2019 Annual Report of Accomplishments and Results

Alabama
Alabama A&M University – Extension
Alabama A&M University – Research
Auburn University – Extension
Auburn University – Research
Tuskegee University – Extension
Tuskegee University – Research

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.

1. Executive Summary (Optional)
No Update.

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates
1. The Merit Review Process	No update.
2. The Scientific Peer Review Process	No update.

III. Stakeholder Input

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	No update.
2. Methods to identify individuals and groups and brief explanation.	No update.
3. Methods for collecting stakeholder input and brief explanation.	No update.
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	No update.

IV. Planned Program Table of Contents

V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

No.	Title or Activity Description	Outcome/Impact Statement	Planned Program Name/No.
1.	AAMU Research: Evaluating the Potential for Small Ruminant Production in Silvopasture and Open Pasture Grazing Systems in North Alabama.	**Brief Activity Description:** The project focuses on increasing the sustainability of pasture-based meat goats and sheep production in a loblolly pine based silvopasture system and conventional open grazing system in North Alabama. The project aims to increase the productivity and quality as well as extend the production duration of traditional warm season pasture sustainably to lower production costs and increase profits. **Outcome/Impact Statement (Results):** In five years, several consecutive grazing periods were successfully completed. The activities of this project included sharing knowledge obtained with the Alabama Cooperative Extension System. For instance, in 2016, a workshop was attended by more than thirty goats and sheep producers from the region in which feedback were positive. Presentations informed the attendance on how to retain a flow of annual income from agriculture while they are growing trees for timber by raising goats and sheep. During the last five years, over 300 animals (sheep and goats) were used to achieve the project's objectives. In 2019, the productivity, quality, and production when sheep and goats graze together (multi-species grazing) had been evaluated. The following results have been found: (1) No significant difference in the percent weight gain in sheep; (2) No significant difference was found in the percent weight gain in goats. Efforts will be made to conduct additional studies in the future.	Global Food Security and Hunger (#1)
2.	AAMU Research: Marketing and Socioeconomic Factors of Organic Farms: Age as a Predictor of Acceptance of	**Brief Activity Description:** The target audience consisted of landowners and farmers, business owners and managers particularly of groceries and supermarkets that sold fresh foods and the general public who were made aware of the importance of quality foods and fresh food intake and their relationship to the health and food processor and food industry. Students, researchers were also targets of the information.	Global Food Security and Hunger (#1)

	Organic Food Products Alternatives among Metropolitan Population in Alabama	**Outcome/Impact Statement (Results):** Oluwoye, J. (2019). "The Significance of Consumer's Educational Level and Other Sources of Motivation Towards Attitude to Organic Food Products: A Case Study of Riverdale, Georgia". CPQ Nutrition Journal, 3:5, September 2019. The above-published paper focused on knowing the significance of consumers' years of educational level completed and other sources of motivations towards consumers' attitudes to organic food products among samples of Riverdale residents in Georgia, United State of America. It should be noted that consumers' educational level is proportionately related to buying more organic products if they were less expensive and, ever been on an organic farm also negatively affects buying more organic products if they were less expensive. Furthermore, increases in educational level and buy more organic products if they were less expensive are other sources of motivation that positively affect the attitude towards organic food products. Policymakers should pay close attention to promoting awareness and consciousness levels and promoting the health benefits of organic foods in order to stimulate real purchasing actions. The findings of this study have important implications for the organic stakeholders, farmers and the food industry in general.	
3.	AU Extension: Alabama Beginning Farmer Program (BFRD)	**Brief Description:** The Alabama Beginning Farmer Program (grant-funded by two major USDA and several smaller SARE grants) is an intensive educational and capacity-building program that has a team of Extension Specialists, Extension Coordinators, and Regional Extension Agents from five PPTs collaborating on content development, delivery, instruction, and evaluation. Overall objectives for the first phases of this program were: 1.) Establish a statewide network of Extension educators, and Technical Assistance Providers (TAPs are external contractors trained by state agencies) to benefit new producers; 2.) Provide on-farm support services to new farmers through vast collaborations; and 3.) Develop a uniform educational infrastructure for training producers through diverse communication channels that is all-inclusive and accessible (ADA compliant). Phase-2 of this major program will continue to expand digital and print educational materials, on-farm services, establish a Farmer Community Clusters and Mentor Farm Network over the next three years. REAs along with four nonprofit agencies and Technical Assistance Providers (TAPs) collaborate closely for program implementation at the county level. Beginning farmers (<10 years' experience), experienced producers (10+ years of experience), limited resource and veteran farmers, nonprofit agencies and educators, ACES personnel across five teams (capacity building), crop advisers and retailers,	Global Food Security and Hunger (#1)

		gardeners and community garden managers, farmer market managers, state agencies and field staff. **Outputs/Impact Statements (Results):** Innovation: Survey QR code printed on business card for scanning and entering data via smart phones. Responses in database (2019) = 42 cases. Client groups (major): 43% beginning (11% veteran farms), 35% experienced, 6% nursery & landscape, 16% community gardeners/urban farms. Percent crop improvement = 10 to 50% (2 respondents). Total reported impacts = $744,850 (28 cases). Estimated ROI = 55:1 ROI is rising as beginning farmers become established producers and expand their operations. Over 120 beginning farmers and experienced producers are part of the network that receives direct assistance from program coordinator (Ayanava) and other Extension Specialists, Regional Extension Agents (multi-teams), County Extension Coordinators (some counties), and the technical Assistance Providers (TAPs that are subcontracted via grants supporting the Alabama Beginning Farmer Program). The program initially received funding (past and ongoing) equivalent to $1.4 million with another $500,000 leveraged by Extension Specialists and new faculty that depend on BFRD program resources as their communication and marketing platform.	
4.	AU Extension: Nutrient Management Training	**Brief Description:** Provide training for Certified Animal Waste Vendors (CAWV) and Qualified Credentialed Professionals (QCP) on issues related to animal waste management and poultry production practices. 2. Increase knowledge of poultry growers on the use of animal by-products in nutrient management and award CEU's as required by the Alabama AFO/CAFO rule. This is accomplished through presentations at local poultry grower meetings, field days, and workshops. **Outputs/Impact Statements (Results):** A total of 1,114 hours of continuing education units (CEU's) was earned by growers attending workshops/trainings in 2019. The value of the CEU's was $92,462. Estimated savings of $25 per acre from attending and receiving the information on proper forage management, reported by respondents at the 2019 Alabama Forage Conference. 76% of	

		respondents were likely to adopt one or more of the forage management practices discussed at the program over the next 12 months.	
5.	AU Extension: Stewardship of Auxin Herbicide Application and Weed Management in Weed Resistant Crops	**Brief Description:** Twenty (20) auxin training were conducted in 16 major row crop producing counties to promote best management practices to reduce dicamba drift and off-target movement. A total of 1300 row crop growers and pesticide applicators were trained in these auxin trainings and received certificates from ACES. Total dicamba drift complaints to ADAI was very low, only 4 official complaints. Weed control information in auxin resistant crop was presented to row crop growers in 16 row crop extension meetings and 6 field day or field tours in summer. Total number of growers received this weed control information during these extension events was 1658. At the meantime, four (4) timely information sheets, 6 research oral or poster presentations, 4 peer review journal articles were generated from Dr. Li's weed science program. Dr. Li has answered 5-10 questions per week for row crop stakeholders on their weed control and herbicide usage questions. We also conducted 10 on-farm trials in 2019 to study the effected of auxin herbicide on resistant weed control. **Outputs/Impact Statements (Results):** only four 'official' drift complaints were reported in 2019 in AL. Trainings resulted in a vast amount of acreage receiving auxin-containing herbicides in row crop counties, resulting in increased yields and a significant decline in weed population.	Global Food Security and Hunger (#1)
6.	AU Extension: Sustainable Livestock Production Systems	**Brief Description:** The objective of the Sustainable Livestock Production Systems Program Plan of Work is to provide a comprehensive set of programming efforts for livestock producers (beef, dairy and equine) to teach best management practices to enhance on-farm sustainability. Activities can include: 1) Production/current topic meetings (such as, but not limited to, drought, climate, forage and feeding implications for livestock), 2) Meeting series (i.e. new and beginning farmer programs, production management series, etc.), 3. Demonstrations related to animal management concepts, 4. Conferences, 5. Field Days and Hands-On Learning Programs (on-farm and at experiment stations), 6. Profit Profiles, 7. Livestock enterprise budgets, 8. Educational curriculum - timely information sheets, publications, newsletters, PowerPoint presentations, magazine articles; 9. Educational videos (YouTube and other short information pieces), 10. Social Media Outreach (Forage Focus and Beef Systems Facebook Page and associated Twitter accounts); 11. Online decision tools and	Global Food Security and Hunger (#1)

		curriculum (Blogs, e-newsletters, websites, Beef Basics Online Course and other e-learning platforms). **Outputs/Impact Statements (Results):** **Beef Systems Short Course -** 120 participants enrolled in this statewide program which was developed as an introductory program for stakeholders interested in learning more about the basics of beef cattle management systems in Alabama. This program was used to highlight information in the Alabama Beef Handbook and introduce producers to best management practices offered through the Alabama Extension System. 120 participants enrolled in the program statewide, which represents ~16,000 acres and 7,580 cattle. Participants indicated that they heard about the program largely from online advertisement resources (65% from email from Extension or through our social media resources). This program reached new producers who had largely never attended an Extension event before (55% indicated this was their first extension program attended). The total economic impact of the program was $457,150 with an estimated return on investment of 7:1. **Systems 360 Discussion Groups -** There were 50 graduates from this program on a statewide basis. This program was designed to provide a more in-depth discussion on beef management topics for advanced or progressive beef producers. Experienced producers were encouraged to submit applications to join a working group. 94% of respondents indicated that they planned to adopt one or more of the management practices discussed in the group within the next 12 months. Top practices included improved winter grazing strategies, rotational stocking, water resource management and testing, and facilities design/animal handling. Producers indicated that they learned the most from farm visits and interaction with other producers in the group. Attendees reported an average economic impact of $6,095 per operation, for a total economic impact of $304,750 for the program. Topic specific meetings focused on educating stakeholders on sustainable management strategies related to forages, nutrition, general herd management, economics and resource stewardship. Post-program surveys at these meetings demonstrated large changes in knowledge among program participants ranging from 49 to 76% increase in awareness regarding topics discussed. The Alabama Forage Conference is an example of a	

		topic specific, statewide program that was offered in 2019 to highlight progressive forage management topics to stakeholders. In this program, respondents (n = 119) indicated that they estimated a savings of $25/acre impacted following their attendance at the meeting. Significant growth in the use of online resources for forage-livestock producers is also reported.	
7.	AU Research: Gene expression and epigenetics effects from administration of rumen protected methionine on rumen epithelium and skeletal muscle in beef cattle	**Issue**: Beef producers are in the need to improve animal performance with the aim to satisfy beef consumers demands. One of the ways to improve animal performance is through nutritional management. **What has been done?** The studies presented here were designed to discover biomarkers present in the genome of the animals that will allow us to develop tools for beef producers for the selection of high-performance animals in terms of nutrients absorption, growth and heat tolerance. **Results:** Rumen protected methionine (RPM) resulted in greater body weight at birth, suggesting its possible effect in late gestation. RPM administered directly to the offspring did not have a significant effect on animal performance (weight or daily gain) when compared to control calves. Hence, there may be an increase milk yield in beef cows benefiting the calf. Offspring's RPM supplementation after weaning potentially stimulates an early differentiation of adipocytes in longissimus muscle samples, detected by the upregulation of adipogenesis-related genes (PPARg). **Target Audience:** Scientists, students, ranchers, policymakers, and general public.	Global Food Security and Hunger (#1)
8.	AU Research: Stimulating the probiotic effects of beneficial microorganisms	**Issue:** There is a need to reduce our reliance on antibiotics in agriculture and aquaculture, and using probiotics is a viable alternative. **What has been done?** We have discovered that our best-performing probiotic strains in animals and plants are able to use plant carbohydrates such as pectin as a source of carbon and energy. By amending the carbohydrate to the seed of a plant or the feed of an animal, we expect to enhance the ability of the probiotic to enhance the growth or prevent disease in the animal or plant	Global Food Security and Hunger (#1)

		Results: We identified a total of 117 unique rhizobacteria isolates and completed a phylogenetic analysis of these isolates consisting of over 30 bacterial genera and many phyla. Specific isolates have demonstrated to promote soybean growth when applied to the seed, inhibitor of bacterial and fungal plant pathogens Ongoing research is looking at the effects of prebiotics (food for the probiotic) as an additional enhancement tool. **Target Audience:** Scientists, students, policymakers, farmers, and general public.	
9.	AU Research: Testing and Improvement of the DSSAT Crop Growth Models for Cropping Systems Analysis	**Issue:** In order to expand world food supplies, it is critical that we develop interactive crop models that extrapolate site specific research results to larger geographic areas. **What has been done?** There are many ongoing field trials to study adaptive management strategies. For instance, *Free Air Carbon Exchange* (FACE) experiments have been constructed in fields to evaluate the impact of elevated CO2 on growth of important agronomic crops. While these trials are important to quantify and understand the underlying behavior of various management strategies, it is difficult to extrapolate these field specific results to the regional or global scales. This is because they do not represent different temperature and rainfall patterns that may exist under future climate change scenarios. **Results:** Methods were developed to simulate county level maize, wheat and sugar beet models. Code developed to simulate pest damage in the CSM-CERES-Wheat model was finalized and submitted to the DSSAT development team for consideration. The DSSAT wheat and maize models were tested at several locations in China and used to evaluate long-term yield gaps and optimum water and nitrogen management strategies. The sugar beet model was evaluated for conditions in Germany. **Target Audience:** Scientists, students, policymakers, farmers, and general public.	Global Food Security and Hunger (#1)
10.	AU Research: Improved technology for hybrid catfish production.	**Issue:** The hybrid catfish (channel x blue) has proven to have superior culture characteristics above the of the channel catfish. To maintain this advantage, we need to improve these genetic lines for both current and future culture technologies and shifts in weather.	Global Food Security and Hunger (#1)

		What has been done? Experiments will be conducted to determine the feasibility of selecting for channel catfish and blue catfish that will produce hybrids with above average performance compared to standard hybrids. Tolerance to higher water temperature and increased densities will be evaluated. **Results**: Family based selection for common traits such as growth, feed conversion, disease resistance, oxygen tolerant, harvestability and carcass traits are being pursued. Additionally, genotype-environment interactions are being pursued for acute temperature and culture technology (standard ponds, in-pond raceways and split-pond systems). **Target Audience:** Scientists, students, policymakers, fish farmers, and general public.	
11.	AU Research: Economics of Aquaculture Production in Alabama	**Issue:** This project addresses economic inefficiencies at critical points in the Alabama aquaculture sector as these issues impede production efficiency, increase costs of production and make aquaculture riskier **What has been done?** The project will analyze the economic consequences of aquaculture farm management practices for all phases of production, harvest, and transport to processors and how research in associated fields can improve the production costs of aquaculture species in Alabama. Surveys, meetings, and personal communications with farmers will be used in developing enterprise budgets and analyzing whole farm situations to determine profitability and areas to focus on for improving efficiency. Additionally, collaborative work with aquaculture scientists will allow economic analysis of their work as it relates to commercialization. **Results:** This research is designed to evaluate the cost of aquaculture production under current and future management scenarios. Economic evaluations included those for in pond raceway systems, vaccine use in catfish, "oversized" fish, and integrated tilapia and vegetable production (aquaponics). By linking economic drives to production results, we have been able to provide guidance and improved production practices across multiple aquaculture practices. A most critical component of this work has been our outreach activities which directly impact our producers. **Target Audience:** Aquaculture producers, extension services, researchers, students, policymakers, and general public.	Global Food Security and Hunger (#1)

