2018 University of Arkansas and University of Arkansas at Pine Bluff Combined Research and Extension Annual Report of Accomplishments and Results

Status: New

Not Yet Submitted

I. Report Overview

1. Executive Summary

University of Arkansas System Division of Agriculture (Division of Agriculture) faculty, staff and facilities are located on seven university campuses, five regional Research and Extension Centers, six Research Stations, three Extension Centers, and in 75 counties. Unlike most states today, the UA Division of Agriculture remains committed to this statewide infrastructure with a presence in all 75 Arkansas counties, ensuring that researchers and Extension educators are readily available to address the science and business of agriculture and the broader needs of families and the communities we serve.

The University of Arkansas at Pine Bluff (UAPB), School of Agriculture, Fisheries and Human Sciences is composed of three academic departments, the 1890 research and Extension programs, the Aquaculture/Fisheries Center of Excellence, the Regulatory Science Center of Excellence, and six Research and Extension sites (including North Little Rock). Research faculty members are integrated into the academic units in agriculture and human sciences, while Extension personnel are under the direct supervision of associate Extension administrators. The Department of Aquaculture/Fisheries and the Aquaculture/Fisheries Center of Excellence are administered by a department head/center director supervised by the dean/director; it is under this structure that academic, research, and/or Extension responsibilities are integrated. The primary clientele served by the University of Arkansas at Pine Bluff are limited resource farmers and rural families, sweet potato producers and industry, as well as the Aquaculture industry and the Arkansas Game and Fish Commission.

Consistent with the land grant mission, the Division of Agriculture and UAPB research and Extension faculty have a long history of providing leadership in the development and dissemination of innovative practices and emerging technology. Division researchers conduct basic and applied research for Arkansas producers, businesses, communities, and families. During FY2018, Division of Agriculture research efforts resulted in the submission of 17 patent applications. Division of Agriculture and University of Arkansas Pine Bluff Extension educators and researchers delivered research-based education through 12,592,542 educational contacts with Arkansans. Division of Agriculture Extension educators employed diverse educational methods statewide including: 41,258 educational classes, 20,978 landowner visits, 63,997 individual consultations, 2,549 demonstrations, and 1,057 field days/tours/camps. County agents and specialists strive to provide the best science-based recommendations available. Although information is readily available in the Digital Age, the Division of Agriculture and UAPB remain providers of data that are independent of financial or philosophical interests.

During 2018, the Division also delivered timely and responsive distance education webinars through the National Center for Agricultural Law on emerging issues including: solar leasing for agricultural lands, Supreme Court cases on water rights, immigration laws for agricultural businesses, commercial shellfish aquaculture, 2018 Farm Bill, and H-2A Temporary Ag Guest Worker Program and estate planning. Extension educational programming for Arkansas clientele is also available 24/7/365 through web-based instruction at the Extension online course website http://courses.uaex.edu. Family and consumer science and agriculture and natural resource online Extension education was delivered to and completed by 9,350 participants in FY2018 through 57 course offerings. One key course continued for a second year in

2018 was an online sprayer course required by the Arkansas Plant Board as a new requirement to purchase certain herbicides.

The focus of work conducted by the Division of Agriculture continues to be guided annually by grass-roots, community-based input from a diverse range of Arkansas citizens; mainly through the use of County Extension Councils and other local advisory groups. The Division of Agriculture formally engaged a large pool of stakeholders (including individual clientele, producers, schools, partner agencies and organizations, state government officials, community leaders, underserved groups, and legislators) in the design and development of the 2017-2023 Strategic Plan. Based on broad stakeholder feedback, the Division identified five emphasis areas to focus our efforts:

- Agricultural Production and Processing;
- Environment, Energy and Climate;
- Access to Safe and Nutritious Food;
- Increasing Opportunities for Families and Youth; and
- Economic and Community Development.

These five emphasis areas help to provide guidance for Division research and Extension programs and help to support integrated research/extension efforts in these areas. Similarly, UAPB continues to meet the needs of clientele by working in the NIFA areas of emphasis.

2018 Arkansas Extension and Research Planned Program Impact Highlights

Agricultural Production & Processing

The University of Arkansas System Division of Agriculture and the University of Arkansas Pine Bluff conducted research and educational programs to promote sustainable and efficient agricultural production and processing.

In the area of row crops, the Division of Agriculture continued their Soybean Research Verification Program for the thirty-fourth growing season and conducted on-farm demonstrations of research-based recommendations on over twenty-one commercial fields in nineteen Arkansas counties. Extension efforts also included soil health in 2018; conventionally and reduced tilled silt loam soils in Arkansas exhibit little soil structure, greatly reducing water infiltration rates. This issue was addressed through various Extension efforts reaching over one thousand producers, consultants, and other professionals. In the area of weed control in row crops, research was conducted by Division of Agriculture researchers on the use of benzobicyclon for weed control in rice and its effect on adjoining soybean fields. Results have shown the herbicide to be effective in rice and causing minimum injury to soybeans when drift occurred.

Water resources are becoming a larger issue with each passing year and Arkansas is no exception. Extension educational efforts on Irrigation Water Management (IWM) practices continued in FY2018 and included collaborative efforts with other county, state, and national agencies. Demonstrations of various irrigation technology and tools, development of irrigation field designs, and many field visits/consultations were employed to improve the sustainability and efficiency of producers' irrigation efforts.

Horticulture efforts in Arkansas focused on assisting producers in expanding production seasons. The Division of Agriculture has developed five commercially available primocane-fruiting blackberry cultivars that provide producers more choices that are better suited for Arkansas conditions and have the potential to expand the growing season from mid-May until mid-November. To support blackberry producers across the state, the Division of Agriculture faculty secured funding and began the process of creating the Arkansas Blackberry Growers Association. UAPB conducted research and Extension programming on sweetpotato varieties for edible leaf vegetable production and the use of rotation and cover crops in sweetpotato production. UAPB initiated the Sweetpotato Foundation Seed Program, which produces plants that are indexed and free of target viruses; this program targets small scale and limited resources farmers in Arkansas.

The AQFI Center of Excellence at the University of Arkansas at Pine Bluff (UAPB) has continued their efforts to support Arkansas' $61 million aquaculture industry. The Center's research and Extension efforts

also support the recreational fishing industry that has an economic impact of over $740 million per year in Arkansas. In 2018, researchers examined the growing issue of cyanobacterial blooms in ponds, lakes, and river ecosystems. Researchers identified manipulating phosphorus concentrations in order to limit its bioavailability to cyanobacteria as a key solution. Alternate to the nutrient reduction strategy, the application of chemicals (e.g. algaecides) is a direct means of controlling harmful algal blooms by lysing cyanobacterial cells.
Livestock and products account for fifty-seven percent of Arkansas' agricultural cash receipts. Activities to advance the livestock industry in Arkansas includes research, on-farm demonstrations, producer meetings, and educational material development. Focus areas include grazing efficiency and forage management, health and disease, alternative finishing systems, and management effects on carcass quality. Extension efforts have included the creation of the Natural State Preconditioned Calf Program, which has created a demand for the value added calves. The calves in this program have evidence of health and management history, which has increased their marketplace sales by an average of $56/head. UAPB research faculty are conducting research to identify "natural" methods to control parasites in sheep and goat production.
The poultry industry is very strong in Arkansas, ranking third nationally in broiler production. With the continued outbreaks of Low Pathogenic AI and Highly Pathogenic AI, the Division of Agriculture has continued efforts to educate producers and small flock owners on proper biosecurity steps to ensure these outbreaks do not occur in Arkansas. Extension efforts in 2018 targeted many audiences, from commercial producers, hobby owners, 4-H and FFA members, and the general public. Extension fact sheets were developed and distributed in Arkansas and Mississippi; Extension also expanded efforts with the use of a free online course, "Backyard Poultry" and ninety-seven gained knowledge by completing the course.
The issue of decreasing numbers of new farmers/producers was addressed through Division of Agriculture Extension efforts in 2018 through two programs: Young Cattlemen's Series and Annie's Project. The programs addressed basic foundational knowledge and risk management, which are both areas producers need. Both programs lead to the adoption of best management practices and the Young Cattlemen's Series showed a total estimated production savings of $47,000 through adoption.

Environment, Energy & Climate
The University of Arkansas System Division of Agriculture and the University of Arkansas Pine Bluff conducted research and educational programs on the environment to ensure sustainable use of soil, water and air. Research and educational efforts were targeted at all citizens of Arkansans, but emphasis was placed on agricultural producers, private landowners, youth, homeowners, and land management professionals. Research was conducted on Experiment stations as well as on private farms through programs such as the Division of Agriculture's Discovery Farms. Critical issues that were addressed included: 1) Meeting competing water needs, 2) Protecting and improving water quality, 3) Protecting and improving soil health, 4) Protecting air quality, 5) Enhancing the ecological services provided by forested lands, riparian zones and wildlife, 6) Protecting the health of aquaculture and aquatic wildlife, and 7) Environmental Sustainability.
In the area of water needs and quality, the Division of Agriculture research focused on evaluating conservation practices in row crop production that increased crop water use efficiency. Meanwhile, education initiatives focused on disseminating proven water savings techniques such as computerized hole selection for designing furrow irrigation that increases uniformity and reduces tail water losses as well as multiple inlet design for flooding rice, using soil moisture sensors and apps for scheduling irrigation, and using cover crops to improve soil infiltration. Extension efforts included working with row crop producers, livestock producers and homeowners through a myriad of delivery methods, including field days, field visits, meetings, and an online course related to nutrient management.
In FY2018, the Division of Agriculture Extension and researchers worked to support the newly formed Arkansas Soil Health Alliance (ASHA), who works to educate farmers on practices to improve soil health. Demonstrations were conducted on best practices for preventing erosion and tools available to assist in improving plant nutrient use.
Burning rice stubble to remove crop residue, greenhouse emissions from flooded rice production and ammonia-laden emissions from poultry house ventilation fans are all air quality concerns for the citizens of

