute was established on the basis of the AU Food Safety Initiative. Food Systems faculty was established to conduct more effective education, research, and outreach. Molecular studies to detect genes in weaker salmonella strains were conducted at Tuskegee University. In Addition, education of limited resource producers on good agricultural practices and development of instructional materials for food safety and GAP certification for limited resource producers were undertaken.

Results
AU has designed a series of food safety programs aiming at educating and training of FDA food inspectors, food processors, and managers of the food industries. At Tuskegee University, Yghc genes were detected in weaker strains of salmonella that could be used as possible candidates for vaccine development.

Farmers trained in GAP and food safety practices have been certified and are able to supply fresh vegetables to large grocery markets including Walmart.

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
2014	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Workforce need to be trained in the area of food processing, food safety, and food security.

What has been done

The food science program was added to the Department of Poultry Science. Students are enrolling in degree programs. Continuous training of limited resource farmers on GAP and food safety techniques.

Results

Students are trained, and they are prepared for jobs in the food industries. Limited resource farmers are certified and are able to supply produce to wider grocery markets directly.

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 is 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 five 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. At Tuskegee University, food safety is central and very critical as we develop and build the new Food processing facility for limited resource producers.

Key Items of Evaluation

Auburn University Food Systems Institute was established in 2012 with the focus of food safety research, training, technology development and outreach. This Institute has made major progress by obtaining of $6.5 million grant from FDA. Very recently, NIFA made an Award of $4.8 million to a group of scientists including TU led by Dr. Christy Bratcher. 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, wellbeing , health, and obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food			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

Auburn University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.0	10.0
Actual Paid	0.0	0.0	6.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

Alabama A&M University

Year: 2014	Extension		Research	
	1862	1890	1862	1890

Plan	0.0	0.0	10.0	10.0
Actual Paid	0.0	0.0	0.0	3.4
Actual Volunteer	0.0	0.0	0.0	0.0

Tuskegee University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.0	10.0
Actual Paid	0.0	0.0	0.0	4.7
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	139595	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	139595	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	180029
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	281809
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	226221
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	207851
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 Childhood obesity program was expanded to include all human health-related issues. Research was conducted to study molecular and cellular mechanisms of obesity, 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 was also conducted on animal production methods that result in healthier meat products. In addition, research activities explored non-traditional means of delivery of nutritive components. Research results were shared with extension personnel for further dissemination to county agents, consumers, and community leaders. Additional dissemination was through direct contact (e.g., survey participants and community gatherings), through publications (experiment station bulletins, on-line reports, press releases, and scientific journal articles), and may include non-traditional efforts, such as working through community and faith-based groups.
Highlights included using avatars as a part of a multi-faceted intervention program to prevent child hood obesity in Alabama; studies for linkages between identity development and romantic relationship beliefs and experiences in a sample of rural and urban African- American and white communities; studies that demonstrate sleep as a support for social, emotional, and cognitive development in children; and a number of studies of food additives, functional foods in prevention of diabetes and obesity. Studies assessed the influence of forest cover on incidence of West Nile Virus (WNV) and related forest cover, climate variability, and mosquito vectored diseases such as WNV. West Nile virus has infected>3 million people, sickened at least 780,000 in the US since 1999, and has reached very high incidence in the southeastern US. Mosquitoes can reproduce in water quality levels associated with land use conversion from forest to urban and that transmission risk increases with increasing impervious cover and decreases as incomes rise. Mosquitoes can also transmit other diseases such as malaria which was endemic to Alabama. A specific cell-surface protein in mosquitoes is used during midgut invasion by Plasmodium falciparum but not by P. vivax, which are respectively the deadliest and most widespread parasite species responsible for human malaria. This result is critical for the design of malaria transmission-blocking therapeutics. G protein coupled receptor pathway(s) involved in regulation of insecticide resistance gene expression was identified. This discovery has significantly impacted on our understanding of molecular mechanisms governing the development of insecticide resistance in insects.
Research determined the relationship of snacking and overall diet quality among adults. Snacking was not associated with poorer overall diet quality, but was associated with a slightly more nutrient-dense diet. Total fruit, whole fruit, whole grains, milk, oils, and sodium component scores were positively associated with snacking frequency showing that snacking is positively associated with overall diet quality. Contrary to expectation, snacking was associated with a slightly more nutrient-dense diet. Much of the literature on snacking has focused on the contribution it may have on single nutrient intakes; however, this focus may overlook the total nutritional impact of snacking. At Tuskegee University, research into physical activities

and healthy food choices is focused on pre-K and K students in underserved communities particularly in Black Belt counties. A Color Me Healthy curriculum is being implemented in the classes to learn about healthy food choices. Fruits and vegetable gardens planted by the students are used to provide practical lessons of healthy food choices.