12.	AU Research: Lean meat production in poultry	**Issue:** Rapid, efficient deposition of lean muscle tissue is essential to economical production of high-quality meat which is critical to both the economic success of producers and the health of consumers. **What has been done?** Development of successful strategies to increase efficiency of muscle production requires increased understanding of the biological processes regulating differentiation and growth of muscle. Continued advances in molecular and cellular biology methods (microarrays, siRNA, gene transfer, real-time RT-PCR, etc.) have provided many of the tools necessary to dramatically advance our understanding of these processes. The goal is to utilize these tools to provide the basic knowledge necessary to increase the efficiency of lean meat production in poultry. **Results:** The project has characterized myogenic stem cell heterogeneity and fiber morphometrics in two divergent lines of broiler chicken. Evaluated egg incubation temperatures and the effect on subsequent muscle development and growth, resulting in improve hatchery incubator management to improve muscle growth and meat yield in broilers. We have also evaluated the effects of dietary amino acid density on growth performance, satellite cell activity, collagen gene expression and the incidence of wooden breast in broilers. **Target Audience:** Poultry producers, extension services, researchers, students, policymakers, and general public.	Global Food Security and Hunger (#1)
13.	AU Research: Mechanisms for Herbicide Resistant Weeds	**Issue:** The development of herbicide resistant weeds is an increasing problem in agricultural and horticultural systems. Genetically modified crops, despite their tremendous value, exacerbate the problem because they foster the use of a single herbicide mode of action. **What has been done?** Monitored herbicide resistance weeds in Alabama and the United States. Investigated herbicide resistance mechanisms and develop molecular tools for monitoring resistance development in weeds.	Global Food Security and Hunger (#1)

		Results: Determined that the common mutation of Ile-1781-Leu in plastic acetyl-CoA carboxylase (ACCase) confers resistance to the relatively new ACCase inhibiting herbicide pinoxaden in southern crabgrass (*Digitaria ciliaris*). Identified a new mutation in chloroplast protoporphyrinogen oxidase (PPO1) confers resistance to PPO inhibiting herbicide oxadiazon in goosegrass (*Eleusine indica)* for the first time. **Target Audience:** Scientists, professional turfgrass managers, crop producers, and general public.	
14.	AU Research: Management of insect-vectored pathogens in row crops	**Issue:** Cotton blue disease, caused by the cotton aphid transmitted cotton leaf roll dwarf virus (CLRDV), is an emerging disease that poses a significant threat to the profitability of the U.S. cotton industry. CLRDV has been detected in 21 Alabama counties along with multiple counties in Florida, Georgia, and Mississippi. **What has been done?** Research trials were conducted to investigate transmission of CLRDV and the impact of aphid management on reducing final incidence of CLRDV. **Results:** In an aphid monitoring study, the cotton aphid was the predominant species of aphid captured and virus spread occurred during peak cotton aphid flights late-June and July. However, other aphid species were present early in the season when virus spread was also detected, suggesting that other aphids may also transmit CLRDV in the US. Cotton aphid resistance to the commonly used insecticide imidacloprid has been confirmed in Alabama. Twenty-three populations of cotton aphid were tested using full dose-response bioassays. Resistance ratios ranged from 4–278 fold, 95% of populations had greater than 10-fold resistance, and 50% of the populations had greater than 100-fold resistance. **Target Audience:** Scientists, extension personnel, crop consultants and producers, and general public.	Global Food Security and Hunger (#1)
15.	AU Research: Plant defense mechanisms against biotic and abiotic stress	**Issue:** Plants cope with the constant environmental challenges through mobilizing intricate signaling networks that regulate genomic, proteomic and metabolomic changes. Signaling pathways orchestrated by hormones, jasmonate and salicylic acid, play crucial roles in plant defense responses against various forms of biotic and abiotic stress. Hence, a	Global Food Security and Hunger (#1)

		comprehensive delineation of those hormone signaling circuitries will enable us to recruit modern biotechnological approaches to upgrade plants' own growth and survival capacity. **What has been done?** Investigated the mode of jasmonate signaling circuitry in plant defense processes. Characterized a new activity of glutathione in the regulation of redox metabolic pathways. Identified new drought tolerance genes in a plant growth-promoting rhizobacteria (PGPR) isolate. **Results:** Determined that 12-oxo-phytodienoic acid (OPDA) was responsible for relaying a jasmonate hormone signal during stress-responsive induction of defense gene expressions. Discovered that glutathione can also act as a signal activating redox and enzymatic cascades, besides serving as a general antioxidant (electron donor). Identified two genes, an abscisic acid and drought-responsive genes, that behave as 'memory' genes of PGPR. These genes appear to play essential roles in drought tolerance but show little effect on growth and development. These findings will likely lead to genetic engineering of drought tolerant plants. **Target Audience:** Scientists, biotech industry, agriculture producers and allied industries, and general public.	
16.	TU Research: Peanut Seed	**Outcome/Impact Statement (Results):** Fatty acid desaturase 2 (FAD2) enzyme catalyzes the conversion of oleic acid to linoleic acid in peanut seeds. High linoleic acid content contributes to rancid flavors and odor in stored products. We have induced mutations in the FAD2 coding region targeted by a gRNA using CRISPR/Cas9 technology. In parallel, we have designed gRNAs targeting the distal (RY repeat motif) and proximal (2S seed protein motif) regions of the FAD2 promoter. Because RY element and 2S seed protein motifs are implicated in the regulation of seed specific gene expression and linoleic acid may be required for healthy plant growth, gene editing the FAD2 promoter may generate seed with reduced linoleic acid while maintaining normal fatty acid profiles in other plant tissues. Our results showed that indel mutations were generated in the CDS and promoter regions of both homeologous *ahFAD2A* and *ahFAD2B* alleles by CRISPR-based gene editing. In the promoter region, the mutagenesis rate was higher at the distal region than at the proximal region. The induced mutations could reduce the expression of FAD2 genes though phenotypes need to be verified.	Global Food Security and Hunger (#1)

17.	TU Research: Cattle	**Brief Description:** Most small-scale Cow Calf beef producers in Black Belt and surrounding counties are having difficult times producing quality beef cattle for market. Beef cattle production in the southeastern United States differs in size, practice, and production type from other U.S. regions. These differences are explained in part by climate, primary land use for crops, and forage availability. As a result, consumers pay higher prices at the grocery store, international beef imports demand grow, and locally grown beef supply becomes limited. **Outcome/Impact Statement (Results)** Twice yearly TUCEP and Tuskegee University School of Veterinary Medicine provide a series of hands-on small-scale beef cattle herd health management demonstrations (Oct.-Dec; Mar.-June). Two hundred two (202) participants were engaged in the herd health management demonstrations. Additionally, 268 farm visits by TUCEP personnel, and 2 workshop/field days were held to educate small scale producers in areas such as: Forge and forge grass improvement, nutrition, marketing strategies, catch pen design, cross fencing, beef cattle genetics, year round pasture management, USDA financial programs and technical assistance, farm enterprise budget, and general herding cattle discussion were disseminated by phone, brochures, news articles, local stockyards, technical assistance, workshops, conferences, and one on one contacts. As a result, 16 livestock producers established or renovated approximately 130 acres of forages. Six beef producers purchased performance tested bulls to improve herd genetics and market calf's quality. In addition, performance tested bulls were able to help beef producers to improve calf crop percentages, weaning and market weights. Calf crop %'s improved on average from 80% to 93 % and weaning weights improved by 180 lbs. and markets only improved by 40lbs on average. Twenty-two (22) producers were able to reduce calf mortality rates from dystocia (Difficult Calving) with performance tested bulls with lower birth weight calves.	Global Food Security and Hunger (#1)
18.	TU Research: Plant-parasitic nematodes	**Outcome/Impact Statement (Results):** Plant-parasitic nematodes (PPNs) are incredibly damaging pests, which cause significant losses in crop yields worldwide. One of the most prevalent PPNs is the root-knot nematode (Meloidogyne spp.) ranks number one on the most economically devastating list of pests and thus scientifically important PPNs. Recently, the use of chemical	Global Food Security and Hunger (#1)

		nematicides for root-knot nematode management has decreased due to governmental restrictions, which necessitates the development and identification of alternative pest management procedures. In this study, we evaluated the use of silver nanoparticles (AgNPs) as a potential biopesticide under in-vitro conditions. AgNPs were synthesized utilizing a naturally occurring biopolymer (chitosan) as a reducing agent through microwave irradiation. When J2-stage nematodes were exposed to 0.0005 µg of AgNPs for 1 min, significant mortality ($P \leq 0.01$) was observed and approximately 100% of nematodes became inactive within 24 and 48 hrs. The study has demonstrated a potential environmentally friendly alternative for the management of the root-knot nematodes.	
19.	TU Research: Asian Fruit Demand	**Outcome/Impact Statement (Results):** This research analyzed the demand for fresh Asian fruits and vegetables by Korean immigrants in central and east Alabama and west Georgia. The growth of the Korean population in these two areas is due to the opening of two automobile manufacturing plants: Kia in West Point, Georgia in 2009 and Hyundai in Montgomery, Alabama in 2005. The study's objectives were to: 1) establish what demand exists for fresh Asian fruits and vegetables among Korean immigrants in central and east Alabama and west Georgia; and 2) examine the opportunity for a niche market in ethnic vegetables for small and medium-sized farmers. This was accomplished by collecting socio-economic data on Korean residents in central and east Alabama and west Georgia; estimating consumer buying patterns of Asian fruits and vegetables; and developing a list of Asian fruits and vegetables for potential local farm production as a niche market. A survey instrument was developed and used to collect data on consumer preferences, socio-economic factors, willingness to pay, and buying patterns. The instrument was translated into Korean to be more attractive to the respondents, and images of selected fruits and vegetables were attached. The survey was administered at Korean churches in Lee and Montgomery counties in Alabama, and Muscogee and Troup counties in Georgia. The results demonstrated that 81% of respondents were willing to buy Asian/Korean fruits and vegetables grown locally, and that 82% of the participants were willing to pay (5 or > 20%) more for the produce grown by local farmers. A list of preferred fruits and vegetables by the customers was also established.	Global Food Security and Hunger (#1)

20.	TU Research: Asian Fruit Demand Chemical De-wormer Ineffective	**Outcome/Impact Statement (Results):** Conventional method of parasite control using chemical de-wormer is ineffective, especially to control the barber pole worm, the most significant parasite—causing a huge loss in the small ruminant industry, as this worm is becoming resistant to most chemical dewormers. Moreover, external parasites, infectious and other diseases, including zoonoses, are crucial in the health and well-being of small ruminants. Producers and professionals must know all these health problems and be able to prevent them. An educational event conducted to educate target audience on the integrated approach for managing diseases and parasites: use of FAMACHA; smart drenching; grazing management; using browse, woodlands, and tannin containing plants and feeds; animal selection; nutrition; and general prevention and control strategies of common diseases and parasites. Research conducted to evaluate the performance and health status of small ruminants while stocked in woodlands and silvopastures. Thirty-five participants increased knowledge and skills (58%, $p<0.0001$) on integrated approach for managing diseases and parasites. They rated presented topics very useful (4.7/5.0) and applicable (4.7/5.0) and would benefit them greatly if applied (4.6/5.0). Significant negative correlations of fecal egg counts (gastrointestinal parasites) with live weight and body condition score ($p<0.0001$) indicated that the gastrointestinal parasite problem in sheep can be minimized by a good live weight and body condition score.	Global Food Security and Hunger (#1)
21.	AAMU Extension: Synergistic Efforts to Reduce Pharmaceuticals in the Environment (SerPIE)	**Brief Description:** The Synergistic Efforts to Reduce Pharmaceuticals in the Environment (SerPIE) program aims to advance knowledge and emphasize the benefits of using safe, effective methods to dispose of expired, unused, and unwanted pharmaceuticals and personal care products (PPCPs). Overall, SerPIE offers a novel "One Health" approach, incorporating the human, animal and environmental aspect into its education and outreach efforts. **Outcome/Impact Statement (Results):** The total of pharmaceuticals and personal care products (PPCPs) stockpiled in homes and fated for the environment was reduced by an estimated 2,698 lbs. via 15 statewide drug take-back programs and 1,377 lbs. via permanent drug drop-off receptacles in the cities of Dothan (633 lbs.), Geneva (211 lbs.), Eufaula (183 lbs.), Troy (144 lbs.), Moulton (9 lbs.), Madison (120 lbs.), Headland (27 lbs.), Daleville (37 lbs.), and Slocomb (13 lbs.). The cumulative	Natural Resource Conservation and Management, Environmental Sustainability, and Climate (#2)

		total collected is 4,075 lbs. in pharmaceutical waste. The collection of these PPCPs in turn reduced the accessibility and potential misuse/abuse of drugs among adults and teens; ultimately decreasing the amount of pharmaceuticals fated for our soil and water supplies.	
22.	AAMU Extension: Water Wheels & Rain Barrels	**Brief Description:** The Water Wheels Program serves as a medium to educate school audiences about the importance of water conservation and to educate consumers, with rain barrel workshops, about water conservation as it relates to landscaping and crop production. **Outcome/Impact Statement (Results)** As a result of these efforts, two hundred 60-gallon rain barrels were sold and installed. This equates to approximately 569,700 gallons of rainwater being harvested by Home Grounds Extension conservationists. • Agents conducted 14 rain barrel programs that reached 8,521 persons (53% male, 47% female, 78% adults, 22% youth, 80% white, and 17% black). Participants were taught the benefits of installing rain barrels, the mechanics of building one, and installed it at home. • Agents setup the Water Wheels education trailer at 15 events. This mobile teaching lab includes fun activities, gaming computers, a 3-D water conservation game – "Water You Doing", and demonstration of a residential rainwater harvesting system and its uses • Harvested rainwater prevented environmental impacts due to lost nitrogen and phosphorus runoff, and reduced municipal water use in vegetable and planter gardens. Changing daily habits saved household water use and water bills.	Natural Resource Conservation and Management, Environmental Sustainability, and Climate (#2)
23.	AAMU Extension: The AAMU/ACES E-waste Institute	**Brief Description:** The AAMU/ACES E-Waste Institute serves as a medium to educate, train, and influence public policies about safe environmental practices for electronic waste (e-waste). It focuses on efforts that advance the knowledge, skills, and abilities of individuals, communities, organizations, and companies to reduce electronic waste in the global environment.	Natural Resource Conservation and Management, Environmental Sustainability, and Climate (#2)