Arkansas. Research is being conducted to find alternatives to burning rice stubble and other surface residues that make agronomic sense and are not cost-prohibitive. Researchers are also investigating the reduction of methane and nitrous oxide production through alternative wetting and drying instead of continuous flooding of rice while others are investigating growing rice with furrow irrigation (row Rice) rather than flooding. Air improvement practices are being studied to determine how to best reduce emissions from poultry house ventilation using small-scale industrial scrubbing techniques.
Arkansas forest and natural resources are critical to the State's economy and to the well-being of its citizens; we are known as "The Natural State". The Forest Management Program for Extension Forestry encompasses multiple education efforts aimed to further advance the overall health and productivity of forest and timber lands in the State and region. Research programs in forestry encompassed work in cellulosic nano-technology development, determining the invasion potential of emerald ash borer, enhancing the resiliency of forests to climate change, enhancing bottomland hardwood restoration for carbon sequestration and wildlife conservation, increasing problem-solving efficiency though better communication among natural resource professionals, estimating the economic contributions of forest management to the state's economy, and revealing how wildlife management affects forest health and productivity.
The Division of Agriculture Extension wildlife education program areas are: (1) addressing nuisance wildlife problems, including Feral Hog Education Program and pesky wildlife around the yard and garden, (2) wildlife habitat management, (3) wildlife enterprises including habitat management for leasing lands for hunting and wildlife viewing, and (4) youth education through the 4-H Wildlife Program.
The University of Arkansas Pine Bluff has many efforts that work towards protecting the health of aquaculture and aquatic wildlife. UAPB houses the Aquaculture/Fisheries Center for Excellence, which is recognized as a leader in aquaculture/fisheries teaching, research and extension programs. Some of the research UAPB conducts includes assisting the AGFS in developing no-lethal, quick method of assessing hatchery contribution to a year class in the field and delineating areas used for spawning and to validate measurement techniques used to collect data. UAPB has continued to monitor the ecological effect of the invasive Northern Snakehead, which at this point is only found in six states in the United States. UAPB provides support and training for county Extension personnel and private landowners on the subject of private impoundment management.
The focus area of sustainability is conceptually and practically interwoven with production, economy, environment, energy and climate activities and concerns. As such, the Division of Agriculture has research and extension faculty making contributions to the Environment, Energy & Climate planned program in the focus area of Environmental Sustainability. Specific efforts (not reported to other focus areas) related to environmental sustainability are being made in alternative residue and water management practice effects of soil properties and crop production, trace gas emissions to the atmosphere from rice production, improving waste water quality through struvite creation to remove excess phosphorous and nitrogen, and quantification and modification of waste water treatment system appropriate for small dairy milk centers. Research continues on poultry litter treatment using liquid anaerobic digestion technology to help poultry producers grow their production by minimizing the nutrient issues associated with poultry litter, to prevent pollution to surface and ground water resources due to nutrient leaching and runoff from land and soil receiving poultry litter application, and to help poultry producers transition to sustainable production practices. A part of the Arkansas Discovery farm effort has been an investigation and quantification of the sustainability of cotton production. There continues to be an extension effort to provide a nutrient management planner, nutrient applicator, and mortality management education. A particular area of growth is the development of online educational courses to provide required certification training for nutrient planners and applicators. A separate but overlapping component is the providing and maintenance of the nutrient management plan development tool that is used by most of the state's certified nutrient planners

Access to Safe & Nutritious Foods
The University of Arkansas System Division of Agriculture and University of Arkansas Pine Bluff faculty and staff faculty developed, evaluated, and disseminated education programs and curricula, incorporating

new research and emphasizing healthy lifestyles to prevent and/or reduce adult and childhood obesity and other diet related diseases. Division of Agriculture and UAPB faculty conducted novel research to determine the impact of diet and food composition and functional food components on body weight and health. Key Extension programs included Supplemental Nutrition Assistance Program Education (SNAP-Ed and FFNews) and Expanded Food and Nutrition Education Program (EFNEP).
UA Division of Agriculture researchers continue to work with UA Fayetteville, the University of Arkansas for Medical Sciences (UAMS), and the Arkansas Children's Research Institute examining the link between childhood obesity outcomes and features of the food, social, and built environment. The Arkansas Children's Research Institute and the UAMS Arkansas Center for Health Improvement (ACHI) provides access to a unique individual-level dataset on obesity outcomes. Access to this data allows research to be conducted at a level of detail and accuracy that is not possible with national-level datasets.
The Division of Agriculture and UAPB faculty and staff developed, evaluated, and disseminated education and curricula incorporating research and teaching for food safety and processing. Extension programs included HACCP workshops and meetings, food safety and preservation workshops, Better Process Control School, and ServSafe workshops. Other programs conducted included culinary arts training for food industry personnel, online distance education in food safety and manufacturing, and assistance to small food companies and entrepreneurs in the form of services, workshops, and consulting. UAPB provided science-based information on catfish production, processing, and economics to USDA-FSIS to assist with development of the new food safety inspection.
Research activities in food safety included work to better understand the ecology of food pathogens, improve food processing systems to minimize food pathogens and to improve detection systems for Listeria, Salmonella, E. Coli and other major food pathogens.
Research activities in food chemistry and food processing included work to (1) improve the quality of rice and improve rice processes, (2) expand the utilization of soybeans and its co-products, (3) assess the health benefits associated with fish, vegetables and other processed foods, and (4) improve the sensory quality of processed foods.

Increasing Opportunities for Families & Youth
The University of Arkansas System Division of Agriculture and University of Arkansas Pine Bluff faculty and staff developed, evaluated, and disseminated education related to increasing opportunities for families and youth through the Family & Consumer Science and 4-H Youth Development areas.
In the area of Health and Aging, the University of Arkansas System Division of Agriculture and the University of Arkansas at Pine Bluff provided programs to improve health at every stage of life by educating and engaging Arkansans to address locally relevant health issues. Programs like Extension Get Fit and Walk Across Arkansas helped young and mature Arkansans increase physical activity, improve health, and improve quality of life. The Extension Wellness Ambassador Program trained and engaged community volunteers to address local health issues by implementing projects and conducting health improvement activities. Extension Health and Aging programs worked to help Arkansans of all ages achieve optimal physical, mental, and social health, which can result in significant savings in healthcare and treatment dollars each year
In the area of Strengthening Families, the University of Arkansas System Division of Agriculture and the University of Arkansas at Pine Bluff offered invaluable resources to parents, couples, and individuals who seek to improve their psychological and relationship health and their overall quality of life. We also offered free, researched-based professional development training to childcare providers and afterschool care workers to help them met their annual state required training hours, improve their job performance, and improve quality of care given to our youngest citizens. The Division of Agriculture and UAPB parenting programs offer parents tools to improve relationships with their children and partners.
In the area of Family Resource Management, the University of Arkansas System Division of Agriculture provided practical, researched-based information to Arkansans to increase financial well-being, equipped adults and youth with the skills needed for financial stability, and explored strategies that can be used to help Arkansans improve personal finance and consumer practices.
In the area of Empowering Youth, the University of Arkansas System Division of Agriculture and the

University of Arkansas at Pine Bluff have worked to expand access to quality 4-H programming in Arkansas. The 4-H program has moved youth towards the future by teaching life skills to prepare youth for adulthood and helping youth explore career and entrepreneurship possibilities. 4-H programs align with the National 4-H Mission Mandates in providing programs that involve youth in science, technology, engineering and math, encourage healthy living for Arkansas youth, and engage youth in citizenship and leadership development.

Economic & Community Development

The University of Arkansas System Division of Agriculture faculty and staff developed, evaluated, and disseminated education in economic and community development (ECD). ECD efforts concentrated in the areas of leadership, community development, business, and public policy.

Division of Agriculture faculty and county agents have conducted many leadership programs in 2018. In addition to developing, conducting, and evaluating local leadership programs, Extension has continued LeadAR (Lead Arkansas), a two-year statewide adult leadership development program to teach participants about issues impacting Arkansas and develop leadership skills.

In community development, the Division of Agriculture has provided stakeholders in-depth analysis of regional socio-economic conditions, opportunities, and strategies for development. Some topics include: development capacity, changing economic base, cluster industries, economic and fiscal impact, enhancing retail trade, and retiree in-migration. Assistance in using a 15-year database of county government revenues and expenses has also been provided in 2018, along with demographic and economic changes, to develop strategies for the provision of county services and infrastructure.

Breakthrough Solutions is a visionary, strategic planning and implementation process for communities or regions that is asset based, community driven, technology enabled and results oriented. In addition to technical assistance, the program features an annual Breakthrough Solutions Conference and an electronic newsletter (Breakthrough News) to support vibrant, sustainable communities in the 21st century economy.

Programs conducted by the Division of Agriculture to support businesses include the Arkansas Procurement Technical Assistance Center (Arkansas PTAC), Create Bridges, and the Income Tax Schools. Customized technical assistance was also provided in developing and implementing economic development strategies, including entrepreneurial support and business development.

The Division of Agriculture's Public Policy Center provided education on local and state ballot issues, worked with state agencies to encourage public involvement on water and other public issues, and helped Arkansans understand and interpret new laws and regulations. In order to reach clientele regardless of location, "Introduction to County Government in Arkansas" was offered online for citizens.

Also housed within the University of Arkansas System Division of Agriculture, the National Agricultural Law Center (NALC) serves as the nation's leading source of non-partisan agricultural and food law research and information, in partnership with the USDA Agricultural Research Service and National Agricultural Library. NALC leads the Agricultural & Food Law Consortium, a first-of-its-kind 4-university partnership designed to expand and enhance the delivery of objective and relevant agricultural and food law research and information to the nation's agricultural community. NALC maintains a formal partnership with the National Association of State Departments of Agriculture (NASDA), and works closely with other state, regional, and national organizations.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	328.4	22.1	464.1	27.2
Actual	374.5	28.8	443.8	27.0

II. Merit Review Process

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

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

2. Brief Explanation

Brief Explanation:
Programs went through a three-tiered review process:

1. Stakeholder program identification and review
2. Administrative approval and review
3. External review

Stakeholder Program Identification and Review

Stakeholder input into program identification and review was derived from both formal and informal means for all program areas. Public comment on current and future Extension and research programs was obtained from county and community meetings, commodity and community associations, commodity check-off boards, state legislative committees and open public forms concerning specific issues. Open public meetings, field days and county and regional production meetings provided forums for stakeholder input open to under-served or under-represented individuals, groups or organizations.