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	50000	200000	10000	60000

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	10	20	30

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- publications

Year **Actual**

2014	30

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 choices 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 choices 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
2014	101000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The public need to know the relationship between the food they consume and obesity.

What has been done
A series of research projects, educational programs and extension programs were developed to provide awareness in an effort to reduce obesity.

Results
Alabama is still one of the most obese states in the country. However, public awareness has been enhanced. A number of educational and outreach programs targeted to reduce obesity in the state have been extremely successful.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food

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, well-being, and happiness, which may have increased the level of obesity.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Research has allowed a better understanding of the factors that influence human health, well-being, and happiness. Other than nutrition, a number of social factors are critical to child development and their eventual success. Specifically, 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 increasingly need to engage with Internet technology. Internet use among the majority of the older population has been limited. Physical, cognitive, and social issues lead to impediments in technology usability among older users. Web-based interfaces with innovative virtual agent technology that reduce older users' physical, cognitive, and social barriers to Internet adoption have been developed to improve quality of life by fostering greater independence and empowerment, facilitating social interactions and communications, and bolstering self-efficacy and morale among seniors.

Associations between individuals' frequency of meals and snacks and total energy intake were found. Obesity prevalence was especially high among those with low-incomes and having a low-income is a critical determinant of food insecurity (absence of access to enough food for an active healthy life).

Children in full-day preschool/daycare programs are suffering sleep deficit during the work week (when they attend childcare programs); this deficit is not made up by daytime naps. Sleep disturbances (in duration or overall sleep quality and organization) interfere with children's adaptive functioning in the preschool setting.

Training sessions for youth to develop competencies in nutrition and healthy leaving showed that majority of the students after the training programs have shown willingness to make positive change in their eating habits and healthy life style. Children who had less overall night time sleep had lower vocabulary test scores, 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, compared with 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. Stress-response systems, including the hypothalamic-pituitary-adrenal (HPA) axis, translate behavior to the production of the stress hormone cortisol. Poor care in early childhood leads to dysregulation of the HPA axis, which in turn triggers a wide range of maladaptive processes. This work is important because the most important sources of stress in young children are poor quality relationships with caregivers. There is 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. Researchers are identifying 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 elucidate the relationship between biochemistry and social success.

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 was 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 workweek (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, and understood less about the causes of emotion.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
125	Agroforestry			5%	10%
201	Plant Genome, Genetics, and Genetic Mechanisms			0%	5%
202	Plant Genetic Resources			5%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			10%	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			10%	0%
405	Drainage and Irrigation Systems and Facilities			10%	0%
601	Economics of Agricultural Production and Farm Management			5%	10%
603	Market Economics			10%	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

Auburn University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	9.0

Actual Paid	0.0	0.0	6.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

Alabama A&M University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	9.0
Actual Paid	0.0	0.0	0.0	4.0
Actual Volunteer	0.0	0.0	0.0	0.0

Tuskegee University

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	9.0
Actual Paid	0.0	0.0	0.0	6.2
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	359536	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	359536	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	217749
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	340854
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	331058
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	304176
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 address issues related to renewable energy using bio-based feed stocks that ultimately contribute to the relief of energy dependence on foreign sources. The goal of this program is to increase knowledge of bioconversion of feed stocks to bioenergy and bio-products, bio-processing systems, biomass production, and conversion of byproducts into value-added products and to enhance understanding of the long-term sustainability of feedstock production and bio-conversion 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 bioenery feed stocks, biotechnology of bioenergy crops to enhance production or to enhance its utilization as an energy source, development of agricultural practices for newly identified bioenergy crops, and technology development for bioenergy conversion. This priority is aligned with new initiatives on Bioenergy and Bio products Research in DOE, USDA, and several other federal agencies, and with the huge energy demands in the state and the nation.