		Outcome/Impact Statement (Results) • In 2019, seven city-wide e-waste recycling drives were held in partnership with the Better Business Bureau (BBB), the North Central Alabama Regional Council of Governments (NARCOG), Assured Data Destruction, Spectracare Health Systems, Retech and several other local agencies. A total of 819 cars dropped off 27,125 pounds or 13.56 tons of e-waste. The e-cycling drives were held in Dothan, Troy, Decatur and Hartselle, Alabama. Total numbers for select electronics (i.e., laptops, cell phones, etc.) were used as input parameters in the Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) to determine the eco-impact resulting from the recycling efforts. • According to the EPA Waste Reduction Model (WARM), which calculates and totals greenhouse gas (GHG) emissions of baseline and alternative waste management practices, the 2019 statewide e-waste activities deferred 27,125 lbs. of carbon emissions from entering the atmosphere. This equates to 4,602 gallons of gasoline conserved [@ $2.51 per gal. = $11,583.23], 1,046 trees saved, 39,312 plastic bottles recycled or 180,836 aluminum cans (5,651 lbs.) recycled [@0.40 per lb. = $2,260.40]. These activities also resulted in the reclamation of plastic, nylon, steel, copper, aluminum and other resources. The economic gains observed from the 27,125 lbs. of e-waste recycled via the 7 city-wide drives is an estimated $2,285.00 (i.e., pounds of wire @ $0.8/pound). • The e-Stewards eco-impact estimations for the 27,152 lbs. of e-waste were as follows: 777.94 lbs. of toxic metals were diverted from city landfills or disposal; while 757.27 lbs. of lead, 22.49 lbs. arsenic, 0.18 lbs. of cadmium, 1,198.35 lbs. of copper, 0.69 lbs. of gold, 0.05 lbs. of platinum, 0.28 lbs. of palladium, 555.13 lbs. of aluminum and 7406.21 lbs. of steel were saved. Notably, mining for new metals like copper and aluminum is a very expensive and carbon intensive process with potentially detrimental impacts on the environment. To that end, these outcomes are significant and provide social, economic, and environmental advances for Extension's clientele. • The total earnings generated since the development of the small electronics recycling program (SERP) equals an estimated $2222.67, and $442.67 in 2019 alone. For the printer cartridges recycled via Funding Factory their eco-impact report revealed that the cartridges recycled were equivalent to offsetting CO2 emissions from the consumption of more than 40 gallons of gasoline. It was also equivalent to staving off global warming via the intake and storage of the carbon	

		of 9 tree seedling(s) grown for 10 years. Overall, outcomes included conserved energy and natural resources, a reduction in environmental pollution, and increased economic gains.	
24.	AAMU Extension: Urban Gardens	**Brief Description:** Staff in the Urban Gardens Program conducted 86 workshops, seminars and consultations to educate Alabama youth and adults on the benefits and methods of community gardens for their schools or communities. **Outcome/Impact Statement (Results)** • Urban Gardens FY2019 reached 6729 individuals through 236 scheduled activities. Urban Gardens accounted for 5% (n=1064) of total Urban Home Grounds programming. Urban Gardens participants were 62% (n=4196) adults, 38% (n=2533) youth, 50% (n=3352) black, 48% (n=3254) white, 46% (n=3118) male, and 54% (n=3611) female. • 48 Community gardens statewide were installed and/or maintained with a total harvest of 31,921 lbs; yielding a total benefit of $475,032. • The Program also accumulated 6,106 volunteer hours.	Natural Resource Conservation and Management, Environmental Sustainability, and Climate (2)
25.	AAMU Research: Modeling the Impacts of Climate Change, Population Growth, and Land Use Change on Water Availability in Tennessee River Basin	**Brief Description:** The middle Tennessee Elk watershed and the adjacent region is characterized as humid and subtropical and receives moderate amounts of precipitation. Climate change affects several environmental factors, and together with socio-economic changes put significant pressure on water resources. Climate change will manifest itself through increasing temperatures and changes in precipitation patterns and intensities, with effects on hydrologically relevant parameters, which have already been observed in this area and are expected to continue in the future. This project focused first on the wider area of the southeast domain in simulating the potential climate change. Second, potential climate change impacts on water resources in Middle Tennessee Elk River Watershed (MTERW) are assessed using scenarios of future climate change of 2015-2039, 2045-2069, and 2075-	Natural resource Conservation and Management, Environmental Sustainability and Climate (#2)

		2099. Daily outputs that transform the scenario into seasonal and annual impacts on the soil water regime and water yield are also employed. The assessments were carried out using the modeling approach in which observed and simulated climate outputs from the regional climate model, commonly known as Providing Regional Climate for Impact Study (RECIS) was used to drive the hydrological model Soil Water Assessment Tool (SWAT). Projection of future climate is based on the Special Report on Emission Scenarios (SRES) A1B emission scenario, which was obtained from the third generation Hadley Centre Regional Climate Model (HadRM3) using PRECIS regional climate model. In contrast, Land use/Land cover (LULC) changes were obtained from the National Land Cover Database. Simulated results show the domain area that covers most of the southeast precipitation will decrease while temperature increases. In the drainage area, both temperature and precipitation will increase in the future. Hydrological assessment of water yield, water balance, including water budget, will increase in the coming century. **Outcome/Impact Statement (Results):** The soil and water assessment tool (SWAT) have been applied to simulate the hydrologic regime in the middle Tennessee Elk watershed in North Alabama and southern middle Tennessee. The PRECIS HADRM3P regional climate model simulated outputs under the IPCC A1B scenario for the period 1980-2009, 2010-2039, 2040-2069, and 2070-2099 has been used to generate future daily weather data. PRECIS has been calibrated and validated using the observed North America Land Data Assimilation System (NLDAS) data set. The simulation results for the southeast domain and the area of interest watershed was not the same regarding precipitation. Because of orographic effect and mountainous location, precipitation projection for the watershed is higher while precipitation decreases projected within the domain. The temperature increase that is projected in the domain and the watershed might contribute to the rise in precipitation within the watershed. The increased temperature could elevate evaporation, and the evaporated moisture-holding capacity increases in the atmosphere. This moisture-holding lasts until the wind drives it to the cooler mountainous area to condense. Because of this reason, an increase in precipitation is projected in the study area. The SWAT model simulation result revealed average annual streamflow; water yield will increase in the future. Even though, rainfall increases runoff is not as high as it should be. This is also because of the HSG in the sub-basin, significant winter and spring precipitation,	

		and projected high temperature with less variability in both projections for the watershed. Overall under the given scenario and single driving GCM accuracy might not be as high as this research wanted because of uncertainty associated with the scenarios, models, and the driving GCM**.**	
26.	AAMU Research: Development of Epigenetic Resources for Reniform Nematode Tolerant and Susceptible Genotypes of Cotton	**Brief Description:** In the southern United States, Reniform nematode (RN) has become a significant pest feeding on cotton roots. The estimated yield loss ranges from 10% to 100%, thus impacting the nation's position in the global cotton trade by reducing profitability to cotton growers and the textile industry in the US. Biotic stress responses vary significantly between susceptible and tolerant cotton cultivars. The genes and genome of the reniform nematode were not fully known. Our previous research efforts at Alabama A&M University (AAMU) resulted in sequencing the partial genome of the reniform nematode, and that helped us in better understanding the biological processes, including physiological, developmental, and parasitism genes of the reniform nematode. This current effort will identify underlying epigenetic regulatory mechanisms linked to biotic tolerance inherent cotton genotypes, which are tolerant by comparing with susceptible genotypes in Gossypium. The study responds to the accentuated needs of the farmers currently experiencing economic yield loss caused by reniform nematode infestation in cotton fields. The resources (both germplasm and data) generated from this project will be made publicly available and are useful for academic, industry, agricultural scientists, plant biologists, geneticists, and farmers. The protocols, tools, and resources developed in this project can be applied to other crops. The project will benefit the cotton researchers in specific and plant biologists in general. Moreover, this project supports one underrepresented undergraduate and one graduate student interested in STEM programs with an emphasis in plant molecular biology. During the project duration, students will be trained with advanced genomic technologies. **Outcome/Impact Statement (Results):** This project so far supported four undergraduates and two graduate students interested in STEM programs with an emphasis in plant biology and genetics. The broader impact will be in training of underrepresented students, and the information generated will help in developing reniform nematode-resistant cultivars by utilizing the germplasm characterized here and in applying genomic strategies identified here to plant breeding. Results from this project will be presented by the graduate student in a regional STEM Day meeting and at other scientific conferences. So far, we have trained two graduate (MS-level) students and three undergraduate juniors in the advanced STEM areas, i.e., genomics and	Natural resource Conservation and Management, Environmental Sustainability and Climate (#2)

		bioinformatics. More specifically, we trained graduate students with next-generation sequencing technologies, followed by processing data with bioinformatics. This proposal adds new dimensions in molecular research at AAMU by incorporating epigenomics and bioinformatics to our existing program. AAMU is one of the very few HBCU's that are undertaking research initiatives in such an advanced area of molecular genetics. The research has also improved our understanding of the genes that regulate biological processes that can be utilized in controlling RN and resulting in better cultivars/varieties of cotton. We recruited two graduate (MS-level) students and three undergraduate juniors to undertake the project goals and to achieve all three objectives. In the first year (Fall and Spring, 2017), we completed sample collection and pre-processing from the objectives, 1 and 2. In the second year (Fall and Spring, 2018), we generated sequencing data from both the unstressed and stressed samples and completed the partial analysis, which resulted in a publication. To meet the goals proposed for the third year, we generated and analyzed cotton transcriptome and methylome data.	
27.	AAMU Research: Effects of Tillage and Residue Management on Soil Microbial Community, Carbon Dioxide Effluxes and Soil Physical Properties in a Biofuel-Sorghum-Feedstock Production System	**Brief Description:** In this research proposal, we aim to address the NIFA priority challenge areas of Sustainable Bioenergy and Climate Change by generating knowledge of soil health for a biomass-sorghum-feedstock production system under climate mitigation managements. The overall objective of the proposed research to determine the effects of tillage and residue removal rate on soil health for the biomass sorghum production system in the Southeast US region. We will examine the impact of different tillage treatments and residue removal rates on the temporal and spatial dynamics of the soil microbial community, soil physical properties, and soil carbon dioxide (CO_2) emissions. The results of the proposed project will contribute to the evaluation of environmental soil health arising from climate change mitigation technologies, and help to establish a fundamental basis for facilitating the development of biomass sorghum production system **Outcome/Impact Statement (Results):** In the sorghum growing season of 2019, we started the treatment of tillage and residue return and initially assessed the effects of these treatments on soil health indicators. The treatments are in a random complete block design (RCBD), with 7 different treatments of tillage and residue return and 4 replicates for each treatment included. Exploratory analysis showed varied patterns that in-row soil CO_2 emission and inter-row soil CO_2 emission had different peaks and that only no-till treatments with low residue return rates had a significant difference in soil CO_2 emission at a few days/stages. ANOVA for RCBD will	Natural resource Conservation and Management, Environmental Sustainability and Climate (#2)

		be done to tell the effects of treatments further. Note that this experiment will be conducted for one more year (2020), and a thorough data analysis will be done after 2020. In 2019, we also prepared a manuscript summarizing our findings on soil CO2 emissions in previous years (2017 and 2018) in this sorghum field. We mainly investigated the effects of growth stage and row position on soil CO_2 emissions. The manuscript is now under review. Also, we also obtained the sequencing results of selected soil properties and microbial communities in a time series of several sampling time points in previous years (before and after the growing season in 2017 and 2018) of this field. Data analysis for the selected soil properties suggested a significant change in some soil properties with the production of sorghum; the manuscript is in prep. Also, initial bioinformatics analysis indicated that the abundance and structure of the microbial community in this field were also dynamic. More in-depth data analysis is ongoing. The results of this study will be used to inform soil and crop management decisions for sorghum cropping systems to ensure sustainable sorghum production systems, specifically in a climate-soil-specific manner in the southeastern US. Further, the results will offer new insights for future alternatives concerning the tradeoffs in optimizing production with soil health indicators	
28.	AU Extension: Oyster Gardening on the Gulf Coast	**Brief Description:** Volunteer gardeners in Alabama's Mobile Bay grew 50,075 oysters form 39 sites with a final mean height of 45.0 mm. Volunteer gardeners in Alabama's Little Lagoon grew 53,460 oysters from 50 sites with a final mean height of 54.96mm. Volunteer gardeners in Mississippi (grant funded) grew 48,558 oysters from 42 sites with a final mean height of 36.46mm. **Outputs/Impact Statements (Results):** Total production was 152,093 advanced stocked oysters with a restoration potential of 7.51 acres and an economic value of $162,975.92 which generates a program wide ROI of 33.72:1	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)
29.	AU Extension:	**Brief Description:**	Natural Resource

	The ACES Forage Focus Program: Growing Grass, Growing Profits	Forage crops represent the largest (by acreage) commodity in Alabama covering over 10% of the state. During 2019, the Alabama Forage Focus Program conducted a comprehensive and complex program. Stakeholders were able to access knowledge regarding forage growth and harvest, forage pests, forage weeds, forage varieties, and development of forage systems across the state. This knowledge was disseminated through meetings, conferences, clinic, field days, result demonstrations, webinars, popular press articles, social media, and one-on-one interactions. Additionally, information was transferred to out-of-state colleagues and stakeholders through comprehensive workshops, abstracts, posters, and scientific presentations. The Alabama Grazing Academy was organized and conducted at 2 locations and the biennial Alabama Forage Conference was held in Rogersville, AL. Multiple result demonstrations were conducted including: small grain variety trial, tall fescue and alfalfa variety trials, control of sugarcane aphid in summer annual mixtures, and baleage production and then incorporated into webinars, publications, and forage-based meetings. **Outputs/Impact Statements (Results):** There were 73 unique activities reported for The ACES Forage Focus Program in 2019 including live meetings, webinars, and agent training workshops with participants from 61% of Alabama's counties. Total participants of all programs were 2,102. Of the live meetings conducted, there has been an increase in field days and hands-on demonstrations compared with educational meetings at night. There was an effort to provide workshops for advanced grazers through the Alabama Grazing Academy. The Alabama Grazing Academy had 45 participants at two meetings held in the Chilton Research and Extension Center and at Perdido River Farms in Escambia County. Participants indicated an average increase of 30 grazing days per year per farm, resulting in an average $12,800 per farm economic impact for a total impact of $576,000. The Alabama Forage Conference had 115 attendees meet at Joe Wheeler State Park in Rogersville, AL. AL. The average farm size was 201acres with 82 head of cattle per operation. Program participants tended to either have 1to 5 years of experience in the forage/livestock industry (35%) or more than 20 years of experience (47%). The participants estimated savings of $25/acre reported from attending this program, $5025 economic impact per farm, and $653,250 total economic impact for the program. There was an 85% increase in willingness of participants to conduct a soil or forage analysis after attending the program 76% of respondents were highly likely to adopt one or more of the forage management practices discussed at the program in the next calendar year.	Conservation and Management, Environmental Sustainability and Climate (#2)

30.	AU Extension: Sustainable Nursery and Greenhouse Production	**Brief Description:** - Three green industry workshops with 102 participants. Two of the three workshops provided CEU credits toward commercial pesticide license. - Three Extension factsheets and three Extension news articles were produced for nursery and greenhouse growers. - A webinar was produced in summer featuring on-sight irrigation audits across the state that were conducted over the last two years in order to demonstrate how many overhead irrigation systems across the state are poorly designed leading to poor nutrient use efficiency. - One research updates email was sent out to over 200 nursery owners and workers across the state. - Research updates surrounding this program was presented at the ALFA commodity conference and a tour was provided at the OHRC to the Nursery, Greenhouse and Sod AL Farmers Federation board group. **Outputs/Impact Statements (Results):** The meetings provided 4 hours of training that was approved for 10 continuing education points for 20 applicators. The workshops impacted the industry through cost savings where 91% of the surveyed respondents indicated that the program would result in production savings (n= 33). When asked how the program increased their knowledge, 100% of the participants reported that their knowledge at least was increased by 10%. Of the 29 respondents, an increase in knowledge was reported as follows: 10% reported a 75 to 100% increase, 24% reported a 50 to 75% increase, 34% reported a 25 to 50% increase, and 31% reported a 10 to 25% increase. This range of responses is not surprising as the audience was extremely diverse and included many medium level employees and managers of various firms. - 100 % of participants increased knowledge by at least 25%. - 87% reported an increase in knowledge over 50% - 70% reported an increase in knowledge over 75% increase	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)