For the Division of Agriculture Extension, county councils and advisory groups met during the summers of 2017 and 2018 (at a minimum) to provide input, feedback and/or review of program implementation, redirection, or newly identified needs. Members of these groups were invited to participate in programs, field days, special tours, workshops and conferences throughout the year and for the duration of the program. All reviews of research and Extension programs included a stakeholder member or members of the community or industry most influenced by the program area. Open public forums were held to address specific issues of importance to the stakeholder community or industry.

Administrative Approval and Review

Identified planned program areas for research and Extension activities were administratively reviewed and approved by the Arkansas Director of the Agricultural Experiment Station and/or Director of Cooperative Extension Service, as appropriate, within the context of the Division of Agriculture's Strategic Plan and the specific needs identified by stakeholder groups. Smith-Lever, Hatch, McIntire-Stennis, Animal Health and regional research projects were administratively reviewed and approved by the subject matter department head and the director of the Arkansas Agricultural Experiment Station. All research projects were reviewed by three outside scientists prior to submission to the respective subject matter department head and the experiment station.

External Review

Merit review is conducted as part of the Division of Agriculture's on-going program review process. The reviews have been by department, or programmatic and cut across departments. Reviews are scheduled on a 9-10 year cycle and conducted concurrently for research, Extension and instruction. All reviews are conducted by a team of recognized outside research, Extension and teaching professionals balanced to reflect the programmatic needs and diversity. All reviews include one or more

stakeholders. The actual review process involves a period of self-study, followed by program assessment and bench marking. The review team evaluates the programs' effectiveness relative to the stated mission and goals of the department or program as well as the needs of stakeholders. Following the outside review teams' written evaluation, the department or program prepares a response to the review. The Division of Agriculture and University administration then meet with the department or program faculty one more time to develop a plan for implementing changes.

The Division of Agriculture is instituting a mid-term internal review for departments, which tracks the progress of the department toward meeting the review team's recommendations and the department's plan for implementing changes.

The University of Arkansas at Pine Bluff, School of Agriculture Fisheries and Human Sciences continually engage and obtain stakeholder input through the Annual Agriculture Field Days at Pine Bluff and Lonoke Farms and during the Annual Rural Life Conference held in Pine Bluff, AR.
An external review of the University of Arkansas at Pine Bluff Department of Agriculture is currently underway for the Regulatory Science Master of Science degree Program. The undergraduate Regulatory Science external review conducted in 2014 suggested that the program include distance education courses to the program's future priorities. This suggestion has been implemented and Regulatory Science Courses are currently offered at UAPB's North Little Rock site. The Aquaculture/Fisheries program underwent a BS program review in 2015, and is currently conducting the first program review for the PhD program.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (County Extension Council and program advisory committee planning meetings.)

Brief explanation.

The University of Arkansas System Division of Agriculture and the University of Arkansas Pine Bluff have utilized both formal and informal mechanisms for ensuring the planned programs address areas of strategic importance to the state.

Each Division of Agriculture planned program was based on the needs identified in a series of electronically delivered surveys with current and potential stakeholders representing the diversity of the population in the regions and state. Single issue and county level meetings were held as needed to address emerging issues and to craft additional program responses if needed to promptly address the problem.
The University of Arkansas Pine Bluff Dean/Research & Extension Director uses formal stakeholder input obtained during annual field days and annual Rural Life Conferences. Aquaculture and Fisheries is in the process of reconstituting their advisory Board. In 2018, they obtained stakeholder input on research and extension issues through meetings with producers at annual or semi-annual meetings of the Arkansas Bait and Ornamental Fish Grower's Association, Catfish Farmer's of

Arkansas, Aquaculture Division of Farm Bureau, and the Arkansas Game and Fish Commission. All stakeholder groups provide meaningful suggestions for programmatic improvements.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Needs Assessments
- Use Surveys

Brief explanation.

In 2017, the University of Arkansas Division of Agriculture sought input from diverse stakeholder groups. Stakeholders serve on county councils, advisory committees, and boards that advise and oversee the work of the Division. Individuals and stakeholder groups were identified by Arkansas Experiment Station faculty and administrators and by asking county Extension staffs to identify individuals in their local communities who were representative of one or more of the following fifteen stakeholder categories: county services (e.g., DHS, Food Bank or Pantry); financial sector (e.g., banks, agricultural lending, investments); faith-based sector (e.g., church, youth minister); education (public, private, vocational); commercial sector (e.g., chambers of commerce, industry); health (e.g., hospital, public health, doctor); agricultural production; agricultural businesses; county Extension council; 4-H program (e.g., leader, teen, alumni, foundation); government official (e.g., county, city); Extension homemaker; natural resources (e.g., wildlife, forestry, conservation); media (e.g., radio, newspaper, television); and youth services (e.g., community center, youth organizations). In addition to these criteria, Extension agents were also asked to identify individuals within the fifteen categories who were representative of the gender, racial, ethnic, and socioeconomic demographic make-up of the counties.

For UAPB, stakeholder input is a core component of all 1890 research and Extension programs. Means for acquiring input varies depending upon the nature of the research or Extension program and the diversity of relevant stakeholders. These include local and state agencies, community groups, producers and other targeted audiences, as well as business and industry groups. Producer meetings, advisory groups, conferences, and focus group discussions are major means for gaining input. Our stakeholder input process is structured individually by departments/schools to represent the differences in audiences served. This approach is taken because the clientele's needs for research and Extension assistance in programs other than aquaculture are broad in scope, local in nature and geographically limited. While the Aquaculture Program provides research and Extension support for all aquaculture producers in the state, other programs support under-served and diverse audiences.

The Agriculture Research and Extension Advisory Council (AREAC)
Members will serve on the Counsel for a three year rotating basis. Membership includes seven (7) producers engaged in a variety of agricultural enterprises (i.e. alternative crops, row crops, livestock, etc.) one (1) retired Extension professional (from 1862 system) two (2) federal agency (NRCS, FSA) representatives, four state agency (Arkansas Department of Environmental Quality, Rural Development, Arkansas Land and Farm Development, and Arkansas Natural Resources Commission) representatives and two (2) industry (Monsanto, Delta Yams) representatives. The broad based representation of Council membership provides a broadened perspective of challenges facing producers and promotes the creation of partnerships to address the challenges.

The Aquaculture-Fisheries Center of Excellence Advisory Committee

Historically, the primary advisory committee that provided feedback and input into the UAPB Aquaculture/Fisheries Program has been the National Aquaculture/Fisheries Advisory Council. Over the past few years the program has been revamped, and the program is committed to reconstituting our advisory Board in the near future. As before, it will include representation from catfish, baitfish, and sport fish farms, feed mills, Arkansas Game and Fish Commission, U.S. Fish and Wildlife Service, and other state university programs. Some committee members also serve as representatives for other state and national aquaculture industry organizations, so that these individuals contribute a much broader perspective to advisory committee meetings than their formal capacity might otherwise suggest. The new Committee will contain a more balanced selection of members from the different stakeholder groups.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public
- Other (Meeting with regulatory groups, state agencies, & commodity prom)

Brief explanation.

During the summer of 2017, Division of Agriculture Extension faculty met with county council members and program sub-committees to identify local needs for the program planning year beginning October first. County profiles developed by state faculty were utilized to examine the diversity of needs and to understand the changing demographics within each county. Stakeholder developed materials, such as the Farm Bureau policy development process was used to identify research needs. Several priority-setting activities were scheduled during 2017 with specific commodity and stakeholder groups to seek input on the research planning process.
In addition to the standard methods of obtaining stakeholder input described above, in 2017, the University of Arkansas System Division of Agriculture updated its strategic plan. The 2017-2023 strategic plan for the Division included input from internal and external stakeholders statewide. Internal and external stakeholders participated in these processes. Specific surveys were conducted with individuals representing underserved or under-represented groups, women in agriculture and small farm operation producers. With the expiration of the current strategic plan, the University of Arkansas System Division of Agriculture is in the progress of creating a new strategic plan.
For UAPB Extension and Research, informal input from stakeholders is presented and discussed at formal meetings with research faculty and staff. Strategies are developed to address identified concerns as appropriate. Faculty are represented on all structured committees for purposes of participating in the discussion and gathering the input from stakeholders that will later be presented back to faculty and staff.
The University of Arkansas at Pine Bluff's Foundation Sweetpotato Program is part of the National Clean Plant Network for Sweetpotatoes. UAPB participates in the annual Sweetpotato Collaborator's trials that test new varieties. Sweetpotato variety performance results are presented at the annual National Sweetpotato Collaborator's meeting. Promising varieties are recommended for release to stakeholders. A National Sweetpotato Council, comprised of sweetpotato growers

conduct annual meetings, periodically in conjunction with the Sweetpotato Collaborator's group. This stakeholder group provides input that directs sweetpotato research and extension needs in respective states, including Arkansas.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Action Plans
- To Set Priorities
- Other (Strategic Planning)

Brief explanation.

Division of Agriculture Research and Extension faculty and scientists met with administration to discuss stakeholder needs solicited at meetings throughout the year. Identified needs were integrated into the Extension and research planning process to ensure program relevance. Several departments and many of our institutes and centers maintain external advisory boards that provide direct feedback to the unit on the specific research or educational program. Stakeholder representatives served on most policy-setting groups or program reviews to ensure that the public has a voice in the decision-making process and in program evaluation. Special meetings were held as needed to address major issues impacting any stakeholder group. Stakeholder input remains vital to ensuring program relevance, and each year programs are adjusted to address identified needs.
For UAPB Extension and Research, the input from stakeholders has been incorporated into outreach efforts with sweet potato outreach programs and enhanced technical support for value-added processing with various agricultural commodities. Aquaculture and Fisheries has also incorporated stakeholder input into research proposals and into extension workshops and other extension efforts.