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 was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

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

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

Patent Applications Submitted

Year: 2014

Actual: 1

Patents listed

TREATED BIODIESEL GLYCERIN

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	41	41

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2014	41

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased percentage of bioenergy in the overall consumption of energy
2	Development and demonstration of logistics for bioenergy production

Outcome #1

1. Outcome Measures

Increased percentage of bioenergy in the overall consumption of energy

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Development and demonstration of logistics for bioenergy production

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Efficiency of bioenergy crops have to be evaluated

What has been done
Several white flesh sweet potato germ plasm high in dry matter have been evaluated. Studies on bamboos and Miscanthus as potential energy crops have been initiated

Results
Several high dry matter and yielding and sweet potato germ plasm has been selected for their ethanol production potential. Genetic mapping of Miscathus species is in progress. AAES researchers studying algae production have shown that benthic algae production is possible even in cold-weather seasons in Alabama. They have collaborated with an Alabama algae company to successfully produce diesel fuel from algae.

4. Associated Knowledge Areas

KA Code	Knowledge Area
125	Agroforestry
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
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

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

Gas prices, national and global markets, and availability of other types and sources of energy can seriously affect the outcomes. Continued funding is required to produce meaningful results.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Auburn University is collaborating on a USDA Bioenergy CAP grants. Working with this CAP project consortium, various public-public, and public-private partnerships have been developed including: The Southeastern Partnership for Integrated Biomass Supply Systems (IBSS) will reduce risks surrounding sustainable, reliable, and predictable supply of lignocellulosic feedstock needed for commercial biofuels production. The IBSS Partnership, which includes ArborGen, Auburn University, Ceres, North Carolina State University, the University of Georgia, and The University of Tennessee, has three overarching goals are:
• Demonstrate solutions to economic and environmental barriers that limit biofuel production.
• Introduce new tools and metrics for effective decision-making in site selection and regional deployment of biofuels production from lignocellulosic biomass.
• Provide credible, impactful, and integrated education, extension and outreach (E2O) programs that train the workforce needed, and inform stakeholders and policy makers with

the knowledge necessary to enable the Southeast's biofuels industry.

The IBSS Partnership and Rentech are tightly integrating the IBSS sustainable biomass production and supply processes with Rentech's biomass gasification and drop- in fuels production processes. Rentech's clean energy portfolio includes biomass gasification technology that can produce synthesis gas for production of renewable power and fuels. They own the patented Rentech Process, based on Fischer-Tropsch chemistry, to producehydrocarbon mixtures. Standard refining practices upgrade the hydrocarbon to diesel or jet fuels or industrial chemicals process and we are nearing the end of a DOE-funded project to design and build a 20 ton/day biomass gasifier to provide synthesis gas.

Specific outcomes include 1. Demonstrated performance of IBSS feedstock in the Rentech pilot plant for production of diesel and jet fuels. This could include four 60-day demonstrations on four separate IBSS feedstocks producing ca. 9000 gallons of fuel from each feedstock. (1,200 tons of IBSS feedstocks would be required for each 60-day run). 2. Availability of Rentech's drop-in diesel to IBSS feedstock partners for planting, harvesting and chipping operations, as well as jet fuel for certification and demonstration.

The IBSS-Rentech partnership will advance additional education, Extension and outreach efforts in local communities to assess their viability as a biomass to liquid fuels host site. The first group of SEED Fellows from Auburn and Tuskegee Universities recently spent 10 days at Rentech's BioEnergy Center of Excellence learning about the Rentech processes and experiencing technology development environment, providing a foundation for further work.

This multi-institutional project involves researchers and outreach specialists from academic, government, and industry organizations across the southeastern U.S. It leverages significant prior investment and extensive expertise in producing alternative liquid fuels from cellulosic biomass. The IBSS Partnership is uniquely qualified to accelerate the deployment of a drop-in fuels industry in the region

Key Items of Evaluation

The IBSS Partnership is currently operating under a grant funded by USDA's National Institute of Food and Agriculture. The grant was independently peer-review and awarded a total of $15 million in funding over 5 years; however, the total funding was $30 million less than requested for the complete project. Bioenergy research depends on continued funding. Its long-term impact will depend on many factors, in particular the gas prices, and availability and economics of many different types of energy sources such as wind, solar, natural gas, etc.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.