		The mean rating on satisfaction was a 9.6 out of 10 level scale. All participants ranked the class at 7 out of 10 or above. Of those surveyed 77 % of the class ranked their satisfaction level as being a 10. - 96 % of the respondents liked the 4-hour format for CEU's.	
31.	AU Extension: Invasive Species	**Brief Description:** Invasive species reduce forest health and productivity across the state. This project provides in-service training, educational events and publications for a wide range of stakeholders including forest landowners, foresters and other natural resource land managers, federal and state agency personnel, natural resource educators, Master Gardeners, Master Naturalists and the general public. Members of the team organized one state-wide conference, six workshops, field tours and/or in-service trainings, and participated in two regional workshops, three natural resource educator workshops, three Master Gardener and Master Naturalist meetings and six other meetings. There were 984 attendees at these 29 events. Team members also participated in five youth activities (243 attendees) where native and/or invasive plants were featured. **Outputs/Impact Statements (Results):** Forest health and productivity are under increasing threat from invasive plants. Infestations of Chinese privet, cogongrass, and Chinese tallowtree (to name a few) reduce forest productivity, degrade wildlife habitat, interfere with outdoor recreation and cost a great deal to control. Education plays a crucial role in the effort to reduce the impact and spread of invasive plants. To meet the challenges of educating the wide range of stakeholders across Alabama about the impacts of invasive plants, we provide a range of educational programs, extension publications, online resources and social media sites. Programming ranges from bringing the issue to the attention of homeowners and the general public for the first time, to providing natural resource professionals with the latest information on effective control techniques, to training K-12 teachers on methods to engage students. Over 1100 landowners and natural resource professionals, other citizens and youth participated in 34 educational events. The impact of this educational programming is highlighted by the annual Alabama Invasive Plant Council (ALIPC) Conference. Attendees reported an increase in knowledge at this well-received full-day	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)

		state-wide conference, and an intention to utilize the information. The vast majority (96%) of returning attendees reported having adopted a new control technique based on information acquired at the meetings. This is especially significant as an estimated 2.5 million acres of forest land was under management of the 115 attendees. Evaluations show too that the Continuing Education Credits offered at this and other meetings are highly valued and contribute to professional development of natural resource professionals across the state. Partnering with the Alabama Invasive Plant Council, Alabama Forestry Association, Us Forest Service and Southern Regional Extension Forestry leveraged opportunities for education and interaction with stakeholders across the state. In addition to face-to-face interactions, stakeholders can access information any time through online and social media resources. Social media reaches a wide range of constituents, providing information on invasive plant identification and control, encouragement and reminders of when to best control invasive plants and other ways to slow the escape of invasive plants into forests and other natural areas. The traffic on these on-line and social media sites, along with positive comments on Facebook, reflects that stakeholders continue to seek and utilize this information, which ultimately will help slow the spread and reduce the impact of invasive plants	
32.	AU Extension: Improving Strawberry Production and Marketing in Alabama	**Brief Description:** The goal of this program is to increase strawberry production and marketing of strawberry fruit statewide leading to higher income for farmers. We focused on helping growers adopt improved strawberry varieties and cost-effective management practices. Educational activities: During two field events/conferences, we discussed best management practices in strawberry production, which will include varieties that are best suited for Alabama and chemistries most effective in weed control. Publication plan: Online learning modules, update bulletins/field guides; IPM blogs/E-newsletter. Marketing plan: Strawberry promotional brochure, strawberry promotional push card/postcard, one webinar **Outputs/Impact Statements (Results):** Over 1,000 individuals were exposed to the strawberry recommendation/technologies and 61% of individuals attending the annual strawberry meeting stated that they would adopt these new practices in their operations.	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)

33.	AU Research: Improving Water and Energy Conservation on Alabama Broiler Farms	**Issue:** Southeastern US chicken growers face increasing energy and water costs. Energy costs include fuel for generators and heating as well as electricity for ventilation, lights, and other equipment. Water is used for evaporative cooling of chicken houses and directly consumed by birds. This project examined best management practices to optimize energy and water conservation in broiler houses. **What has been done?** Broiler house rainwater harvesting storage technologies and ventilation schemes were evaluated. **Results:** A smartphone app, *Poultry Toolkit*, was developed to provide poultry growers with sets of calculators, checklists, and newsletters to improve their production efficiency. Calculators include minimum ventilation, evaporative pad design, and radiant heater sizing. Checklists include generator transfer steps electrical system maintenance steps, generator service steps, evaporative cleaning maintenance activities, and fan maintenance. Supporting newsletters allow users to access National Poultry Technology Center materials without the need for internet access, which is limited in many rural areas. **Target Audience:** Scientists, students, poultry growers, and other poultry industry professionals.	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)
34.	AU Research: Introduced Species in Aquatic Systems in Alabama: Investigating their effects on Lentic Food Webs	**Issue:** Healthy prey fish populations are critical to the populations of sport fishes (bass and crappie). Exotic prey species were often introduced into Alabama watersheds without a complete understanding of their interactions with other prey species and the larval stages of sport fishes **What has been done?** Populations of blueback herring, Alabama bass, and striped bass have been monitored in Alabama reservoirs including lakes, rivers, and dams. **Results:** Blueback herring, native to the northeastern US and introduced into Alabama, are now the second most common species of larval and juvenile in Lewis Smith Lake. Alabama and striped bass are shifting their diets to include blueback herring, but largemouth bass have not. Even though the caloric of value of blueback herring is much greater than that of the native prey species of threadfin shad, there has been no change in the growth or abundance of prey (sport) fishes. However, their preferential consumption of large-size	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)

		zooplankton continues to be a concern due to potential long-term changes in the zooplankton community of watersheds. **Target Audience:** Scientists, students, policymakers, U.S. Army Corps of Engineers, Alabama department of Conservation and Natural Resources, and general public.	
35.	AU Research: Developing Positive Feedbacks Between Agriculture and Conservation of Freshwater Organisms	**Issue:** The high biodiversity of native southeastern organisms represents a valuable, but underutilized agricultural resource for new products and low-cost ways to improve water quality in aquiculture ponds (fish farms). **What has been done?** Research accessed effects of various stressors such as heat, hypoxia (low oxygen), ammonia, and salinity of the health of mussels and crawfish. **Results:** Respirometry to investigate effects of temperature on energy demand and hypoxia tolerance of two narrowly distributed mussel species, and two subpopulations of a widely distributed. There was no mortality during acclimation and respirometry runs even when mussels were exposed to hypoxic conditions for several hours at 36 °C. However, type and magnitude of sublethal effects varied across species and subpopulations as temperatures increased. A narrowly distributed species exhibited the greatest increase in energy demand, and a decreasing ability to regulate oxygen consumption. Results suggest that effects of increasing temperature on energetic requirements are more important than effects on hypoxia tolerance. Management strategies considering physiological differences among species and/or subpopulations are likely to be more effective than a simple "one-size-fits-all" approach. **Target Audience:** Scientists, students, policymakers, conservationists, aquaculture farmers, and general public.	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)
36.	AU Research: Hydro-climate analytics and modeling for sustainable water and agronomic management	**Issue:** Hydro-climate monitoring and forecasting will provide important information for agricultural and water resource communities to effectively manage weather and climate risks.	Natural Resource Conservation and Management, Environmental

		What has been done? Developed novel methods for forecasting rainfall, referencing transpiration and crop yields, and constructed data-driven hybrid models for forecasting rainfall. **Results:** Models were developed that predicted the impact of climate oscillations on maize and winter wheat yields in the US. Comprehensive modeling methods were developed and verified that predicted precipitation over Brazil. Models of streamflow in response to environmental change were developed based in 144 river basins throughout China. These models were developed and verified from worldwide data. The approaches and methods are now available to be used for specific US applications. **Target Audience:** Scientists, students, policymakers, health professionals, climate scientists, and general public.	Sustainability and Climate (#2)
37.	AU Research: Forecasting harmful algal blooms in freshwater systems throughout the southeastern US	**Issue:** Water is necessary for our survival, but current environmental challenges have resulted in sporadic toxic cyanobacterial (blue-green algae) blooms. These blooms can kill fish or result in "off-flavor events" and significant economic losses to fish farmers around the world. **What has been done?** All 70+ surface water utilities in Alabama are now partners in this research as are many fish farmers. More than 400 water sample have been obtained and analyzed for the algae and their toxins. Laboratory and field studies have evaluated various chemicals for algae control. **Results:** Algal toxins are relatively rare in Alabama surface water intakes. However, algal blooms frequently occur in commercial fishponds. Chemical control of blue-green algal blooms has been effective using hydrogen peroxide (H_2O_2) has proved quite effective. Based on these studies, it is suggested that aquaculture ponds experiencing blooms of blue-green algae be treated with ~7 mg/L dose of H_2O_2 under high ambient sunlight. **Target Audience:** Scientists, students, policymakers, water utilities, natural resource managers, and general public.	Natural Resource Conservation and Management, Environmental Sustainability and Climate (#2)
38.	AU Research:	**Issue:** Urban arthropod pests live in and around our homes and can transmit disease, cause structural damage, and are repulsive to many homeowners. Even though these species are common, there is relatively little information on their behavior, biology, and behavior with which to base management systems.	Natural Research Conservation and

	Biology, physiology, and management of urban arthropod pests in Alabama	**What has been done?** The toxicity of several essential oils was evaluated against three strains (susceptible and two field-collected and insecticide resistant) of German cockroaches. Topical application methods and probit analysis was used to determine toxicity, resistance ratios, and synergism. **Results:** These essential oils killed cockroaches that were resistant to conventional insecticides (permethrin) and could be synergized using Piperonyl butoxide. These studies are the first to identify resistance to some essential oils and the first to report synergism. Mechanisms of conventional insecticide resistance may confer to resistance against some, but not all essential oils. **Target Audience:** Scientists, students, policymakers, insecticide companies, farmers producing essential oil crops, and general public.	Management, Environmental Sustainability and Climate (#2)
39.	TU Research: Groundwater Resource Management	**Brief Description:** Delineating areas that are susceptible to contamination from anthropogenic sources is an important component of sustainable groundwater resource management. As communities continue to make sustainable waste management plans, the potential for natural resource contamination should be a serious consideration. **Outcome/Impact Statement (Results):** This study used the DRASTIC method, performed in a geographic information system (GIS) environment, to create a vulnerability map of groundwater in Elmore, Macon, and Tallapoosa Counties of central Alabama. The study site was selected for its high percentage of residents who are dependent on private wells and its suspected susceptibility to pollution from agricultural sites, municipal solid waste facilities, and other human-centered activities. The seven components of DRASTIC are: **D**epth to water, net **R**echarge, **A**quifer media, **S**oil media, **T**opography, **I**mpact of vadose zone, and hydraulic **C**onductivity. Each of these hydrogeological parameters were assigned pre-determined weights and ratings of importance regarding its influence on groundwater contamination. Spatial data for the seven elements were collected, pre-processed, and spatially superimposed to produce a final DRASTIC vulnerability map. The findings indicate that approximate 78.98% of the study site is characterized by *very* high vulnerability, 8.7% is *highly* vulnerable, 11% is *moderately* vulnerable, and 1.32% has *low* vulnerability. The main parameters that contribute the high percentage of susceptible areas are the net recharge and topology factors. Nitrate data was used to validate the map	Natural Research Conservation and Management, Environmental Sustainability and Climate Sustainability, and Climate (#2)

		and were found to exist at compliant levels across the entire study site. The DRASTIC technique provided an efficient tool for assessing and analyzing the vulnerability to groundwater pollution. The study suggests that the model can be an effective tool for local authorities who are responsible for managing groundwater resources.	
40.	TU Research: Silvopasture Management	**Brief Description:** With changes in land use systems across the globe due to new management techniques, urbanization, and confined agricultural space, there have been major shifts in the soil health in these ecosystems. Land use is a major driver of soil health and community ecology. Various land use systems and management practices alter the soil biotic and abiotic properties that affect the microbial community structure and diversity. Past researches have focused on the soil health in response to major land use types (forest, pasture and cultivated) however, the specific response to silvopasture systems remains understated. **Outcome/Impact Statement (Results)** Therefore, the objective of our study was to assess the impact of silvopasture management on the soil microbial communities, enzyme activities, and soil physicochemical properties as soil health indicators. This study was conducted at the Camp Atkins agroforestry research and demonstration site, Tuskegee University, Tuskegee, Alabama, USA. The research site consisted of the six silvopasture and six woodland plots. This study used the MiSeq platform next-generation sequencing method for bacteria and fungi data analysis which consist of 16S rRNA gene V4-V5 variable region PCR primers 515/806 for bacteria and ITS primers for fungi. Silvopasture systems (SPS) had a significant effect on acidic phosphatase, alkaline phosphatase, phosphodiesterase, and β-glucosidase activity. Significantly higher soil organic carbon, total nitrogen, mehlich phosphorous, nitrate, and pH were observed in SPS soil. Copiotrophic bacteria, fungal phylum Ascomycota, pathogenic fungi, and arbuscular mycorrhizal fungi showed a positive correlation to soil physicochemical properties and were abundant in SPS while oligotrophic bacterial phyla and ectomycorrhizal fungi showed the opposite pattern. Generalist fungi weren't affected by land use change. Overall, SPS practices had a distinct impact on soil quality and health indicators.	Natural Resource Conservation and Management, Environmental Sustainability, and Climate (#2)
41.	AAMU Research: Investigate the Efficacy of Natural Antimicrobials to Inhibit the Growth of *Salmonella* in	**Brief Description:** There has been a steady interest among consumers in foods labeled as natural and organic. This trend has resulted in the manufacture of apple cider and apple juice labeled as natural and organic. Therefore, the goal of the project is to improve the microbiological safety of apple juice and apple cider labeled as natural and organic.	Food Systems and Food Safety (#3)

	Natural and Organic Apple Cider and Apple Juice	**Outcome/Impact Statement (Results):** All phytochemical analyses were completed. Also, natural antimicrobials were evaluated in-vitro in the apple juice products. Work continued the use of natural antimicrobials to control pathogenic growth. Graduate and undergraduate students were trained on this project. Preliminary results of this work are providing awareness of the use of natural antimicrobials for the control of foodborne pathogens in juice products.	
42.	AU Extension: Food Safety for Food Service Workers	**Brief Description:** A total of 190 food safety certification classes for food service workers was offered in all 67 counties in Alabama. As a result of these classes a total of 1816 food service workers completed the certified food safety training. After the completion of the rigorous exam, 1455 passed, which is an 80% passage rate. **Outputs/Impact Statements (Results):** Out of the 1816 individuals that took the Food Safety Certification Course (ServSafe), which is an ANSI certified training course, 1455 individuals passed the rigorous exam. This is a passage rate of 80%. If an individual was not able to pass the exam a certificate of course completion was given to the individuals which allows the individual to work for a year before they must retake the exam. This change of condition was to allow the individuals to keep their jobs and to even increase their employment status.	Food Systems and Food Safety (#3)
43.	AU Research: Identification of biomarkers for improving cattle reproduction.	**Issue:** The ability to identify heifers with high reproductive potential, for recruitment into breeding stock, is one of the keys to profitable cattle production. Due to a lack of informative biomarkers, replacement heifers are selected based on phenotypic and genetic background information. However, selection efficiency remains limited due to the low heritability of reproductive performance resulting in the selection of more heifers (~25%) than required. Analysis of heifer breeding data in the US over two years found artificial insemination (AI) conception rate of 40-70%, in first service heifers. Overall pregnancy rates in heifers range from 70-90% utilizing AI and natural breeding programs. This leaves a significant proportion of heifers remaining open but still consuming resources leading to a loss in production efficiency. **What has been done?** Collected samples from reproductively managed heifers to determine markers that may show a positive correlation to artificial insemination success.	Food Systems and Food Safety (#3)

		Results: Previous research had shown that increased cellular communication through connexin 43 based gap junctions was correlated with successful embryonic outcomes following in vitro fertilization. Current research has shown that treatment of bovine oocytes in vitro with 10µM retinoic acid led to significantly increased connexin 43 expression at both the mRNA (2.61-fold) and protein level (3.31-fold). It was also found that functional cellular coupling in cumulus cells to be significantly enhanced by retinoic acid exposure. This enhanced coupling resulted in improved preimplantation development following in vitro fertilization with blastocyst rates improving to 27.5% following treatment, compared to 19.3% in untreated controls. This information can be used to help improve healthy oocyte pools allowing a larger number of oocytes to reach the transferrable (morula/blastocyst) stage following in vitro fertilization. **Target Audience:** Scientists, students, and cow-calf farmers.	
44.	AU Research: Developing Novel Processes and Strategies to Improve Quality and Safety of Poultry and Foods	**Issue:** The rise of muscle myopathies in commercial poultry can be attributed to the success of the poultry industry in that the geneticists have created an extremely high muscle accretion bird. One such myopathy is wooden breast. To reduce the consumer complaints, poultry processors are sorting out the fillets using a rudimentary hand palpation technique which is unreliable and inaccurate. Hence there is a need to develop rapid, pragmatic methods to detect wooden breast. **What has been done?** Developed a segmental bioelectrical impedance method for rapid detection of wooden breast myopathy in chicken breast fillets. **Results:** Using differences in bioelectric impedance levels between wooden breast and non-wooden breast fillets a mathematical model was developed and validated that would distinguish between these fillets. This will allow poultry companies the ability remove these fillets from the market and in so doing reduce economic losses. **Target Audience:** Scientists, students, and poultry industry professionals.	Food Systems and Food Safety (#3)
45.	AU Research: Strategies to prevent the negative impact of coccidia on the intestinal health of broilers	**Issue:** Understanding the changes in the gut microbiota after infection with Eimeria a unicellular parasite which is the causative agent of the disease known as coccidiosis, will help in the development and evaluation of prebiotics and probiotics against the coccidiosis.	Food Systems and Food Safety (#3)