Brief Explanation of what you learned from your Stakeholders

Stakeholders want to be involved. Due to the size and scope of the University of Arkansas System Division of Agriculture and UAPB, reporting all specific stakeholder feedback would exceed the space allocation for this item. Stakeholders are involved in identification of Extension and research needs and priorities.
For UAPB Extension and Research, input from stakeholders through the agricultural Extension agents and program assistants in the field continue to play a major part in program development. Farmers and packing house operators continue to voice the need to support increasing sweet potato production in Arkansas. Sweet potato research was expanded in the area of product development and the Extension program has given increased attention to farmer production problems. Aquaculture-Fisheries uses feedback from Producer groups and Arkansas Game and Fish Commission to help plan research and Extension programs. Particular interests center around developing techniques for producing food fish more economically, and to address the effects of invasive species on natural fisheries.
Division of Agriculture stakeholders participate in establishing annual Cooperative Extension program priorities for each of the 75 counties in Arkansas. During the statewide listening sessions in support of the Division of Agriculture five-year strategic plan, 172 policy makers and key community and state organizational leaders considered critical and emerging needs within our state, and the role of the Division in addressing those needs. This group voiced their concerns about population changes across the state and challenges facing communities in a competitive economy. We heard

comments concerning the different issues Arkansans must struggle with every day, including maintaining a competitive edge in agriculture and childhood health and obesity.

The following emphasis areas were identified for 2017-2023:

- Agricultural Production and Processing
- Environment, Energy and Climate
- Access to Safe and Nutritious Food
- Increasing Opportunities for Families and Youth
- Economic and Community Development

The Division of Agriculture's 2017-2023 Strategic Plan outlines the specific objectives for each area and is based on what we learned from our stakeholders.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	3892277	1788012	4285109	2105044
Actual Matching	3892277	1919980	54469110	2141480
Actual All Other	49279158	0	8562482	0
Total Actual Expended	57063712	3707992	67316701	4246524

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	3892277	45001	4834	321778

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Agricultural Production & Processing

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	13%	0%	10%	10%
111	Conservation and Efficient Use of Water	4%	0%	5%	0%
112	Watershed Protection and Management	4%	0%	6%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	4%	0%	10%	10%
204	Plant Product Quality and Utility (Preharvest)	6%	15%	9%	5%
205	Plant Management Systems	20%	35%	1%	35%
206	Basic Plant Biology	0%	0%	2%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	1%	3%	2%	3%
212	Pathogens and Nematodes Affecting Plants	1%	0%	1%	0%
213	Weeds Affecting Plants	7%	0%	9%	0%
216	Integrated Pest Management Systems	20%	0%	4%	0%
301	Reproductive Performance of Animals	2%	0%	4%	0%
302	Nutrient Utilization in Animals	2%	0%	7%	8%
303	Genetic Improvement of Animals	2%	0%	4%	0%
306	Environmental Stress in Animals	4%	0%	8%	0%
307	Animal Management Systems	2%	15%	5%	10%
311	Animal Diseases	4%	15%	7%	5%
601	Economics of Agricultural Production and Farm Management	4%	15%	6%	10%
603	Market Economics	0%	2%	0%	2%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	0%	0%	0%	2%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	110.3	17.0	261.0	20.0
Actual Paid	120.0	20.0	332.8	21.0
Actual Volunteer	44.4	0.0	12.4	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1586693	1248091	2021959	1707400
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1586693	1315527	34182676	1698310
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
20088724	0	3366324	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Agriculture contributes more than $20 billion per year to the Arkansas economy, and 1 in 6 jobs. Our continued success in agriculture relies on the abundant resources in the state, including good soils, abundant water, favorable climate, and hard-working people.

Challenges to sustained agricultural production and processing increased in 2018 as commodity prices continued to fall while production costs remained high. In the row crop area, prices for corn, cotton, rice, wheat and soybeans have fallen since 2011, with no turnaround in sight.

New pests continued to emerge in this sector with the fourth year establishment of the sugarcane aphid in sorghum, third year of detection of kudzu bug in soybean, first year of red banded stink bug, additional spread of the emerald ash borer and crepe myrtle bark scale in forests and urban landscapes, and the continued issue of PPO-resistant palmer amaranth populations in the Delta. HPPD resistance appears to be increasing and herbicide resistant plants are less susceptible to new chemistry. The introduction of dicamba resistant technology and the volatility of the compound has complicated political and weed control issues. Emerging diseases in baitfish and other aquatic production in recent years led to more intense monitoring by disease labs in the state, as well as stricter certification efforts in the large aquaculture industry in Arkansas. Challenges related to invasive species, new pathogens, global economic turmoil, and the plethora of bizarre "research" reports and "recommendations" from low-quality and belief-driven "science" continue to demonstrate, as a Division of Agriculture specialist put it, "there has never been a time when land grant University research and extension were more needed" than today.

Arkansas had about 43,000 farms on 13.7 million acres and another 19 million acres in managed forests as of 2017. The state ranked 16th in agricultural cash receipts of $8.9 billion as of 2015. Of this amount, crop production totaled $3.7 billion and livestock/poultry $5.2 billion. The public value of our agricultural and forest lands also enhanced the tourism and travel potential of the state through natural beauty, diversity of plant and animal life, and rural charm.

Nationally, Arkansas is 1st in rice, baitfish and sport/game fish production, 2nd in poultry production, 3rd in catfish, and among the top 25 states in production of cotton, sweet potatoes, hogs, cattle, and meat goats. Poultry production is concentrated in the northwest section of the state, but during 2014 a major new area in north central and northeast Arkansas was opened to poultry production. Cattle are raised in every county, with a January 1, 2016 inventory of 1.6 million head. Horses continue to increase in popularity with 60,000 households having horses.

Row Crops

To educate soybean producers on current Division of Agriculture production recommendations for soybean production, producers can enroll in the Soybean Research Verification Program (SRVP). The 2018 growing season was the thirty-fourth year for the SRVP. The SRVP is an interdisciplinary effort between producers, county Extension agents, Division of Agriculture specialist, and researchers. The SRVP is an on-farm demonstration of all the research-based recommendations required to produce soybean profitably in Arkansas. Since the inception of the SRVP, over 620 commercial soybean fields in 41 of the 75 counties in Arkansas have been enrolled in the program. In 2018, 21 fields in Arkansas, Ashley, Chicot, Clark, Clay, Conway, Crawford, Crittenden, Cross, Desha, Greene, Jackson, Jefferson, Lincoln, Lonoke, Miller, Randolph, St. Francis, and Washington County were enrolled in the SRVP. These fields averaged 62.8 bushel per acre, compared to the State average of 50 bushels per acre. Many producers that have participated in the SRVP have indicated that the program has made them more aware of the need for timely production practices. Some of these practices include timely irrigations and the use of new technologies to improve irrigation efficiency, timely pesticide applications to control weeds, insects, and diseases, and proper variety selection. Due to reduced disease pressure and scouting, no field enrollee in the 2018 SRVP was treated with a foliar fungicide which saved these produces as much as $20 per acre in unneeded fungicide cost. Every summer, all of the row crop commodity Verification Programs are showcased with a field tour. In 2018, this field tour was conducted in the Arkansas County with over 50 producers, consultants, industry personnel, and Division faculty and staff attending the tour.

Conventionally and reduced tilled silt loam soils in Arkansas exhibit little soil structure. The lack of soil structure greatly reduces water infiltration rates. A reduction of the effective rooting depth of cotton occurs as a result of decreased infiltration. This is often the underlying cause of many of our water and nutrient issues. While producers' budget resources toward addressing symptoms associated with water and nutrient issues, little attention is directed to improving soil health which plays a direct role in the cause of these issues. An integrated, multi-disciplinary research, education, and outreach program has been established to develop and disseminate information regarding strategies to improve soil health that are profitable and practical for Arkansas producers. Field days, county and multi-county meetings, on-farm demonstrations, news articles, publications, personal contacts and information gained from applied research projects were used to promote adoption. University of Arkansas System Division of Agriculture educational efforts to promote practices to improve soil health resulted in the education of over 1,025 producers, consultants, and other professionals about soil health and sustainability at 9 meetings. Producer groups including Arkansas Soil Health Alliance, Cotton Incorporated, Cotton Board, and the National Cotton Council as well as NRCS and other organizations and individuals have posted, shared and tweeted this information.

Results from the experiments show that it is imperative that new chemistry such as benzobicyclon be brought to rice soon. In weed control experiments using Provisia™ technology, the addition of benzobicyclon into currently used herbicide programs provided improved weedy rice control along with minimal crop injury. In a varietal tolerance experiment, we found that japonica rice varieties showed high levels of crop safety to benzobicyclon while indica varieties, such as 'Rondo,' were extremely injured. Sensitivity of rice to benzobicyclon was also a function of crop size (or weedy rice size) at application. In another experiment, drift rates of common rice herbicides, including benzobicyclon, were applied to soybean at both V3 and R1 stages. Soybean exhibited a high degree of tolerance to benzobicyclon, which would indicate low risk for injury when drift occurs from adjacent rice fields. Likewise, an application of benzobicyclon plus halosulfuron (premix) was applied from an airplane over a soybean field with minimal injury from off-target movement of both herbicides. This is important because benzobicyclon will be

predominantly aerially applied in the Midsouth, thus alleviating the risk of injury from off-target movement to adjacent soybean crops is of necessity. Some practical implications of adding benzobicyclon into the current rice herbicide portfolio would be that it is a non-traited POST option for rice weed control, which would allow varieties like Diamond to be planted instead of lower yielding Clearfield and Provisia varieties. Diamond often yields more than 15 bu/A better than Clearfield and Provisia varieties, which equates to increased profits of $71/acre assuming a rice price of $4.75/bu. Additionally, weedy rice is estimated to cost growers $150/acre in additional management costs and reduced yield and quality according to Terry Gray of Delaplaine Seed Co. For conventional Clearfield rice, the added seeding cost for the technology versus non-traited rice is approximately $55/acre. Using the above mentioned information, it is likely that use of benzobicyclon for weedy rice control in non-traited rice could save growers at least $200/acre and assuming this saving on 250,000 acres of Arkansas rice annually, growers would reap $50 million in returns each year from use of this herbicide.

In furrow-irrigated and levee weed control experiments, Loyant was effective in controlling Palmer amaranth. Loyant allows growers to have an additional mode of action they can use to control this troublesome weed. In the tolerance trials, Loyant caused significant injury to hybrid rice when sequential applications were made close together. However, no significant injury was observed when Loyant was applied with an insecticide. The use of Loyant in furrow-irrigated rice, especially in areas of the state where 2,4 4-D is not an option, will allow the crop to be successfully grown in fields where it otherwise could not be grown without substantial yield losses. Conservatively assuming that Palmer amaranth reduces yield of furrow-irrigated rice by 15 bu/acre (10% yield loss at $4.75/bu and 150 bu/A yield potential) and no effective alternative is available, the economic benefit of this herbicide on just 50,000 acres of furrow irrigated rice would be more than $3.5 million annually. Additionally, the fact that yield loss was observed on hybrid rice in some Loyant trials in 2018, the tolerance research could save growers millions annually if the conditions or parameters that increase the risk for injury and subsequent yield loss are better understood.