		What has been done? A series of tests were on how different strains of E. maxima, alone or in combination with other Eimeria spp., varying infection doses, and immunological background of the chickens influence the bacterial-parasitic interactions. **Results:** Initial 16s rDNA results provided the time points as well as the location as to where to collect samples. A follow up experiment using amprolium, green tea, acetic acid and nothing as the treatments for Eimeria control had shown that changes were first observed four days after the infection, and this continued after the birds cleared the infection up to 14 days later. Bacteria in the order of Clostridiales were significantly enriched at the expense of Lactobacillales in infected compared to uninfected birds. However, the green tea treated group prevented proliferation of Clostridiales induced by Eimeria and increased the relative abundance of Melainabacteria. None of the treatments tested influenced parasite shedding, except for the amprolium-treated birds. **Target Audience:** Scientists, students, veterinarians, poultry producers.	
46.	AU Research: Antimicrobial resistant bacteria and genes in Alabama poultry	**Issue:** Antimicrobial resistance is important for proper treatment of illness. Understanding how resistant bacteria are being transported in the environment is important and can lead to strategies in controlling its spread. **What has been done?** Flies as well as feces were collected from sympatric animal to determine if flies can be sentinels for bacterial resistance in the environment. Collected samples were then analyzed and the bacterial profile determined, antimicrobial resistant bacteria number determine as well as the number of antimicrobial resistant genes. **Results:** Antimicrobial-resistant bacteria were recovered from 45.2% of flies and 75.0% of feces from poultry farms and other animal facilities. Microbiome analysis showed that over 98.0% of the fly and fecal microbiomes were similar at the bacterial phylum level. Forty-three of 886 bacterial genera identified in flies and 33 of 596 genera in feces included potential human and veterinary pathogens. The same nine bacterial genera including potential pathogens showed significant abundance in flies and feces. Microbiome source tracking determined that flies collected inside the poultry house shared 64.5% of the bacteria found in feces from the house while <7.0% of the microbiomes of flies captured in urban settings matched microbiomes of animal feces.	Food Systems and Food Safety (#3)

		Target Audience: Scientists, students, policymakers, health professionals, and general public.	
47.	AU Research: Address animal health and disease related issues using biological engineering and synthetic biology approaches	**Issue:** *Development of genome engineering tools (such as the CRISPR-Cas9-based) for engineering pathogenic bacterial strains to gain an understand of the disease mechanisms.* **What has been done?** High-efficient genome editing for two fish pathogens using CRISPR-Cas9 system. **Results:** The CRISPR-Cas9 system was adapted to edit the genomes of these two fish pathogens. A highly efficient genome editing procedures was developed and several key genes related to pathogenesis were deleted. In addition, a green florescent protein gene was inserted into the genome of these strains. This is the first report about using CRISPR-Cas system in the genome editing in fish pathogens. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	Food Systems and Food Safety (#3)
48.	AU Research: Noncoding RNA-protein complexes as targets for developing novel therapeutic agents against domesticated animal and human pathogens	**Issue:** Viral, bacterial, and eukaryotic genomes encode a myriad of small and large noncoding RNAs (ncRNAs). The ncRNA molecules associate with proteins to form ribonucleoprotein complexes that play critical roles in the life cycles of many pathogens. Understanding ncRNAs interactions with their protein ligands is essential for the development of novel drugs against these pathogens. **What has been done?** Investigated complexes of phenylalanyl-tRNA synthetase (Phe-RS) and tRNAPhe from M. tuberculosis using x-ray crystallography. These two molecules constitute essential components of the protein synthesis apparatus in all bacteria. The enzyme attaches phenylalanine to tRNAPhe during the aminoacylation. Inhibition of aminoacylation kills bacteria because they are not able to produce proteins. **Results:** Produced a new crystal structures of M. tuberculosis Phe-RS complexes with precursor tRNA, phenylalanine, and a specific inhibitor-phenylalanine intermediate. This inhibitor blocks specifically the first step of the aminoacylation reaction, which produces phenylalanine-adenylate (Phe-AMP). The discovery of a new inhibitor of protein synthesis in M. tuberculosis is essential and may produce a new anti-tuberculosis drug.	Food Systems and Food Safety (#3)

		Target Audience: Scientists, students, policymakers, health professionals, and general public.	
49.	TU Extension: Tuskegee Public Dialogue Team	**Brief Description:** Alabama, like much of the Southern Black Belt exhibits a deep need for racial understanding and equity. Through the establishment of the Tuskegee Public Dialogue Team (TPDT), TUCEP is building internal capacities to help communities engage in civil dialogues around racial issues and their intersections with the food system. **Outcome/Impact Statement (Results):** The TPDT, 21 Dreams (non-profit organization), and the City of Montgomery collaborated in June 2019 to produce a pilot dialogue series in the Peacock Tract community of Montgomery, Alabama. After witnessing 21 Dreams' vision and community model, the TPDT responded by partnering and helping to implement a two-part pilot dialogue series that ran from June-August 2019. The purpose of the series was to gauge community interest in creating a dialogue series focused on community voice/input to tailor Cooperative Extension and community programming. After the pilot, community attendees expressed a desire to continue to engage in dialogue and to deepen conversations. The Peacock Tract Public Dialogue Pilot Series witnessed over seventy attendees ranging in age from 4 – 85. 100% of respondents reported that attending the Peacock Tract Public Dialogue Pilot Series increased their knowledge of what was going on in the community. 100% of respondent also agreed or strongly agreed that they felt their participation in the event was valuable. 27% of respondents reported that they were not satisfied	Food Systems and Food Safety (#3)
50.	TU Extension: Sustainably produced Food	**Brief Description:** Interest in sustainably produced food is increasing and encouraging growth in the numbers of local and regional producers of such foods will help revitalize rural economies. Indeed, many consumers now seek products that are produced in a sustainable manner, and they believe such products are safer and of better quality. Associated with sustainable production, is food security as well as improvement of quality of life for both producer and consumer. Specifically, the project assesses production practices, consumer perceptions, as well as educate key stakeholders, including producers, students, and others in order to bring about awareness. **Outcome/Impact Statement (Results)**	Food Systems and Food Safety (#3)

		Seventy-six (76) contacts (small producers) participated in workshops regarding local or regional agricultural production. Topics included heir property, good agricultural practices, increasing productivity, marketing, and farm economics, financial management and record keeping. Also, data were collected, analyzed, and findings were presented through presentations and publications; two (2) papers were published; six (6) students participating in research-related efforts working on research, with four (4) defending theses. Seventy-six (76) contacts gained knowledge in practices related to farm economics, financial management, and record keeping, including other areas in agriculture. Six (6) students gained knowledge and skills in agricultural sciences and research. 75% (i.e., 57 contacts) participants said that they will utilize knowledge and skills gained and change their behavior to improve operations, and in the long-run, at least 60% (46 contacts) believe that the relevant information will help to increase their incomes.	
51.	AAMU Extension: Urban SNAP-Ed	**Brief Description:** Staff taught 274 lessons using the Wise Eating for A Lifetime of Healthy (WEALTH) curriculum for adults and an adapted version of the Power of Choice curriculum and the Coordinated Approaches to Child Health (CATCH) Curriculum for youth. Lessons focused on basic nutrition, food safety, food resource management, meal preparation, and physical activity. **Outcome/Impact Statement (Results)** • The percentage of adult participant responses of "always" or "most of the time" when asked if they had enough food to last to the end of the month increased from 48% to 85%, resulting in a 37 percent increase. From pre to delayed post, the mean indicator for adult participants who had enough food to last until the end of the month reduced from 2.74 (pre) to 1.68 (post-delayed). • The percentage of adult participants who engaged in some type of physical activity each day, such as walking , jogging, swimming, etc., increased from 62% to 90%,resulting a an 28% increase from pre to delayed post assessment. Youth participants who engaged in physical activity daily, increased from 55 to 90%, resulting in a 35% increased. Mean indicators: Adults 2.25(pre) - 1.52 (delayed post) Youth 1.73 (pre) - 1.12 (delayed post) • The percentage of ADULT participants who:	Human Nutrition, Well-being, Health and Obesity (#4)

		○ Ate the recommended servings of GRAIN each day, increased from 61% to 81%, resulting in a 20 percent increase. ○ Ate more than one KIND of FRUIT a day, increased from 60 % to 88%, resulting in a 28 percent increase. ○ Ate more than one KIND of VEGETABLE a day, increased from 71% to 90%, resulting in a 19 percent increase. ○ Consumed low-fat or fat-free DAIRY products, increased from 58% to 78%, resulting in a 20 percent increase. ○ Ate the recommended servings of PROTEIN each day, increased from 70% to 90%, resulting in an 20 percent increase. ○ Consumed fat, oils, salt, and sugar sparingly, increased from 66% to 92%, resulting in a 26 percent increase. • The percentage of YOUTH participants who: ○ Ate more than one KIND of FRUIT a day increased from 33% to 64%, resulting in a 31 percent increase. ○ Ate more than one KIND of VEGETABLE a day increased from 25% to 49%, resulting in a 24 percent increase. ○ Drank low-fat or fat-free milk increased from 33% to 80%, resulting in a 47 percent increase. ○ Chose foods based on MyPlate increased from 22% to 59%, resulting in a 37 percent increase.	
52.	AAMU Extension: Technology Enhance Exercise and Nutrition (TEEN)	**Brief Description:** TEEN is an interactive technology drive program designed to educate teenagers on health, nutrition, and physical activity. The program is comprised of four modules on nutrition, nutrients, sports nutrition, and chronic diseases: four iDance exercises and two food demonstrations. **Outcome/Impact Statement (Results)** • Staff conducted 166 TEEN class at middle and high schools, boys' and girls' clubs, youth camps, recreation centers, attention centers and after school programs. The audiences demographics (n=676) were 1) Ethnic Background: Blacks (69%), Whites (20%), and Hispanics (3%), 2) Gender: Females (85%) and Males (16%) and 3) Ages: 9-12 (69%), 13-16 (25%), 17 and above (2%).	Human Nutrition, Well-being, Health and Obesity (#4)

		• Tweens and Teens' increased nutrition, nutrients, food labels, portion control, and chronic diseases knowledge from pre (n=676)- 71% to post (n=641)- 68%. The total number of steps was over 700,000 (n=632 teens). Tweens and teens' (pre- n=676; post- n=641) consumed the following food groups All the Time: Vegetables- pre (28%), post (35%), Fruits- pre (73%), post (70%), Whole Grains- pre (40%), post (59%), Low fat//Fat Free Dairy- pre (54%), post (59%), High Fatty Foods/Sweets- (65%), post (41%). One hundred and seven (107) tweens and teens were assessed six months post-delayed. The participants demographics were Age: 9-12 years old (60%) and 13-16 years old (22%), Gender: Female (61%) and Male (39%) and Ethnic Background: Black (84%), White (4%) and Hispanic (6%). T The tweens and teens retained knowledge post-delay (92%) on nutrition, nutrients, food labels, portion control, and chronic diseases information. The participants also (n=107) consumed the following food groups All the Time: Vegetables- (50%), Fruits- (76%), Whole Grains- (55%), Low fat//Fat Free Dairy- (65%), High Fatty Foods/Sweets- (57%). Eighty-three (83%) were physically active for 60 minutes per day.	
53.	AAMU Research: A Multiple-Pronged Attack on Quackery and Nutrition Misinformation to Reduce Obesity Rate in Alabama	**Brief Description:** The current research explores the knowledge levels amongst the common public and possible sources of any nutrition misinformation. The study examines the individuals' dietary practices, optimum weight, fitness, the rationale for their food choices, and recommended daily allowances. **Outcome/Impact Statement (Results):** Past research has been explored, and the literature (so far) showed that the knowledge and understanding of obesity are significantly being twisted and impacted by deception and nutrition misinformation. A comprehensive instrument (self-reported survey) has been developed to seek approval from IRB. The protocol consists of questions on demographics, basic principles of nutrition, nutrient contents of different food groups, recommended food intake, and a grasp of various healthy eating habits. The results from this study will shed light on the popular misconceptions, distortion of scientific facts, misbeliefs, and fallacies regarding nutrition information. The study will also bring awareness to communities about misleading agencies and their profiteering	Human Nutrition, Well-Being and Obesity (#4)

		practices. After collecting sufficient data, the research team plans to develop educational and informational materials for use in Alabama.	
54.	AAMU Research: Preventing Obesity in Low-Income Children: A Community Nutrition-Based Approach	**Brief Description:** The project addresses the obesity and food insecurity paradox by assessing the nutrition environments in low-income communities. Urban and rural food environments were measured for the availability, affordability, and quality of nutrient-dense foods in various food retail settings (i.e., grocery stores, convenience stores, and restaurants). **Outcome/Impact Statement (Results):** In less than five years, the activities of this study have contributed to the body of knowledge concerning the paradoxical relationship between food insecurity and obesity. Specifically, the correlation between consumer nutrition environments and accessibility to nutrient-dense food options in north Alabama has been established. There was significantly less ($p<0.05$) accessibility to and availability of nutrient-dense food options in both rural and urban, north Alabama, communities. Nutrient-dense options were often more expensive compared to higher calorie, less healthy food options. The affordability, availability, and quality of foods in low-income communities can influence food choice and serve as a barrier to overall good health. The results of this study can inform new approaches to conducting and evaluating nutrition interventions and make correlations between food insecurity and obesity.	Human Nutrition, Well-Being and Obesity (#4)
55.	AAMU Research: Effects of Mass Media on Overweight and Obesity Among 19-26-year-old Young Adults	**Brief Description:** This research study aimed at exploring the influence of mass media use among 19-26-year-olds, mainly on their food choices, fitness practices, lifestyle habits, environmental factors, and overall media consumption. **Outcome/Impact Statement (Results):** Since 2015, the project successfully examined the patterns of media use among young adults and indicating correlations to their overweight and obesity. With a resolute goal of investigating 2000 participants, the researcher was collected data via paper/pencil and online methods. The results were intriguing in that, the correlations between the media use and fitness practices were found to be remarkably high. This large-sample-exploratory research (n=1700) across the state of Alabama showed that the use of mass media influenced young adults' food choices, dietary practices, cooking at home, and shopping online for food, etc. It was also found that age, sex, and place of living had an impact on various dietary practices and were correlated with their mass media usage. The study has	Human Nutrition, Well-Being and Obesity (#4)

		provided insights into the use of media among young adults, and its substantial correlation with overweight and obesity. This demands using media outlets for education on healthy eating, fitness, and effective use of online information. The results of the study were used to design and create informational materials (bookmark, info-card, brochure, and booklet). In addition, educational programs were developed and implemented during three summer camps (2017-2019) covering a total of 120-plus youth from Madison county on improving their awareness of misleading advertising, judicious use of media, the importance of healthy eating, exercise, and fitness habits. To name a few educational activities: Name that Food (NTF), Make Your Meal (MYM), Do You Know Your Advertisements (DYKYAs) (Online and Print). Given the scope of the obesity epidemic shooting to an alarming 50% by the year 2020, such training and preparation are important to public health. Further, proposing early health interventions and state-level policy recommendations are imminent.	
56.	AAMU Research: Supermarket Tour-Based Intervention to Increase Fruit and Vegetable Choices and Intake Among College Students	**Brief Description:** The majority of college students are learning to grocery shop and cook for themselves for the first time as young adults. Assuring that college students are consuming adequate amounts of fruits and vegetables could be key in setting the stage for future generations to come. The purpose of this study was to evaluate whether a hands-on supermarket tour intervention could increase the consumption of fruits and vegetables. **Outcome/Impact Statement (Results):** The activity of this study has contributed to the body of nutrition knowledge about understanding the effects of hands-on nutrition education is of utmost importance in the United States. As our country continues to be in the midst of an obesity epidemic, it is crucial to find ways to increase the healthfulness of American diets; doing so will aid in preventing diseases such as heart disease, cancer, and diabetes. College students have the potential to play a significant role in "setting the tone" for the American population. In a quasi-experimental study, 330 students from Alabama A&M University were recruited to assess the average fruit and vegetable consumption among college students. Half of the students were randomly selected to attend a supermarket tour focused on fruits and vegetables. Results showed no significant increase in the intervention group's fruit and vegetable consumption when compared to the control group. The lack of increase among the intervention group could possibly be rationalized by the perceived barrier found within this sample population of college students, cost. The overall fruit consumption was found to be below recommendations, but vegetable consumption exceeded the recommendations. It is essential to educate our future leaders on the importance of	Human Nutrition, Well-Being and Obesity (#4)

		consuming adequate fruits and vegetables in order to aid in the reduction of many chronic diseases.	
57.	AU Extension: Auburn University Supplemental Nutrition Assistance Program – Education (SNAP-Ed)	**Brief Description:** Alabama Extension at Auburn University Supplemental Nutrition Assistance Program – Education (SNAP-Ed) used an evidence-based, multi-level approach to create a healthy population. AU SNAP-Ed reached youth and their parents with healthy eating and physical activity **education** through school-based initiatives and after-school and summer programs. AU SNAP-Ed facilitated local and state **policy changes, systems changes, environmental improvements and promotional efforts** to make it easier for individuals to choose healthy food and beverages and physically active lifestyles. AU SNAP-Ed developed an original **social marketing** initiative, Live Well Alabama, to reach its target audience through social media, outdoor advertising and text messaging. The campaign integrated SNAP-Ed resources into local communities and home environments to increase awareness of better food and drink choices and increased motivation for daily physical activity. SNAP-Ed educators used direct education coupled with policy, systems and environmental changes and social marketing to move limited-resource individuals toward healthy choices, making it easier for Alabamians to live well. **Outcome/Impact Statement (Results):** ***Direct Education*** During FY19, AU SNAP-Ed educators provided Body Quest (BQ), an evidence-based childhood obesity prevention initiative, to more than 5,800 third graders and their parents in 45 Alabama counties, 126 schools and 312 classrooms. Written pre- and post-assessments measured behavior change of **students** in treatment and control groups. Significant differences ($p < 0.001$) were observed in treatment students from pre- to post-assessment and compared to control students. • **Fruit and Vegetable Consumption:** At the end of BQ, treatment students ate vegetables and fruits more times per day and ate greater variety of vegetables and fruits compared to before BQ and compared to control students. • **Beverage Consumption:** At the end of BQ, treatment students drank more water compared to before BQ and compared to control students. Also, at the end of BQ, treatment students drank less whole milk and more low-fat milk compared to before BQ and compared to control students.	Human Nutrition, Well-being, Health and Obesity (#4)

		Parents completed written pre- and post-assessments measuring behavior change. Significant differences ($p < 0.001$) were observed in treatment parents from pre- to post-assessment and compared to control parents. • **Fruit and Vegetable Consumption:** At the end of BQ, treatment parents ate more cups of vegetables daily, ate vegetables more often, and ate a greater variety of vegetables and fruits compared to before BQ and compared to control parents. • **Beverage Consumption:** At the end of BQ, treatment parents drank fewer sugary beverages and more low-fat milk compared to before BQ and compared to control parents. • **Food Resource Management:** At the end of BQ, treatment parents implemented better food resource management practices (i.e., comparing prices, changing meals to include budget-friendly items, shopping with a grocery list, buying low-fat or fat-free dairy, buying foods and drinks with less sugar, buying foods with less salt) compared to before BQ and compared to control parents. ***Policy, Systems, Environmental and Promotional Change Strategies*** Policy, systems, environmental and promotional change strategies were used to increase access and appeal for healthy foods and beverages in low-income communities for 46,000 residents. Settings and example strategies include: • **Farmers Markets** (n=22): improved farmers market hours of operation • **Schools** (n=126): improved school wellness policies • **Grocery Stores** (n=7): increased shelf space for healthier foods and beverages • **Food Pantries** (n=26): facilitated donations of fresh fruits and vegetables • **Gardens** (n=33): enhanced row-based, raised bed, hoop house and container gardening practices • **Faith Communities** (n=2): facilitated healthy options at congregational meals ***Social Marketing*** Live Well Alabama messages to Eat Better, Move More, and Make a Change for better health reached more than **785,000 Alabama residents** in multiple ways every day. Billboards made over **162 million impressions**, social media following grew by **44%** on average, and more than **5,000 people** joined texting campaigns. Signs in schools, grocery stores, and parks reminded Alabamians to Eat Better, Move More, and Choose Water. SNAP-Ed educators spread Live Well Alabama messages through recipe demonstrations, nutrition education, and food and physical activity access projects.	

58.	AU Extension: Auburn University Expanded Food and Nutrition Education Program (EFNEP)	**Brief Description:** EFNEP teaches limited-resource audiences, through a series of lessons, primarily in group settings, how to improve dietary practices and become more effective managers of available resources. The overall goal of EFNEP is to aid limited-resource audiences in acquiring knowledge, skills, and changed behavior necessary for nutritionally sound diets and to contribute to personal development and the improvement of family diet and nutritional well-being. **Outcome/Impact Statement (Results)** Through its 256 community partners, 389 delivery sites and 25,896 indirect contacts, EFNEP supported dietary change and healthy living for Alabama adults and youth. Adult Food and Physical Activity Behavior Questionnaires and 24-hour dietary recalls, administered at program entry and at program exit, measure change in adult behavior. Data show that 95.9% of adult EFNEP graduates showed positive change in any food group at exit (fruits, vegetables, grains, protein foods, and dairy). To summarize practices within clusters of behavior change questions for **adults**: • 82% of participants showed improvement in one or more **food resource management practices** (i.e., cook dinner at home, compare food prices, plan meals, or make a list before shopping) • 93% of participants showed improvement in one or more **diet quality indicators** (i.e., eating fruits, vegetables, red and orange vegetables, dark green vegetables, drinking less regular soda (not diet), drinking less fruit punch, fruit drinks, sweet tea or sports drinks, or cooking at home) • 81% of participants showed improvement in one or more **food safety practices** (i.e., washing hands before preparing food, washing all items and surfaces after cutting raw meat or seafood, not thawing frozen food at room temperature, or using a meat thermometer) • 50% of participants showed improvement in or one or more **food security indicators** (i.e., not eating less than you wanted so there was more food for your family or having enough money to get food for your family) • 78% of participants showed improvement in one or more **physical activity behaviors** (i.e., exercising for at least 30 minutes, doing workouts to build and strengthen muscles, or making small changes to be more active). To summarize outcome results for **youth**:	Human Nutrition, Well-being, Health and Obesity (#4)

		• 91% of youth improved their ability to **choose foods** according to federal dietary recommendations or gained knowledge • 69% of youth improved their **physical activity practices** or gained knowledge • 64% of youth used **safe food handling practices** more often or gained knowledge • 57% of youth improved their ability to **prepare simple, nutritious, affordable food** or gained knowledge. • 958 youth also participated in other 4-H programs through Alabama Cooperative Extension System.	
59.	AU Extension: Breast feeding Friendly Child Care	**Brief Description:** The Alabama Breastfeeding Friendly Child Care (ABFCC) initiative, a new statewide effort, aims to increase knowledge and application of breastfeeding best practices among childcare providers by utilizing direct education, policy change and hands-on application. Through ABFCC, childcare providers (program directors, teachers and substitutes) attend a two-hour face to face training, for which they receive continuing education hours. After completing the initial training, childcare providers receive training on the requirements to become breastfeeding friendly. In order to become certified, there are policies, environmental changes and system changes that providers must implement within their programs at the childcare centers. A site visit is included to verify that all requirements are being met. **Outcome/Impact Statement (Results)** In the first 10 months of the ABFCC initiative, 31 childcare providers across Alabama were certified as Breastfeeding Friendly in 2019. All 31 of these providers implemented environmental changes such as creating a breastfeeding friendly area in the childcare centers. Centers also had to create/update current program policies in order to provide evidence-based care to better support and encourage breastfeeding families that attend their program. Each of these providers now openly welcome all breastfeeding mothers and support their breastfeeding employees. More than 1,000 children under the age of five attend the programs of the certified providers. The Pre-K children now see books with images of nursing	Human Nutrition, Well-being, Health and Obesity (#4)

		mammals, posters of mothers breastfeeding, and moms encouraged to nurse on site. In summary, the Alabama Breastfeeding Friendly Child Care initiative has increased the support, encouragement and education available to women of all ages throughout Alabama. This helps normalize breastfeeding in a state with below average breastfeeding rates More than 1,000 children under the age of five attend the programs of the certified providers. The Pre-K children now see books with images of nursing mammals, posters of mothers breastfeeding, and moms encouraged to nurse on site. In summary, the Alabama Breastfeeding Friendly Child Care initiative has increased the support, encouragement and education available to women of all ages throughout Alabama. This helps normalize breastfeeding in a state with below average breastfeeding rates.	
60.	AU Extension: Diabetes Empowerment Education Program (DEEP)	**Brief Description:** Alabama ranks among the top five states in the nation for the prevalence of diabetes, surpassing the national average. Diabetes is the 7th leading cause of death in Alabama and directly contributes to the incidence of heart disease and stroke. Seven Regional Extension Agents are certified as DEEP Peer Educators. As DEEP Peer Educators, they implement diabetes education through six weekly sessions. These sessions provide participants with the necessary knowledge and skills for diabetes self-management. The content of the curriculum is presented in activities applying adult education methods. Participants learn portion control, how to read the Nutrition Facts label, how to wisely select carbohydrates and learn about monitoring their A1C number. **Outcome/Impact Statement (Results)** DEEP was delivered in 19 Alabama counties. Of the 420 participants, they were female (82%) and male (18%); African America (50%), American Indians (3%), White (42%), Hispanics 4%, and More than one race (.01%).	Human Nutrition, Well-being, Health and Obesity (#4)

		Based on statistical outputs, significant ($p < 0.05$) improvements in participants from pre- to post-surveys were found in the following categories: Participants were able to correctly answer all the knowledge questions with a significant increase from 58% to 99%, pre- to post-survey. Participants who felt good significantly increased from 19% to 59%, pre- to post-survey. Participants behavioral performance significantly increased pre- to- post-survey. For example, participants started looking and washing their feet every day. This personal behavior is important for people with diabetes because many people with diabetes have circulation/sores that can lead to amputations. In summary, DEEP education allows people affected by diabetes to more closely manage and control their diabetes. Ultimately, this leads to lower health care costs for Alabama	
61.	AU Research: Black Women's Experiences Living with Lupus (Be WELL)	**Issue:** Examined the role of social environmental stressors experienced by African American women that exacerbate lupus, an autoimmune disease. Over 1.5 million Americans have lupus. Lupus is 10-15 times more common among women compared to men; moreover, African American women are most affected by lupus, having an incidence rate 3-4 times higher than that for White women. Lupus affects over 27,000 Alabamians. **What has been done?** Wave 3 of quantitative and qualitative data were collected from participants; data were cleaned, coded and analyzed to address the research aims. **Results:** Results identified unique psychosocial risk factors associated with worse health outcomes among African American women with lupus; racial discrimination was associated with greater disease damage and disease activity. The research is identifying stress and protective factors for coping with health compromising conditions that are exacerbated by health disparities due to racial, gender and socioeconomic discrimination and lack of access to support and resources for coping. Next steps in this study are to explore the biological implications of psychosocial stressors and systematic lupus erythematosus, in relation to elevated systemic inflammation and accelerated aging at the cellular level.	Human Nutrition, Well-being, Health and Obesity (#4)

		Target Audience: Scientists, students, policymakers, health professionals, and general public.	
62.	AU Research: Mechanisms for Race Differences in the Link Between Educational Attainment and Health	**Issue:** Health disparities and race differences in insulin resistance. **What has been done?** Investigated race differences in early life (childhood) adversity on insulin resistance in adulthood. Insulin resistance was calculated from fasting glucose and insulin concentrations in the blood. Twelve risk factors relating to household dysfunction, socioeconomic disadvantage, and maltreatment were sum scored to index childhood adversity. Measures of adult stress included socioeconomic adversity, major stressful events, everyday discrimination, and lifetime discrimination. **Results:** This project is determining linkages between childhood stress exposure and adult insulin resistance and other health compromising conditions that result, in part, from health disparities. Childhood adversity was associated with higher levels of insulin resistance and helped explain greater insulin resistance in Black relative to White adult participants. Race differences in insulin resistance were largely the result of stress exposures across the life span. Measures of adult stress accounted for some of the association between childhood adversity and insulin resistance and accounted for an additional portion of the race difference. Higher inflammation and lower nocturnal cortisol both played an important role in mediating the association between stress exposure and insulin resistance. The findings of this study show that race differences in insulin resistance are largely the result of stress exposures across the life span, which in turn influence glucose metabolism through multiple biological pathways. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	Human Nutrition, Well-being, Health and Obesity (#4)
63.	AU Research: Reducing E-Health Literacy Disparities among Rural Elders Using Intelligent Agent Technology	**Issue:** Addressing Rural Elderly Health with Consumer-friendly Technology **What has been done?** Tested the effectiveness of an assistive intelligent agent technology to facilitate access among rural elderly to health information and resources. User evaluation of the effectiveness of the intelligent agent technology was performed through a consumer experiment employing a 2 × 4 mixed design.	Human Nutrition, Well-being, Health and Obesity (#4)

		Results: The adoption and use of e-health tools is slow with rural elders because the remoteness of their locations allows fewer opportunities for obtaining social and training support for the use of such tools. Intelligent agent technology was shown to be effective in enhancing seniors' ability to process information; consumers perceived this technology permitted them more capacity to move through the decision process effectively. This research is offering avenues for connecting rural elderly with smart technology to help them overcome barriers to e-health literacy and experience the accompanying benefits. Well-designed AI agents can enhance rural elders' e-health literacy, which will lead to more informed health decisions, more positive health behavioral changes, and thus increased quality of life among the rural elderly community. Next steps are to conduct observation and survey studies with a sample of older (65+ years old) Alabamian Medicare beneficiaries to understand their awareness, knowledge, and challenges with regard to the Medicare Plan Finder (on the Medicare.gov website), which is the only electronic decision support system for Medicare plan selections. Findings of this study will help the project team identify problems and issues that need to be considered in designing intelligent agent technology to provide this population with critical on-screen assistance that enhances their ability to make optimal Medicare plan decisions. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	
64.	AU Research: Obesity-linked Non-alcoholic Fatty Liver Disease Progression and Colorectal Cancer	**Issue:** Link between obesity and diseases such as diabetes and cancer. Pathophysiological changes associated with obesity are linked to the progression of nonalcoholic fatty liver disease (NAFLD) to nonalcoholic steatohepatitis, which is associated with increased prevalence of colorectal cancer. **What has been done?** Established an in vitro model to examine putative therapeutic targets for the treatment of nonalcoholic steatohepatitis. Cultures were generated and a series of experimental tests were undertaken to examine the role of Cas9 expressing hepatocytes. **Results:** Results validated that hepatocytes expressing Cas9 have the capacity to be induced by palmitic acid to express collagen. This research is generating Cas9 expressing hepatocytes as a first step to examine the function of putative genes. Additional testing and assessments will move this research toward the ultimate goal of delineating the	Human Nutrition, Well-being, Health and Obesity (#4)