Irrigation

Irrigation is essential to modern farming operations because it insures crop success independent of rainfall. Concern for cost of irrigation and the decline in aquifer levels leads producers to find ways to be more efficient in irrigation. A collaborative effort between employees from the University of Arkansas Division of Agriculture Cooperative Extension Service, the Natural Resource Conservation Service, and the County Conservation Districts has increased the educational efforts on Irrigation Water Management (IWM) practices. In 2018, the 8 IWM Specialist have prepared783 Irrigation Water Management Plans representing 166, 936 acres. .They also developed 521 irrigation field designs representing 31,988 acres. Including County Extension Agents and other NRCS employees well over 1000 irrigation wells were checked during the 2018 season. Over 50 soil moisture units with telemetry were used across the state to schedule irrigation on various crops. One grower in Monroe County reported the field we monitored with the soil moisture sensors yield higher than it has ever made with only 2 irrigations. He said typically he would have irrigated 3 more times at the very least, but because of the sensors he learned how good his infiltration rates were, the water holding capacity of his soil, and the differences in crop water use during various growth stages. Our collaborative irrigation efforts on Irrigation Water Management are making substantial economic impacts and leading to long-term sustainability of our aquifers and other natural resources.

The sustainability of a family farm depends on three key points: economic, environmental, and social. All three key points are vital to support the farming operation and allow it to grow and be available to future generations. Improving irrigation efficiency affects all three points. Extension worked with a producer to utilize soil moisture sensors in a soybean field planted in June following oat harvest. Soil moisture sensors and a surge valve were utilized to increase the water infiltration and the efficiency of the irrigation. Surge Irrigation is the intermittent application of water in furrow irrigation for the purpose of improving down furrow efficiency and reducing deep percolation. By utilizing the soil moisture sensors to know how much plant available water was in the soil profile one irrigation was delayed on the surge side resulting in one less irrigation on the surge area for the season. The surge side yielded 56.4 bu/ac of soybeans and used 5.8 inches from 2 irrigations with about a third less water. The control side yielded 52.9 bu/ac of soybeans

and used 14.27 inches from 3 irrigations. Combining water savings and increased yields can help the family farm protect the environment while remaining profitable and leave the farm operation in a better state for the future.
Most rice grown in Greene County is irrigated using a conventional flood or zero grade production. Higher crop yields along with more acres being irrigated in recent years, have put heavy pressure on aquifers in this region, resulting in depleting groundwater levels. Producers continue to evaluate new ways to reduce irrigation water use. A rice irrigation systems project was set up on the Pigue Farm in Greene County in 2018. Groups partnering to make the project a success include the Greene County Conservation District, Extension Service, and Natural Resources Conservation Service. Different irrigation methods evaluated include zero grade, furrow (row rice), alternate wetting & drying, and conventional. Flow meters were used on each of the project fields to track and quantify irrigation water use for each irrigation method evaluated. Yields ranged from 196 to 220 bpa for fields in the study. The zero grade field recorded the best yield while the row rice field had the lowest. Considering irrigation water use for the season, the row rice field came out on top, using only 25-acre inches (AI) while the conventional and AWD fields used the most (39-40 AI). When you look at irrigation efficiency, the row rice field (7.7 bushels/AI) exceeded the yields of the AWD and conventional fields (5.3-5.4 bushels/AI). The zero grade field fell in the middle with 6.3 bushels/AI. ET measurements resulted in 4 fewer irrigations than the producer standard without decreasing yields. The additional irrigations applied using the producer's standard practices represented an increased production cost of $22.72 per acre. Scheduling irrigation based on ET measures resulted in a reduction of 8-acre inches of water in this demonstration. Extrapolated across the 18,000 acres of corn in Mississippi County, timing irrigation based on ET measurements could reduce pumping costs by $408,960.00, and conserve just over 3.9 billion gallons of water.

Horticulture

Expanded production season is very valuable for fresh fruits, in that it allows expanded grower profits, and consumer availability of the crop. The ability to extend production season and expand areas of the country where a crop can be grown are both very valuable. Blackberries are an increasingly popular, healthy fruit, so additional technology to expand production is timely to develop. The University of Arkansas has conducted fruit breeding since 1964 and in recent years has released the first five commercially available primocanefruiting blackberry cultivars beginning in 2004. The most popular of these is 'PrimeArk® 45' that has been planted across the United States and provides high quality fruit for both the summer (floricane) and fall (primocane) seasons. Large berries with very good flavor produced on healthy, highyielding plants are key advantages for this cultivar. Subsequent releases 'PrimeArk® Freedom' and 'PrimeArk® Traveler' provide high quality fruit on thornless canes. This has resulted in a potential blackberry fruiting season from mid-May until mid-November, depending on location in the country. These cultivars, in addition to new floricanefruiting developments from the Arkansas program, have provided the basis for major innovation of this native crop. Longer production season, higher quality, increased postharvest handling capability, and thornless canes have all contributed to more opportunities for American growers and berry consumers.
Commercial blackberry growers in the state of Arkansas often lack access to research based information, have limited interactions or networks with other growers and may have limited marketing options. To address these issues Division of Agriculture Extension specialists sought out and was awarded funding from the Arkansas Department of Agriculture Specialty Crop block grant program to start an Arkansas Blackberry Growers Association (ABGA). In 2018, she conducted six listening sessions in conjunction with local county agents across the state to identify commercial blackberry growers interested in forming a grower's association. Forty-two growers attended a listening session and since then a total of 72 growers from across the region have expressed interest in joining the ABGA. An advisory committee of grower-leaders has since been formed plan a winter 2019 conference aimed at solidifying the formation of the ABGA. The initial efforts to bring together growers from across the state has already garnered the attention of regional buyers and aggregators who are interested in buying blackberries from Arkansas growers. It is anticipated that the association will increase the volume, quality and competitiveness of Arkansas produced Blackberries.
UAPB conducted research and Extension programming on sweetpotato varieties for edible leaf vegetable

production and the use of rotation and cover crops in sweetpotato production. Lack of virus-indexed slips has hampered sweetpotato production in Arkansas. To address this need, UAPB's Sweetpotato Foundation Seed Program provided growers 63,000 virus-indexed slips that resulted in 25% increase in production; this program targets small scale and limited resources farmers in Arkansas.

Aquaculture & Fisheries

The AQFI Center of Excellence at the University of Arkansas at Pine Bluff (UAPB) has continued their efforts to support Arkansas' $61 million aquaculture industry. The Center's research and Extension efforts also support the recreational fishing industry that has an economic impact of over $740 million per year in Arkansas. In 2018, researchers examined the growing issue of cyanobacterial blooms in ponds, lakes, and river ecosystems. Cyanobacterial blooms are progressively becoming a major water quality issue in pond, lakes, and river ecosystems globally. These blooms limit light availability for photosynthetic phytoplankton; these conditions negatively affect the fisheries resources and reduce the overall primary productivity of the ecosystem. High turbidities induced by intense cyanobacterial growth also suppress aquatic macrophytes that serve as habitats for many fishes and invertebrates. Although this phenomenon is more publicized in natural water bodies, aquaculture ponds also are susceptible to these impacts. In addition, cyanobacterial blooms threaten the use and sustainability of many freshwater resources, and are very likely to impact supplies of clean water in the near future, which is an issue of global concern for current fish producers. Therefore, controlling cyanobacterial nuisances and their toxins are major challenges to aquaculturists, water quality specialists, and toxicologists at UAPB. Manipulating phosphorus concentrations in order to limit its bioavailability to cyanobacteria is a key solution. Alternate to the nutrient reduction strategy, the application of chemicals (e.g. algaecides) are direct means of controlling harmful algal blooms by lysing cyanobacterial cells. Manipulating phosphorus concentrations in order to limit its bioavailability to cyanobacteria is a key solution. Alternate to the nutrient reduction strategy, the application of chemicals (e.g. algaecides) are direct means of controlling harmful algal blooms by lysing cyanobacterial cells.

Animal Science

Of Arkansas' cash receipts, 57% are from Livestock and Products. Poultry production accounts for 86% of cash receipts, followed by beef cattle receipts at 10% of the total for livestock and products. Arkansas ranks 11th in the nation for beef cows. Hay represents 1.5% of the crop cash receipts. The Division of Agriculture and UAPB assists livestock and poultry production with research and Extension programs focused on enhancement of well-being and animal handling methods to minimize stressors in food animals, determination of the impact of common stressors (castration, parasite load, disease, etc.) that aid in development of on-farm best management practices, improvement of food safety while maintaining product quality characteristics, improvement of environmental sustainability (reduction of greenhouse gasses, and nitrogen cycling/use); input efficiency of production, enhancement of reproductive performance, animal and poultry health, and reduction of feed/forage needs and costs.

Sheep and goats suffer from a blood sucking parasitic worm that is developing resistance to all chemical dewormers available in the U.S. On many farms, total failure of chemical dewormers is possible in the future. Death losses could be as high as 20 percent of a flock or herd, which would put sheep and goat producers out of business. During FY2018, UAPB research faculty conducted research to identify "natural" methods to control parasites in sheep and goat production. UAPB Extension livestock programs focus on small and socially disadvantage farmers (SSDF) in southern and eastern Arkansas.