		mechanism(s) of nonalcoholic fatty liver disease progression and the link between hepatic dysfunction and colorectal cancer. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	
65.	AU Research: Nerve Growth Factor and its Receptor TrkA in Insulin Signaling	**Issue:** Understanding of how NGF-TrkA influences insulin signaling in the brain. Aimed to elucidate how NGF-TrkA (nerve growth factor – TrkA bind) can be exploited to regulate neuronal glucose uptake to prevent or treat diabetes. **What has been done?** A series of tests were undertaken using a rat model to examine the possible role of NGF-TrkA in controlling blood sugar level. **Results:** Results showed that expression of proNGF increased, and NGF decreased in the STZ rat brain; interaction of TrkA with insulin receptor and insulin receptor substrate-1 was impaired; Tyrosine phosphorylation of TrkA, insulin receptor and insulin receptor substrate-1 is reduced in the STZ rat brain; activation of Akt was decreased in the STZ-induced type 1 diabetic rat brain. This work is demonstrating how NGF-TrkA influences insulin signaling in brain and its function in inducing insulin secretion from pancreatic beta cells. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	Human Nutrition, Well-being, Health and Obesity (#4)
66.	AU Research: Deciphering the Relationships between Gut Microbiota and Dendritic Cells in the Setting of Obesity	**Issue:** Link between obesity and diseases such as diabetes and cancer **What has been done?** Determined how the functional genome of the gut microbiota changes during the development of obesity; tests the effects of diet manipulation. Fecal microbiota samples were collected for two obesity studies, one with pigs and one with mice. Diet manipulation followed by a series of measurements and assessments were used to address the study aims. **Results:** Findings indicated that the different diet groups among the pig samples were significantly different from each other in weight gain and in fat; DNA samples are still in the sequencing pipeline, awaiting analysis. The different diet groups among the mice sample showed that mice fed high fat diets (with or without sugar) demonstrated overgrowth of certain bacterial families. Collectively, this research is contributing to	Human Nutrition, Well-being, Health and Obesity (#4)

		understanding how obesity is controlled by the microbiome and the potential to manipulate microbes within the digestive system to enhance weight loss efforts. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	
67.	AU Research: Childhood Obesity in Alabama: Risk Factors	**Issue:** Childhood obesity in Alabama. In the United States, approximately 12.7 million children and adolescents are classified as obese. The prevalence of obesity is 8.9% among 2 to 5-year-olds compared with 17.5% of 6 to 11-year-olds and 20.5% of 12 to 19-year-olds. Around $190 billion dollars have been estimated as annual medical expenditures associated with obesity. Alabama has one of the highest obesity rates among adults 36.2%, and 35% of Alabama's youth are overweight or obese. **What has been done?** Investigated differences in the composition of salivary and gut microbiome in lean, overweight and obese young children. 169 rural children (ages 6-9) and their parents were recruited for the study; parent reports and measurements/assessments were collected from children to address the study aims. **Results:** Results determined the relationship between the copy number of salivary amylase (AMY1) gene and obesity measurements in a sample of rural Alabama children. This research is progressing toward identifying the composition of salivary and gut microbiome in lean, overweight and obese children, and identifying diverse genetic, behavioral and environmental factors that contribute to the development of childhood obesity. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	Human Nutrition, Well-being, Health and Obesity (#4)
68.	AU Research: Person-Environment Interplay in the Development of Adolescent Substance Use and Young Adult Substance Use Disorders	**Issue:** Childhood obesity in Alabama. In the United States, approximately 12.7 million children and adolescents are classified as obese. The prevalence of obesity is 8.9% among 2 to 5-year-olds compared with 17.5% of 6 to 11-year-olds and 20.5% of 12 to 19-year-olds. Around $190 billion dollars have been estimated as annual medical expenditures associated with obesity. Alabama has one of the highest obesity rates among adults 36.2%, and 35% of Alabama's youth are overweight or obese. **What has been done?** Investigated differences in the composition of salivary and gut microbiome in lean, overweight and obese young children. 169 rural children (ages 6-9) and their parents were recruited for the study; parent reports and measurements/assessments were collected from children to address the study aims.	Human Nutrition, Well-being, Health and Obesity (#4)

		Results: Results determined the relationship between the copy number of salivary amylase (AMY1) gene and obesity measurements in a sample of rural Alabama children. This research is progressing toward identifying the composition of salivary and gut microbiome in lean, overweight and obese children, and identifying diverse genetic, behavioral and environmental factors that contribute to the development of childhood obesity. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	
69.	TU Research: Black Belt Region and Obesity	Counties in the Black Belt region of the United States present with higher levels of obesity compared to other regions. Alabama is one of the states in the black belt region and it has the fifth highest rate of obesity in the United States. The prevalence of obesity in black belt counties is high among low income rural African Americans. Several interventions have been introduced to reduce obesity in the Alabama Black belt region; however, the health knowledge, and perceptions of obesity among rural African Americans remain poorly understood and thus limiting the success of obesity prevention and treatment programs. This study assessed the knowledge, attitudes and perceptions of obesity among African Americans in Bullock County, Alabama. Focus group discussions (FGDs) were conducted in the cities of Union Springs and Midway to collect information on participants' understanding of healthy lifestyle, physical activity, community programs and barriers to healthy living in their communities. Findings showed that participants had a good understanding of the importance of physical exercise and healthy eating. However, limited access to safe walking trails and fresh fruits and vegetables were still major barriers to healthy living. Participants (85%) strongly support increasing physical activity in school, while 78% support limiting TV ads for unhealthy foods. More than 50% of the participants were knowledgeable about obesity but it was not of concern.	Human Nutrition, Well-being, Health and Obesity (#4)
70.	AU Research: Development of new wood composites for packaging application	**Issue:** Most of the adhesives that are used in forest product industry are derived from petroleum based. The proposed research will investigate the use of agriculture-based products such as soybean flour or lignin as a replacement of petroleum derived adhesives. **What has been done?** A number of experiments were run to evaluate the soy flour, nano cellulose and lignin for producing lighter weight wood composites.	Sustainable Energy (#5)

		Results: The composite materials developed were able to meet the weight requirement for pallet decking. An invention disclosure agreement has been filed with Auburn University. **Target Audience:** Scientists, students, forest products industry, and general public.	
71.	AU Research: Nanocellulose-based materials for novel applications	**Issue:** Use of nanocellulose in adhesives production and water treatment is still lacking, and its effects on those applications are not fully understood. **What has been done?** Nanocellulose has been produced and characterized from different biomass including soybean hulls. They have been tested for microsystin adsorption to be used in water remediation and for wood composites manufacturing to obtain higher strength. **Results:** In addition to extracting nanocellulose from biomass and testing for microsytin adsorption, three review papers have been published that look at the potential use as adsorbents and other applications. **Target Audience:** Scientists, students, forest products industry, and general public.	Sustainable Energy (#5)
72.	AU Research: Integration of anaerobic digestion with algae cultivation for conversion	**Issue:** Constant use of poultry litter as a fertilizer in agriculture fields has overloaded those field with phosphorus. The proposed research will investigate an alternative approach to poultry litter management that will lead to reduced environmental impacts and greater income for farmers. **What has been done?** Researchers have use algae to manage the nutrient in poultry litter while recovering some energy from poultry litter digestion. **Results:** Use of aerobic wastewater bacteria has helped to pretreat poultry litter digestate in order to remove compounds that inhibit algal growth. A provisional patent has been field for this work. Algae promoted the growth and efficacy of nitrifying bacteria in anaerobic digestate. **Target Audience**: Scientists, students, poultry farmers, high school students, water utilities and general public.	Sustainable Energy (#5)
73.	AU Research:	**Issue:** Antibiotic is the most common treatment for various animal disease pathogens, but is not specific, leads to antibiotic resistance, and disrupts normal microbiome of the host.	Sustainable Energy (#5)

	Address animal health and disease related issues using biological engineering and synthetic biology approaches	**What has been done?** The CRISPR-Cas9 system was adapted to edit the genomes of two fish pathogens (Edwardsiella ictaluri and Aeromonas hydrophila). A highly efficient genome editing procedures was developed for fish pathogens. **Results:** Several key genes related to the pathogenesis have been deleted from the strains. In addition, the *green fluorescent protein* (GFP) has been inserted into the genome of the strain. This is the first report about using CRISPR-Cas system in the genome editing in fish pathogens. Established an in vitro model to examine putative therapeutic targets for the treatment of nonalcoholic steatohepatitis. Cultures were generated and a series of experimental tests were undertaken to examine the role of Cas9 expressing hepatocytes. **Target Audience:** Scientists, students, Biotech companies, Fish farmers, and general public.	
74.	AU Research: Bioenergy and bioproducts production through systematic metabolic engineering and bioprocess engineering of solventogenic clostridia	**Issue:** The finite nature of fossil fuels and their associated environmental impacts drive the nations of the world to seek alternative biobased fuels and chemicals from renewable resources. **What has been done?** Rational manipulation of biological pathways of solventogenic clostridia has been carried out to develop robust workhorses that can produce various high value biofuel and biochemicals including butanol, ester, fatty acids, and long-chain alcohols from low-value renewable lignocellulosic materials. **Results:** In the clostridial acetone-butanol-ethanol (ABE) fermentation, the intermediate acetate and butyrate are re-assimilated for solvent production. Here, key genes in ABE pathways in Clostridium saccharoperbutylacetonicum N1-4 were overexpressed to enhance acid re-assimilation and solvent production. With the overexpression of sol operon, acid re-assimilation was enhanced, and ABE production was increased by 20%, with ethanol production increased by six times but almost no increase in butanol production. Compared to the control, butanol, acetone and total ABE production in the new strain was increased by 8%, 18%, and 12.4%, respectively. Finally, simultaneous saccharification and fermentation was carried out using acetate-pretreated switchgrass. 15.4 g/L total ABE (with a yield of 0.31 g/g) was produced in both engineered strains, which was significantly higher than the control. Also, team members established a biomass pretreatment approach using acetic acid (which can be used as a carbon source for acetone-butanol-ethanol (ABE) fermentation) as the	Sustainable Energy (#5)

		chemical catalyst, leading to comprehensive biomass utilization and enhanced solvent production (especially acetone production due to re-assimilation of elevated fatty acids) using Clostridium saccharoperbutylacetonicum. Additionally, simultaneous saccharification and fermentation was carried out with the mutant using acetic-acid-pretreated switchgrass, and 16.2 g/L IBE was produced. Our engineered strain produced the highest IBE that has ever been reported in a batch fermentation. Our results indicated that acetic-acid-pretreated biomass can be efficiently converted into biofuel using metabolically engineered Clostridium. **Target Audience:** Scientists, students, Biotech companies, and general public.	
75.	AU Research: Surface-modified biochar: evaluation of its performance in anaerobic digestion, sorption of heavy metals and herbicides	**Issue:** Biochar produced from thermochemical conversion of biomass has wide applications. This study explores the possibility of using it for anaerobic digestion and glyphosate sorption. **What has been done?** Several types of biomass were used to produce biochar, and they were fully characterized. Biochar was tested for glyphosate removal and its effect in anaerobic digestion. Presence of carbonyl, carboxylic, and hydroxyl functional groups make biochar attractive for both sorption and also to immobilize methane producing bacteria. **Results:** The sorption study examined glyphosate sorption capacity of different bio-based materials such as biochars and activated carbons synthesized from Douglas fir, kraft lignin and mixed wood pellets. All biochars showed poor sorption of glyphosate in comparison to activated carbons derived from biochars and commercial powdered activated carbon (PAC) investigated in this study. All biochar derived activated carbons produced in the laboratory showed comparable glyphosate sorption in comparison to PAC. Activated carbons synthesized from Douglas fir biomass showed the highest glyphosate sorption among the activated carbons investigated. Our biogas production results indicate all adsorbent-added cultures showed higher methane production ranging from 1.2 to 1.8 times higher methane yield in comparison to non-adsorbent added cultures. **Target Audience:** Scientists, students, policymakers, and farmers.	Sustainable Energy (#5)

76.	AAMU Research: Latino Immigrant Travel Behavior and Planning Responses in Alabama and Georgia	**Outcome/Impact Statement (Results):** This ongoing project seeks to understand the transportation and travel behaviors of Latino and immigrant communities in Alabama and Georgia. Findings will facilitate informed policy and planning decisions among cities and local leaders. Currently, two products have emerged from this project, a journal article and conference presentation. A paper entitled "Urban Design of On-Street Stops and Road Environments: A Conceptual Framework" published in Pacific International Journal (authors A. Ajayi, E. Erickson, and J. Oluwoye). Conference presentation entitled "Latino Carpooling in Alabama and Georgia" presented at the Urban Planning Conference at Alabama A&M University (E. Erickson, S. Misra, and L. Balderrama). A paper based on the conference presentation is forthcoming. The project has employed and trained four students and one visiting scholar. The students have been trained in the collection and analysis of secondary data sources (American Community Survey and the National Household Transportation Survey), the production of literature reviews, and research design.	Community Development (#6)
77.	TU Research: Social Justice Assessment	This study presents a unique approach in assessing social justice in Alabama by combining a variety of community capital indicators grouped into seven forms of capital: human, physical, social, environmental, natural, financial, and political. Geographic Information Systems (GIS) was used to map the indicators at the county level, combine them into sub-indices for each of the seven capitals, and then aggregated to create a Social Justice Index (SJI). Data were obtained from the US Census Bureau and various Alabama State services and analyzed using GIS Hotspot Analysis tool (Getis ORD*). Additional methods included the computation of z-scores and percentiles for each indicator, the development of sub-indices and then a final index by averaging of the percentiles, and the mapping of the resulting capital distributions spatially. The results indicate very high levels of capital distribution in the following counties: Walker, Lamar, Pickens, Sumter, Greene, Washington, Marengo, Clarke, Monroe, Conecuh and Wilcox. The results also showed very low levels of capital distribution in the following counties: Etowah, St. Claire, Calhoun, Cleburne, Talladega, Chilton, Coosa, Tallapoosa, Chambers, Lee, Macon, Elmore, Autauga and Russell. The results of this study, in	Community Development (#6)

		particular, the map products, will help community advocates and policymakers identify strategic intervention areas and address related social issues. Based on the results, it is recommended that strategic community development approaches such as are employed to promote equity in all areas. Key stakeholders should be educated regarding the predominant resources available to the community. Consequently, further research can be conducted in identifying and incorporating other vital indicators and variables for the capitals.	
78.	TU Research: Heir Property	Heir property is a term used to describe land without a secure title, often due to transfer from one generation to the next without the benefit of a will. Heir property is one of the leading causes of African American land loss and decline in wealth. Heir property cannot be used as collateral for mortgages, resources cannot be extracted without the consent of ever heirs, and certain USDA programs are not available to make improvements on heir property. Thus, heir property has been called "dead capital." Due to the financial limitations placed on heir property, it is assessed by local governments at a lower value than titled property. The purpose of this research is to compare heir property to title property to determine the economic difference, if any, between these two types of properties. The objectives are 1) to determine the difference between assessed value of heir property versus heir property; 2) to determine differences in assessed property tax based on any difference in land assessed value; and 3) to provide a preliminary assessment of the impact, if any difference, of both land owner and community value. Data were obtained from the Macon County Revenue Commissioner's Office Parcel Viewer. Heir property (n=1,398) and title property (n=16,647) land tracts were analyzed using descriptive statistics. The results show that heir property land value was assessed at a lower rate than titled property, heir property has fewer improvements than titled property, and heir property was taxed significantly lower than titled property. The results indicated that heir property contributes to a loss of revenue for Macon County.	Community Development (#6)
79.	AAMU Extension: Successful Aging Initiative (SAI)	**Brief Description:** Approximately 5,766 individuals participated in the Successful Aging Initiative. Nearly three-quarter of the participants (73%) were females and 27% were males. Similarly, 72% of the participants were African Americans/Blacks and 27% were Caucasian Americans. All other racial groups (Hispanic, Asian, American Indian, and Multi-Racial) made up less	Family, Home and 4-H and Youth Development (#7)

		than 1% of the participants. Almost all participants were adults. Only 77 of 5,766 participants were youth participants (1%). **Outcome/Impact Statement (Results)** • The program was implemented by the equivalent of 2.75 Urban Regional Agents throughout urban areas in 18 counties. Classes, workshops, seminars, family day programs, conferences, and support groups were used in the implementation of the program. A pretest, posttest and delayed posttest for each of the four lessons were utilized in assessing participants' knowledge and behavior changes. • Of the 5,766 program participants, 373 senior participants enrolled and completed a series of four lessons. The program entailed participants receiving four hours of training – one hour of training per session or per lesson. Findings from participants' pretest and posttest results indicated a significant increase in participants' knowledge of finance after attending the classes. They had a significantly higher knowledge of how to cut cost on prescription medication (t = 13.19), food (t = 12.60), entertainment (t = 5.90), cleaning products (t = 11.39), clothing & household items (t = 12.88) after participating in the program. Likewise, participants' knowledge of spending plans/budgets increased after attending the series of classes. Pre and posttest results indicated that participants' knowledge of how to write SMART financial goals (t = 14.59), track their spending (t = 13.59), create a spending plan/budget (t = 14.00), and incorporate savings into their spending plan (t = 12.85) increased as a result of attending the classes.	
80.	AAMU Extension: Making Money Count	**Brief Description:** The Making Money Count Pam focuses on improving the financial knowledge and skills of individuals. It uses the financial management curriculum, Making Money Count. Four lessons from the curriculum were modified and implemented as a series or as stand-alone programs in various settings throughout the state of Alabama. The focus of the lessons was on decision making, spending plans, credit, predatory lending, and banking. Included in this program is a stand-alone lesson on the use of a debt management software (PowerPay). **Outcome/Impact Statement (Results)**	Family, Home and 4-H and Youth Development