Ground beef consumption continues to increase, with ground beef sales accounting for almost 50% of all retail beef sold and 40% of all retail beef dollars annually. Due to this increased demand for ground beef, retail ground beef prices have increased over $1.00 per pound over the past decade. This trend begs the question, "Could the beef cattle industry produce carcasses on a low-cost, grass-based system used totally for ground beef production? Grain-fed and grain-supplemented, grass-finished (166 days on grass) steers were processed and saleable yields of beef products were calculated. Value of each carcass was calculated based on the annual highest, lowest, and average prices. Return on investment was then calculated from actual costs of production for calves. There was no difference in the quantity of saleable beef between the two production systems. At the highest prices, grain-fed steers had the greatest carcass value and return on investment; however, at the highest prices for 80% lean trimmings, the ground beef

production system from grass-finished was equal in carcass value ($1,452 vs.1,531/carcass) and return on investment ($962.65 vs. 926.11/head) to the grain-fed system when average prices were used. Grain-amended, grass-feeding system for production of ground beef may be an attractive alternative production system to improve profitability of Arkansas cattle producers.
Arkansas ranks 11th nationally for beef cows, and at weaning, most calves will be sold as feeder calves through local livestock auction. Calves that enter the market channel without prior evidence of health and management are more than twice as likely to become sick. Calf illness decreases growth, reduces carcass quality, and increases medicine and labor cost. In addition, long-term antibiotic use in the industry places excessive use of antibiotics at risk to microbial resistance and reduced effectiveness. County agents created a preconditioned calf program steering committee. The steering committee developed the framework for the Natural State Preconditioned Calf Program. The program was officially launched in June 2018 and has been dubbed GoGREEN as calves marketed through the program are identified with a green ear tag. This program has resulted in increased demand for Beef Quality Assurance (BQA) training. Although BQA is required to market calves through the preconditioned calf program, far more producers are completing BQA certification than enrolling calves for GoGREEN. Sale barns that traditionally have not had special preconditioned calf sales began offering sales through industry partnerships. The fall Arkansas markets indicate that value added calves were fetching nearly $10/100 pounds or $56/calf more in the marketplace than calves without known health and management history.
According to the Census of Agriculture, the number of beginning farmers has decreased by 20% from 2007-2012. Female principal operators were less than 14% of producers. In Hot Spring County, the number of farms decreased by 17%, with the average age of 58. It is essential to engage new and younger producers in order to maintain agriculture production. Two primary programs were implemented in Hot Spring County in the 2018 program year. The Young Cattlemen's Series was a seventh month series program going back to the basics to give beginning producers the foundations many producers needed. The class filled to capacity with 25 producers enrolled, 16 completing the full program. Annie's Project was a six week series targeting women in agriculture on the five areas of risk management (financial, legal, marketing, human resources, and production). 14 ladies enrolled in the program, with 11 attending the full six weeks. 100% of participants reported they had already begun implementing practices by the end of each course. 54% of those participants were implementing 1-4 practices, 23% were implementing 4-8 practices, and 23% were implementing more than 8 best management practices. The average score on post test questions was 87%, compared to 32% on the pretest. The Young Cattlemen's Series reached 25 new producers in the first year of the program. At the end of the program producers reported a total estimated savings of $47,000 by implementing the practices learned through the program. This kind of difference can make or break a new farmer.
The Arkansas poultry industry is the leader in the agriculture industry of Arkansas. The largest portion of the industry is broilers with Arkansas ranking third in the nation in broiler production. In Arkansas broilers are produced in 58 of the 75 counties with the counties of Washington and Benton producing the most. The state also ranks third in the nation in turkey production and third in the value of egg production. Over 136,000 jobs are provided to the citizens of Arkansas by the poultry industry. The 2014-2015 outbreak of High Path H5N1 Avian Influenza (AI), was the largest animal health emergency in the history of the United States; affecting multiple states, including Arkansas. The disease outbreak caused the death and destruction of over 49 million+ birds with federal costs in disease control and indemnity exceeding 1 billion US dollars. Continued outbreaks of Low Pathogenic AI and Highly Pathogenic AI around the world kept tensions in the poultry industry at a high level especially since the reservoir of the AI virus is waterfowl and shorebirds. Currently in California there is an outbreak of virulent Newcastle which began in 2018 in backyard/exhibition birds and has spread to over 360 premises of backyard/exhibition birds and 5 commercial egg layer operations. This outbreak of Newcastle is also of tremendous concern to the commercial poultry industry as the popularity of keeping a small flock of poultry and/or keeping poultry as pets increases. Often individuals that acquire a few birds may be inexperienced with keeping poultry, have limited knowledge of poultry diseases or be unaware of what Biosecurity practices they can implement. They may not have ready access to veterinary care for their small flocks since there are few veterinarians that will accept poultry into their practice. There are also concerns regarding public health as there has

been an increase of Salmonellosis in young children correlated with the increase in keeping of small poultry flocks. Biosecurity educational outreach to the poultry industry and hobby flock poultry owners is extremely important to prevent and/or reduce the spread of an outbreak such as Avian Influenza or Exotic Newcastle disease or of diseases such as Mycoplasma, Salmonella, Laryngotracheitis, etc. Veterinary care for small flocks can be a problem as there are few veterinarians willing to practice on poultry. Health departments are concerned about small flock popularity due to a rise in Salmonellosis in small children correlated to the increase. Farm visits were made to 63 premises as requested by growers and small flock owners. Educational outreach was in the form of printed and electronic materials, newsletters, seminars, short courses, field days, staffed booths and displays, etc. Educational meetings for growers/owners/veterinarians were conducted across the state of Arkansas and in Oklahoma with a total of 1300 4H/FFA youth, 120 Tyson employees, 75 commercial testers, 65 private testers, and 236 veterinarians trained on poultry diseases and Biosecurity. Veterinarians have reported incorporating the information received through the trainings into their practices and in what they provide to their clientele. Seven Extension Fact Sheets were developed and published in 2018 in Arkansas and Mississippi. 97 individuals completed the free on line Extension course titled Backyard Poultry in 2018. Biosecurity educational outreach to industry and hobby flock poultry growers is extremely important to prevent or reduce spread of a poultry disease in an outbreak in Arkansas and/or the nation.
Division of Agriculture researchers examined global gene and protein expression in muscle that provide a picture of how feed efficiency works at the cellular level. Oxidative stress turns out to be the first of many cellular activities affecting feed efficiency researchers have identified. Discovering the causal agents of oxidative stress and locating gene markers that identify more efficient birds is critical to poultry breeding programs. Researchers also examined stress response pathways in poultry to alleviate such physiological stressors. That would help improve poultry welfare, health and may lead to improved meat quality for the poultry industry. Initial findings have included the discovery of a new structure of neurons in the poultry brain, which may be a starting point for some stress response signals. These findings will assist future researchers develop remedies to chronic stress responses. Research on a proprietary method of litter beetle control began in 2018 and will continue into the next program year. Initial results will be available in future reports.

Agricultural Economic & Agribusiness

The Division of Agriculture clientele are informed about best management practices and policies through research and educational programs as conducted by the Agricultural Economics and Agribusiness program. The goal is to increase the value of agricultural commodities, analyze production efficiency and mitigate price and production risk while being mindful of potential negative environmental impacts and preserving key productive resources of land, labor and capital in a production environment affected by climate change. Hence, monitored are production and marketing practices, the financial sector and public policy issues at the state, regional, national and international level. Research conducted during FY2018 by Division of Agricultural researchers included i) analyses that reflect on consumers attitudes toward genetically modified food as well as CRISPR technology; ii) identifying efficient irrigation strategies and assessing demand for irrigation resources; iii) assessing climate change related impacts on agricultural production practices; iv) analyses of off-farm activity on irrigation and agroforestry sectors; v) red rice impacts on food security; vi) evaluation of WIC participation and the quality of household food purchases; vii) analysis of crop verification programs in soybean, rice, cotton, feed grains, and wheat along with updates to interactive budgeting software targeting all row crops; viii) assessment of economic, social, and environmental impacts of global renewables and nuclear energy electricity targets; ix) developing and updating decision support software guiding cattle, forage, energy crop, weed management and tractor guidance technology adoption decisions; x) analyzing rice price dynamics using innovative econometric techniques; xi) evaluation of borrower characteristics that benefit from loan modification; xii) evaluation of greenhouse input use efficiencies; xiii) impacts of international labor movement; xiv) evaluation of protected area designations and natural amenities of forested areas; and xv) fertilizer recommendations for switchgrass as livestock feed and/or for renewable energy production. All these analyses draw attention to tradeoffs producers face when making production decisions that can impact more than their own profitability and risk. Commodities analyzed varied from apples, tomatoes, green peppers, cocoa,

rice, and corn to forestry products. Regions and countries affected with these research efforts included but were not limited to Arkansas, the US, Kosovo, China, Kenya, Philippines, Bangladesh, Singapore, and Mozambique.

2. Brief description of the target audience

Target audiences for Agricultural Production & Processing include:

- Small and Socially Disadvantaged Farmers (SSDF)
- Agricultural food crop growers/producers
- Livestock producers
- Non-traditional and small flock poultry producers
- Commercial poultry producers
- Commercial poultry company personnel
- Aquaculture and aquaponics producers/consultants
- Beekeepers
- Local, niche producers
- Farm Pond Owners
- Non-farm private landowners
- Agricultural consultants
- Agribusiness/allied Industry personnel
- Horticulture production and service business personnel
- Local, state and federal agency personnel
- Master gardeners
- Community leaders
- Policy and decision makers
- Low-income families with children
- Low-income older adults
- Hispanic/Latino families
- African-American families
- Female producers
- Veterans
- First responder emergency personnel
- Research funders
- General Public
- Policy makers
- Water and Natural Resource personnel
- Supply chain managers
- Processors
- Biotech industry
- Value-added industry
- Community Based Organizations

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1214634	5049101	70749	371323

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

Patent Applications Submitted

Year: 2018

Actual: 12

Patents listed

9,957,520. Methods of Increasing Resistance of Crop Plants to Heat Stress and Selecting Crop Plants with Increased Resistance to Heat Stress, 5/1/18. Pereira.

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3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	93	280	373

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of agricultural production education meetings related to food, fiber and non-food plant and animal production

Year	Actual
2018	5256

Output #2

Output Measure

- # of demonstrations/on-farm research related to food, fiber and non-food plant and animal production

Year	Actual
2018	3674

Output #3

Output Measure

- # of farm visits related to food, fiber and non-food plant and animal production

Year	Actual
2018	41509

Output #4

Output Measure

- # of field days related to food, fiber and non-food plant and animal production

Year	Actual
2018	584

Output #5

Output Measure

- # of educational materials distributed related to food, fiber and non-food plant and animal production

Year	Actual
2018	49949

Output #6

Output Measure

- # of website visitors and downloads related to food, fiber and non-food plant and animal production

Year	Actual
2018	1814024

Output #7

Output Measure

- # of diagnostic samples related to food, fiber and non-food plant and animal production

Year	Actual
2018	279648

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of clientele using improved crop best management practices.
2	# of clientele using improved fish farming best management practices
3	# of livestock producers using best management practices.
4	# of poultry producers using best management practices.
5	# of crop varieties or germplasm lines released.
6	# of producers using improved biosecurity practices
7	# of diagnostic plant health and nematode samples submitted.
8	# of fish samples submitted for disease testing.
9	# of fish samples submitted for disease-free certification.
10	# of samples submitted for exotic animal or poultry disease testing.
11	# of small and socially disadvantaged farmers reporting increased profitability
12	# of clientele who initiated specialty food-related enterprises
13	# of producers adopting herbicide resistance best management practices.
14	# of pesticide applicator training participants certified or re-certified
15	# of small or socially disadvantaged farmers adopting crop best management practices
16	# of Master Gardener participants trained, certified and re-certified.
17	# of small or socially disadvantaged farmers adopting more diverse crops

18	# of small or socially disadvantaged farmers adopting livestock best management practices
19	# of new ideas/concepts for textile structures/end products from bio-fibers
20	# of acres using improved crop best management practices.
21	# of clientele adopting non-food plant best management practices

Outcome #1

1. Outcome Measures

# of clientele using improved crop best management practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	152048

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Corn has become a crop of choice for many Arkansas growers as they see the benefits it provides their farming operations including; more and better weed control options to control glyphosate resistant weeds, profit potential, rotational benefits for following crops, water conservation, and overall crop diversity and risk reduction. In past years, Arkansas corn yields have been greater than many in more traditional corn growing regions due in part to improved management practices and irrigation capability.

What has been done
Educational efforts were made throughout the year to educate corn producers, county extension agents, crop consultants, and industry representatives on management strategies to grow quality

high yielding and economical corn. Various methods were used to disseminate information on corn production and including; newsletters, blog postings, county production meetings, field tours, IPM meetings, field visits, verification program fields, and phone calls.

Results

Despite a challenging growing season, Arkansas corn producers averaged 181 bu/acre from the fourth highest state corn acreage in recent history (660,000 acres). This yield tied the 4th highest all time state average yield. The seven highest state average corn yields have all occurred during the last seven years indicating that Arkansas corn producers have learned how to grow high yielding corn through successful extension educational programs. Corn is and will continue to be an economically important crop that producers want to grow. In 2018, Arkansas produced approximately 119 million bushels of corn worth an estimated $447 million. With educational programs that were delivered on proper production techniques of corn, Arkansas producers are able to grow high yielding and profitable corn in 2018.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

# of clientele using improved fish farming best management practices

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	37

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Aquatic vegetation control continues to be a problem for aquaculture producers, recreational pond owners and row crop producers. New products are developed but information provided to the stakeholders is limited.

What has been done
An annual update of the Aquatic Herbicide section of the Cooperative Extension publication; Recommended Chemicals for Weed and Brush Control, MP44 to include aquatic weeds is done. This helps to keep Arkansas farmers and pond owners aware of the current legal herbicides and some information on their use. One article titled. Winter is a Great Time to Apply Aquatic Dyes, was published in the April issue of Arkansas Aquafarming. Further assistance was also given to many pond owners, often through county agents, on farm pond and aquatic weed issues. Presentations to extension agents, private pond owners, producer organizations, and aquatic plant management professional organizations were given. Over 450 requests for information and recommendations were received by phone call, phone texts, and/or emails from county agents and stakeholders.

Results
The impact for this program is difficult to monetarize. For producers, seining ponds, and loss of fish are reduced. For recreational pond owners, ponds are more aesthetically pleasing, and easier to fish. County Agents and Recreational Pond Management companies have the latest information on approved chemicals for aquatic use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

of livestock producers using best management practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	6596

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Only approximately 20% of ranchers implant their nursing calves prior to weaning. In Arkansas, only 17% of male calves sold in livestock auctions weighing between 300 and 550 pounds were already castrated (suggesting the other 83% of calves perhaps have never been handled for vaccination or other husbandry procedures). Economically speaking, growth-promoting implants can affect profitability by improving average daily gain and increasing feed to gain ratio.

What has been done
Crossbred beef steers were assigned randomly to 1 of 4 growth-promoting implant treatments. Implantation of beef calves at branding, weaning, and feedlot entry increased growth performance without affecting carcass quality.

Results
For Arkansas, the beef calf inventory is approximately 800,000 head. If growth implants were utilized in all of calves throughout production, it could potentially improve the average body weight produced by 192 pounds compared to not using growth implants. This would be an approximate increase of $250/head adding a total of $200 million in value to the annual Arkansas calf crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
205	Plant Management Systems
301	Reproductive Performance of Animals

302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

# of poultry producers using best management practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5922

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Highly Pathogenic Avian Influenza (AI) and virulent Newcastle continue to be concerns for the poultry industry with outbreaks around the world. The current virulent Newcastle outbreak in California is of particular concern as it has now been detected in 5 commercial egg flocks and over 360+ backyard/exhibition flocks. The increasing popularity of keeping a small poultry flock compounds the concerns as individuals may have limited knowledge of poultry diseases and Biosecurity. Veterinary care for small flocks can be a problem as there are few veterinarians willing to practice on poultry. Health departments are concerned about small flock popularity due to a rise in Salmonellosis in small children correlated to the increase.

What has been done

Dr. Clark serves as an educational resource providing trainings on diseases and Biosecurity practices to the commercial poultry industry, hobbyists, poultry producers, animal owners, veterinarians, etc. This was accomplished by premise visits, staffed displays, monthly meetings,

outbreak updates for counties, Biosecurity information to Poultry Chain participants, Avian Advice newsletter, Extension publications, Biosecurity presentations at short courses , Arkansas NPIP Blood testing schools, Arkansas and Oklahoma Veterinary Medical Association meetings, Food Animal Medicine meeting series, revisions of disease and Biosecurity informational handouts and the UA/CES online course on Backyard Poultry.

Results

Farm visits were made to 63 premises as requested by growers and small flock owners. Poultry questions were answered at the staffed poultry display at the Arkansas Flower/Garden show and 200 Fact sheets, 150 Biosecurity DVDs, and 500 Backyard Poultry course cards were distributed to visitors. Educational meetings for growers/owners/veterinarians were conducted across the state of Arkansas and in Oklahoma with a total of 1300 4H/FFA youth, 120 Tyson employees, 75 commercial testers, 65 private testers, and 236 veterinarians trained on poultry diseases and Biosecurity. Seven Extension Fact Sheets were developed and published in 2018 in Arkansas and Mississippi. 97 individuals completed the free on-line Extension course titled Backyard Poultry in 2018. Biosecurity educational outreach to industry and hobby flock poultry growers is extremely important to prevent or reduce spread of a poultry disease in an outbreak in Arkansas and/or the nation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

# of crop varieties or germplasm lines released.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since boll weevils have been essentially eradiated and worms are mostly controlled by Bt cotton, the tarnished plant bug (TPB) has become the primary insect pest of Arkansas cotton. Some presently available cotton varieties display partial resistance to TPB, but high TPB populations adversely affects all varieties. Nectaries on cotton leaves and fruit attract TPB and other insects. Research in large fields has demonstrated that nectariless cottons reduce TPB populations by about 50%.

What has been done
Over 50 years ago, the nectariless trait (absence of nectaries) was transferred from a wild cotton species to Upland cotton and found to be governed by two recessive genes. Nectariless germplasm lines have previously been released by the University of Arkansas cotton breeding program. These nectariless lines represented improvements but were not suitable for variety release. A line derived from a 2008 cross led to the release of the nectariless variety ?UA212ne? in 2018.

Results
Over four years of testing at four Arkansas test sites, UA212ne yielded 10% more than check varieties. In the 2016 Regional Cotton Breeders Network test (28 entries, 13 locations spanning the U.S. cotton belt), lint yields of UA212ne were equal to the highest yielding line at each location, which indicates that it is widely adapted. Yields of UA212ne were produced with highly efficient yield components, namely very high values of lint percentage, lint index, fibers per seed and fiber density. Host plant resistance traits measured on UA212ne include bacterial blight resistance, Verticillium wilt tolerance, and resistance to TPB (small and large plot tests). This combination of host plant resistance and yield components should led to more stable yield production over contrasting environments. Fiber quality of UA212ne is better than most commercial varieties.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #6

1. Outcome Measures

# of producers using improved biosecurity practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	6001

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Arkansas poultry industry is the leader in the agriculture industry of Arkansas. The largest portion of the industry is broilers with Arkansas ranking third in the nation in broiler production. In Arkansas broilers are produced in 58 of the 75 counties with the counties of Washington and Benton producing the most. The state also ranks third in the nation in turkey production and third in the value of egg production. Over 136,000 jobs are provided to the citizens of Arkansas by the poultry industry. The 2014-2015 outbreak of High Path H5N1 Avian Influenza (AI), was the largest animal health emergency in the history of the United States; affecting multiple states, including Arkansas. The disease outbreak caused the death and destruction of over 49 million+ birds with federal costs in disease control and indemnity exceeding 1 billion US dollars

What has been done
Farm visits and observation of poultry exhibited at county and state fairs with discussions with the owners allowed an assessment of practices utilized. 100% of the farms and exhibitors practiced Biosecurity at some level. A key component of the Biosecurity practices taught was providing information as to a source of assistance for individuals and veterinarians. In addition, 211 veterinarians in Arkansas and Oklahoma were provided training in the various problems and diseases of poultry, Biosecurity measures, and poultry husbandry so to be better capable of practicing on poultry in their veterinary clinics.