		• The majority of the participants resided in urban areas (61%). A little more than half of the participants (51%) were male. Adults made up 79% of the participants while youth made up 21%. More than half of the participants (53%) were African Americans/Blacks. Hispanics represented a little more than one-third (34%) of the program participants, and whites represented 13%. All other races made up less than one percent of the group. • Of the 2,594 program participants, 317 individuals completed the entire series of four lessons which was equivalent to 4-5 hours of class time. Based on participants' pretest and posttest results, there was a significant increase in participants' knowledge of credit. Participants' knowledge of what makes up their credit score (t = 17.17), how to build and maintain their credit (t = 15.14), and how to request their credit reports (t = 16.16) increased significantly after completing the program. Similarly, their understanding of predatory lenders (t = 15.91) and their tactics (t = 16.62) increased significantly. • Approximately 47% of the individuals who enrolled in the series of lessons offered through this program were assessed, on average, more than two months after completing the program. Results from the delayed post assessment indicated positive changes in program participants' behavior. Based on the results, the majority of the respondents were continuing to use a spending plan (72%), track their spending (85%), make financial decision less impulsively (74%), and seek ways to reduce their expenses (63%). Similarly, 23% of the participants were still using debt management software for help in managing their debt, and 53% had reduced their use of alternative sources of credit (i.e. cash advance, title loans, rent-to-own, etc.). • 601 participants applied for their credit report for the first time. • 208 participants were trained to use a debt elimination software (PowerPay).	
81.	AU Extension: Financial Well-Being for Adults	**Brief Description:** Healthy money management habits are required to provide for daily needs and plan effectively for the future. Financial education supports individuals in learning essential information and skills to manage personal finances and reach life goals. This initiative focused on developing and using a spending plan, understanding and using credit effectively, saving for the future, banking services, and how to protect financial assets and personal identity.	Family, Home and 4-H and Youth Development (#7)

		Eight Regional Agents taught serial (4 lessons) lessons utilizing "FDIC Money Smart for Adult" Curriculum to increase financial literacy and promote financial well-being among adult Alabamians. **Outcome/Impact Statement (Results)** In summary, the financial management program reached 2,170 Alabama participants. Of the 2,170 participants, they were: female (71%) and male (29%); African American (54%) and White Americans (44%). All other ethnic groups combined made up less than 2% of the participants. Emphasis was placed on service limited resource audiences. A composite analysis of the all lessons shows that participants were significantly ($p < 0.0001$) more knowledgeable of healthy habits regarding spending plans, credit, saving, banking and protection/identity theft after the class compared to before. With increase knowledge on these financial practices, adults now have essential information and skills to manage personal finances and reach life goals.	
82.	AU Extension: Escape Vapes	**Brief Description:** There has been a staggering increase among high school students using e-cigarettes. These high-dose nicotine products are a direct gateway to traditional cigarettes and cause several health issues in addition to nicotine addiction. Escape Vapes aims to prevent and reduce adolescent use of electronic cigarettes (e-cigarettes). E-cigarettes have become popular among youth as a "safer" alternative to traditional tobacco. However, e-cigarettes can be more dangerous than traditional cigarettes. Escape Vapes uses education to inform and stop adolescents' use of these substances. **Outcome/Impact Statement (Results)** Escape Vapes is conducted as a three-weekly series with youth in schools and community settings by seven Regional Extension Agents. Pre- and post-assessments are conducted on the youth.	Family, Home and 4-H and Youth Development (#7)

		Of the 4,474 youth participating in the assessment, they are females (49%) and male (51%); African American/Black (28%), American Indian/Alaska Native (2%), Asian American (7%), Caucasian/White (54%), Hispanic Americans (6%), Native Hawaiian/Other Pacific Islander (.1%), and More than one race (8%). Grades targeted were 5-12 graders: 5-6 grade (20%), 7-8 grade (27%), 9-10 grade (39%) and 11-12 grade (13%). *Knowledge about Nicotine* • 70% adolescents reported increased understanding of how nicotine affects their brain • 66% adolescents reported increased knowledge that E-Cigarettes can contain nicotine • 77% adolescents reported increased knowledge that one JUULpod has as much nicotine as 12 cigarettes *Knowledge about JUULing and smoking* • 68% adolescents reported increased knowledge of the long-term effects of vaping and JUULing • 78% adolescents reported increased knowledge of what's in a JUULpod • 65% adolescents reported increased knowledge of how e-cig, vape, JUULpod manufactures target young people • 70% adolescents reported increased understanding that Hookah is as harmful as smoking cigarettes *Confidence* • 34% adolescents reported increased in their confidence to avoid nicotine products In summary, Escape Vapes uses education to inform and stop adolescents' use of harmful substances such as e-cigarettes. After Escape Vapes education, at least 65% of youth reported increased gains in knowledge about nicotine and JUULing. In addition, one third of youth had an increase in their confidence to avoid nicotine products.	

83.	AU Extension: 24/7 Dad	**Brief Description:** 24/7 Dad is an evidence-based fatherhood program. The goal of 24/7 Dad is to increase the parenting skills of a father with children 18 years and younger. The target audience is all fathers with a special emphasis on underserved fathers such as rural, fathers with Head Start children, and incarcerated fathers. **Outcome/Impact Statement (Results)** 37 fathers completed 24/7 Dad: In the correctional facilities, 29 fathers completed all 12 weekly sessions; In the jail, 3 fathers completed 11-12 sessions, 2 fathers completed 8-10 sessions, and 3 fathers completed 1-4 sessions. The average portion of correct responses on the post-test were significantly ($p < .05$) higher than the average portion of correct answers on the pre-test scores. On average, there was a 17-point increase between post- and pre-test scores. In the domain of communication, there was a significant ($p < .05$) 21-point increase between post- and pretest scores. In the domain of father involvement and children's education outcomes, there was a significant ($p < .01$) 24-point increase between post- and pretest scores. In the domain of positive co-parenting practices, there was a significant ($p < .01$) 26-point increase between post and pretest scores. In the domain of role of the father, there was a significant ($p < .05$) 24-point increase between post- and pretest scores. In summary, fathers residing in Alabama correctional facilities reported an increase in fathering knowledge related to communication skills, child development, positive co-parenting, and role of the father. Lastly, two correctional facilities did not have parenting education. Both facilities have adopted the 24/7 Dad fatherhood curriculum. Both facilities reported receiving request from fathers to schedule more fatherhood classes.	Family, Home and 4-H and Youth Development (#7)

84.	AU Extension: Tuning in to Kids	**Brief Description:** Tuning in to Kids addresses social emotional development of children. Social-emotional competence is targeted as a protective factor against child abuse and neglect prevention. The TiK program helps parents communicate more effectively, respond and reflect emotions, and model appropriate behavior. **Outcome/Impact Statement (Results)** In summary, Alabama Extension has been engaged in program renewal, which resulted in selecting the evidence-based Tuning into Kids program. In 2019, a $43,000 grant was obtained for training. A total of 31 agents and community partners were trained, including 3 students.	Family, Home and 4-H and Youth Development (#7)
85.	AU Extension: Alabama 4-H at Auburn University	**Brief Description:** Alabama 4-H is committed to helping our Alabama communities thrive by providing opportunities for young people to be healthy, caring, and responsible. Dedicated staff and volunteers provide caring and supportive relationships that empower young people to feel valued, useful to their communities through service and action, and culturally competent to work and live with a diverse community. **Outcome/Impact Statement (Results)** Enrollment and Demographics: 161,937 young people enrolled, 51,699 club members, 3,346 clubs, 8,935 volunteers, 742 total schools served, 590 Title I schools served, 28% Black or African American, 10% Hispanic, 66% white, 48% reside in towns with less than 10,0000. • 21,149 graduating 4-H seniors over the last three program years indicated that it is important to *have a career where they can make a difference in the lives of other 97%s.* • 21,149 graduating 4-H seniors over the last three program years indicate *Workplace Skills*: arriving to work on time, being trusted by an employer, doing your job well, showing respect for others, and acting professionally, are important 91%.	Family, Home and 4-H and Youth Development (#7)

		• 430 club officers and youth advisory council members agree it's important everyone has a chance to say what they think 68%. • 1402 summer 4-H campers feel 4-H is a place where adults care about them 98%. • 1402 summer 4-H campers think 4-H is a place where they feel safe 96%. • 1402 summer 4-H campers think 4-H is a place where it is ok to make a mistake 93%. • 233 were engaged in bilingual programming encouraging participation in fishing, boating, and citizen science. Participants become aware of basic fishing and/or kayaking skills, how to purchase a fishing license, how to become involved in Alabama 4-H, and how to access resources. Most importantly, relationships were formed. Project personnel assisted with the purchasing of 18-daily fishing licenses, 7-annual non-resident licenses, and 2-annual resident licenses. • 14,971 participated in project work learning how to set goals, make decisions, follow-through with a commitment and self-evaluate their work and present it to others. • 1,109 youth participated in animal programs learning how to feed, care, treat humanely, show, and prepare for safe food consumption, and keep appropriate records strengthening essential skills: responsibility, respect, caring, citizenship, and trustworthiness. • STEM related resources were utilized by 4-H by more than 30,000 youth • 4-H STEM Camp was conducted for youth in learning about the Science of Energy, Aerospace & Rocketry, drones, coding with robots, engineering design, and citizen science (NASA's GLOBE Curriculum, science protocols). Partners assisted through science of energy (an electric cooperative) and aerospace (Civil Air Patrol).	
86.	AU Research: Using Deviance Regulation Theory to Combat Bullying	**Issue:** Effective strategies to reduce bullying and create supportive, safe school environments. **What has been done?** A novel intervention activity based on Deviance Regulation Theory (DRT), designed to increase defending behaviors (i.e., supporting children who are bullied), has been delivered in fourth- and fifth-grade classrooms. Data collection has included self and peer reports from over 1,500 students across 13 elementary schools.	Family, Home and 4-H and Youth Development (#7)

		Results: Analyses of the effects of the DRT intervention are underway. **Target Audience:** Scientists, students, policymakers, health professionals, and general public	
87.	AU Research: Sleep and Adaptation in Childhood and Adolescence	**Issue:** Stress, sleep, and psychosocial adjustment in childhood and adolescence. **What has been done?** Data collection has included child, parent, and teacher reports as well as objective assessments of sleep, cognitive functioning, and autonomic physiology from children and adolescents. **Results:** Studies reveal that family stressors (e.g., marital conflict, parental problem drinking) and broader environmental adversities (e.g., socioeconomic disadvantage, community violence) undermine children's sleep. Disrupted sleep, in turn, predicts behavioral problems, poorer cognitive functioning, and psychological difficulties. **Target Audience:** Scientists, students, policymakers, health professionals, and general public.	Family, Home and 4-H and Youth Development (#7)
88.	AU Research: Parental Social Coaching and Preadolescent Physiological and Coping Responses to Peer Stress	**Issue:** Parent and adolescent responses to peer stress in early adolescence. **What has been done?** Data collection has included self-reported and observational measures of parent and adolescent responses to peer stress, as well as autonomic physiological measures of adolescents' responses to peer stress. **Results:** Parents' prosocial and engaged responses to peer stress, as well as adolescents' stronger physiological responses and engaged coping responses to peer stress, predicted more positive social, academic, and psychological adjustment. **Target Audience:** Scientists, students, policymakers, health professionals, and general public	Family, Home and 4-H and Youth Development (#7)
89.	AU Research: Context Effects on Adolescent Risky Decision Making: A Multi-level Approach	**Issue:** The effects of peer and reward contexts on brain activity and risky decision making in adolescence. **What has been done?** Data collection has included behavioral and functional magnetic resonance imaging measures of adolescents' safe or risky responses to experimental manipulations of monetary reward and peer observation.	Family, Home and 4-H and Youth Development (#7)

		Results: Rewards for safe choices decrease risky decision making in peer contexts, and conditions that involve rewards for safe choices and peer observation activate areas of the brain that indicate motivational conflict between approaching and avoiding risk. **Target Audience:** Scientists, students, policymakers, health professionals, and general public	
90.	AU Research: Advancing Military Family Science Through Research and Outreach	**Issue:** Military family research **What has been done?** Data collection involves three critical issues within Alabama. Specifically: 1) employment opportunities and circumstances that influence decisions to enlist in the military, 2) the well-being of youth in military-connected families, and 3) the needs of geographically dispersed military families, especially those in the Reserve component and those in rural areas. Data for each of these projects have been collected and analyses are underway. A digital repository of military family research has been created, containing 2,615 holdings (e.g., research articles, research summaries, action-based reports) that are free and easily accessible to stakeholders. **Results:** Data analyses and dissemination of military family research resources are underway. **Target Audience:** Scientists, students, policymakers, health professionals, and general public	Family, Home and 4-H and Youth Development (#7)
91.	TU Extension: At-risk Development	**Brief Description:** An alarming number of young children and teens are disconnected from the mainstream of our society. They have been labeled "at risk" because of the harsh realities of their lives. If these young people remain disconnected, we will lack the skilled, motivated workers to sustain our economy. We will have denied these young people the chance to lead healthy, fulfilling, productive lives. **Outcome/Impact Statement (Results):**	Family, Home and 4-H and Youth Development (#7)

		Weekly meetings with students in order to educate them on Character Development and presenting topics in STEM, Nutrition and Obesity, as well as community development and personal finances. The Exert Competition was a one-day event culminating in the application of these same type of skills that some have gained through TUCEP educators throughout the year. The EXERT Camp held in the summer further establishes these hallmarks of character, citizenship, and STEAM through team-building activities, agricultural/planting activities, hiking & tree identification, art, reading, writing and reflection, swimming fishing and other recreation. Results indicated that of the 520 students participating in the EXERT program throughout the year that 90% of all of the students reported that they had increased their knowledge of Sciences (including basic science, tools of science, and scientific method), while 91% reported increases in their ability to apply science (includes agriculture, engineering, design, culinary arts, etc.). Participation in the program increased a total of 63% from FY2018 showing growth of the EXERT program	
92.	TU Extension: Agricultural Education	**Brief Description:** Agriculture in America plays an essential role in the nation's economy and ability meet necessities of food, clothing, and nutritional security. The value of experiential learning in agricultural education has long been recognized as an important part of the process as workforce development in such areas is an imperative for our nation to remain economically viable. Through tradition and legislation youth agricultural programs have been installed on local and national levels to develop and disseminate information involving skills in food, agriculture, and mechanical sciences. Early exposure to career opportunities in these fields increases the likelihood for enrollment in agriculture related fields during postsecondary education. **Outcome/Impact Statement (Results)** Two-week long residential programs at Tuskegee University train participants in activities associated with forestry protection, management, agricultural production, conservation, soil quality, water quality, and more. Participating youth are also introduced to career pathways in agriculture and related sciences. They take part in team building activities, conduct research projects based in agriculture and related fields, and take part in site visits to industry organizations such as the USDA Forest Service.	Family, Home and 4-H and Youth Development (#7)

		Nearly 80% of youth participants indicated increased likelihood to in a program leading to a profession in agriculture and related sciences because of the program, with more than 20% indicating a desire to focus on program in forestry, natural resources or a related area.	