Results
Farm visits were made to 63 premises as requested by growers and small flock owners. Poultry questions were answered at the staffed poultry display at the Arkansas Flower/Garden show and

200 Fact sheets, 150 Biosecurity DVDs, and 500 Backyard Poultry course cards were distributed to visitors. Educational meetings for growers/owners/veterinarians were conducted across the state of Arkansas and in Oklahoma with a total of 1300 4H/FFA youth, 120 Tyson employees, 75 commercial testers, 65 private testers, and 236 veterinarians trained on poultry diseases and Biosecurity. Seven Extension Fact Sheets were developed and published in 2018 in Arkansas and Mississippi. 97 individuals completed the free on-line Extension course titled Backyard Poultry in 2018. Biosecurity educational outreach to industry and hobby flock poultry growers is extremely important to prevent or reduce spread of a poultry disease in an outbreak in Arkansas and/or the nation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
307	Animal Management Systems
311	Animal Diseases
603	Market Economics

Outcome #7

1. Outcome Measures

# of diagnostic plant health and nematode samples submitted.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	6932

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soybean and cotton nematodes (southern root-knot and reniform nematodes) are among the most important yield-limiting factors that affect crop production in Arkansas. These nematodes have been reported in 95% of the counties that produce cotton and soybean in Arkansas. Individual fields with a severe population density of nematodes can have yield losses that exceed

50%

What has been done

Since 2012, Division researchers have evaluated new and experimental seed-applied nematicides in cotton and soybean to determine their fit in Arkansas production system. These experiments are labor intensive, but are needed and frequently requested by farmers. Another management practices is the use of host plant resistance. Although there is no standard for what is truly resistant or susceptible in soybean or cotton cultivars, this program has evaluated popular soybean cultivars against the southern root-knot nematode over the past several years. Of the 60 soybean cultivars evaluated recently only a handful had an acceptable level of resistance.

Results

Seed-applied fluopyram is one of the most recent nematicides marketed in cotton and soybean. Because of our efforts we have been able to deliver the usefulness of this new seed-applied nematicide to farmers. Our data indicate that seed-applied fluopyram may be more effective in cotton than soybean with both being less effective than soil-applied fluopyram. In general, many of the seed-applied nematicides provide a similar degree of protection, but there are several new nematicides that need to be investigated. Information on host plant resistance to southern root-knot nematode is one of the most requested pieces of information by farmers and consultants. Recently, a farm near Kerr, Arkansas changed from a susceptible soybean variety that averaged 11 bu/A to a resistant cultivar based on our data, increasing the field average to over 50 bu/A.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #8

1. Outcome Measures

# of fish samples submitted for disease testing.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3337

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Annually, Arkansas Catfish Producers lose over $1 million worth of catfish due to catfish diseases. Timely accurate disease diagnoses can save the producer time plus money. Additionally, new problems are beginning to emerge such as the ?hot Aeromonas? bacterial strain which could potentially devastate the remaining catfish industry in Arkansas.

What has been done
Approximately 3337 samples were submitted to the disease diagnostic laboratories in Lonoke and Pine Bluff for diagnosis during 2018. These samples were processed, and appropriate treatment recommendations were made to the producers. The virulent strain of Aeromonas bacteria remains on farms in Arkansas and occurred on one new farm this year in Southeast Arkansas. Losses were minimal due to quick diagnostic response and getting the fish on medicated feed immediately.

Results
The diagnostic service saved the producer approximately $250,000 versus not treating the problem. The Aeromonas strain has been particularly devastating on infected farms in Alabama and East Mississippi. Producers in those areas report losses of nearly 3 million dollars annually. Our rapid response to the problem and the implementation of on the farm bio-security protocols has helped control the spread of the disease in Arkansas, however no program is fool proof and resent research reveals that fish-eating birds can spread diseases through their feces.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases

Outcome #9

1. Outcome Measures

# of fish samples submitted for disease-free certification.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	22225

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Detection of diseases in farmed raised fish is not as readily visible as in other terrestrial livestock species. Fish are raised in aquatic environments and are not easily visible to the farmer. Proper diagnosis of fish diseases prevents catastrophic losses to the producer. Healthy fish used as foodfish, baitfish, or for stocking waters for recreational fishing ensures the safety of seafood for human consumption and prevents the spread of diseases to other aquatic systems.

What has been done

The UAPB Fish Health Inspection lab in Lonoke, AR, conducts routine health inspections; issues health certificates for fish being shipped to other states and countries, conducts inspections for the baitfish certification program in Arkansas, analyzes water quality, and identifies aquatic weeds. The Lonoke Fish Health Inspection Lab is one of 11 APHIS approved laboratories in the US for aquatic organisms.

Results

In 2017, personnel at the lab conducted 332 disease diagnostic cases, 414 water quality/aquatic weed cases, and 147 health certifications for interstate or international transport of live fish. I also provided technical assistance to clientele through more than 90 farm visits, 1611 phone consultations, and 94 office visits. The Arkansas Baitfish Certification Program provides APHIS certifications for fish to be exported interstate and to other countries. In 2017, 22,225 fish were sampled and certified for the Arkansas Bait and Ornamental Fish Certification program. These certifications obtained by farmers, enables the shipment of more than $1,000,000 of fish. These farms are required to have biosecurity practices in place that prevent the spread of disease.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management
603	Market Economics

Outcome #10

1. Outcome Measures

of samples submitted for exotic animal or poultry disease testing.

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

of small and socially disadvantaged farmers reporting increased profitability

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Based on the outcome of this project, the local limited resources farmers, researchers, and commercial growers can know the varieties as well as the production technology for commercial vegetable production. To address the stabilization of a\ growing demand for nutritious vegetable it is imperative, therefore, to take up the cultivation at higher population levels. Such selections of elite genotypes with proper production technology would ensure sustainability and profitability of the vegetable agribusiness.

What has been done
We hypothesize that a successful selection and evaluation of sweetpotato varieties for edible leaf vegetable production will enhance the national competence of the UAPB's faculty and students in agricultural research, hasten the opening of the US market for the sweetpotato products, and lead to increased revenue for the farmers, especially the limited-resource farmers in the Lower Mississippi Delta.

Results
In the recent past, research has been conducted to determine the health-promoting functions of sweetpotato. Acceptable sweetpotato tops should be tender, glabrous and purplish. Those eating sweetpotato heads prefer the top 4 inches (10 cm) of tips including both stem and leaves. These parts are eaten in many countries. This preference for 4-inch tops is logical since a large proportion of the leaves in the top area are new and tender. Tips with the highest number of leaves with petioles less than 4/10 of an inch (1 cm) long are considered desirable because they are tender and easy to use as an ingredient. Researchers and Extension workers could help make this vegetable?s tops more appealing and acceptable. The average tip (average of 35 accessions) yield was found between 11.4 to 85 g per plant. Sweetpotato has many uses in addition to that of a food crop. It is also an important industrial raw material for producing starch, sugar, and alcohol.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #12

1. Outcome Measures

of clientele who initiated specialty food-related enterprises

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	479

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Commercial blackberry growers in the state of Arkansas often lack access to research based information, have limited interactions or networks with other growers and may have limited marketing options.

What has been done
To address these issues, Division of Agriculture Extension sought out and were awarded funding from the Arkansas Department of Agriculture Specialty Crop block grant program to start an Arkansas Blackberry Growers Association (ABGA). In 2018, six listening sessions were conducted in conjunction with local county agents across the state to identify commercial blackberry growers interested in forming a growers association. Forty-two growers attended listening sessions and since then a total of 72 growers from across the region have expressed interest in joining the ABGA.

Results
An advisory committee of grower-leaders has since been formed to plan a winter 2019 conference aimed at solidifying the formation of the ABGA. The initial efforts to bring together growers from across the state has already garnered the attention of regional buyers and aggregators who are interested in buying blackberries from Arkansas growers. It is anticipated that the association will increase the volume, quality and competitiveness of Arkansas produced Blackberries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
601	Economics of Agricultural Production and Farm Management
603	Market Economics

Outcome #13

1. Outcome Measures

# of producers adopting herbicide resistance best management practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	94180

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Palmer amaranth is the biggest weed threat to Arkansas soybean and cotton. When glyphosate-resistant Palmer amaranth was discovered in Arkansas, soybean growers began to rely heavily on herbicide like Valor (Group 14), Reflex (Group 14), and Dual Magnum (Group 15). After repeated use of Group 14 herbicides, Palmer amaranth populations throughout Northeast Arkansas evolved resistance to all herbicide chemistries with this site of action. Reduced sensitivity of these PPO (Group 14)-resistant populations to other herbicide modes of action; especially Group 15 herbicides including Dual Magnum, Warrant, and Outlook, has been observed.

What has been done
Field trials were conducted at research locations where PPO-resistant Palmer amaranth occurs naturally and at locations with PPO-susceptible Palmer amaranth to compare differences in control between resistant and susceptible populations for some experiments. Two experiments were designed to evaluate how well PPO-resistant populations could be controlled at application timings with herbicides commonly used in cotton. Another set of experiments was conducted to compare how varying sprayer parameters such as carrier volume and nozzle type .

Results
Overall, our results have indicated that PPO-resistant populations of Palmer amaranth are more

difficult to control with common cotton herbicides than populations that are not PPO-resistant. When evaluating
preemergence cotton herbicides, the combination of Brake plus Cotoran herbicide provide satisfactory control of PPO-resistant populations. The postemergence herbicide treatments included technology systems such as Enlist One, Liberty, and Xtendimax alone or in combination with the Group 15 herbicides Dual Magnum, Outlook, or Warrant. In these experiments, there was no difference in residual weed control when a Group 15 was added, compared to Enlist One, Liberty, or Xtendimax alone. It is estimated that Palmer amaranth with resistance to at least four sites of action cost Arkansas cotton growers an additional $50 to $100/acre in management costs over fields where this weed is not present. This an other palmer amaranth control strategies were presented at 6 field days and producer meetings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology
213	Weeds Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #14

1. Outcome Measures

# of pesticide applicator training participants certified or re-certified

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4933

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Integrated pest management (IPM) is a very broad area encompassing pest management in agriculture, urban and industrial settings, for public health concerns, trade issues, etc. The Environmental Protection Agency (EPA) requires that pesticides be used properly and judiciously. The Agency also requires that most individuals and businesses that apply pesticides receive proper and recurrent training on pest management and the proper use of pest control products.

What has been done

The Pesticide Safety Education Program (PSEP) is responsible for educating, training, and certifying over 26,000 private, commercial, non-commercial pesticide applicators. The PSEP works closely with the Arkansas State Plant Board to ensure that Arkansas? pesticide applicators are competent and licensed to use pesticides safely and effectively. Once certified, the applicators must be retrained (recertified) every 3-5 years and Extension provides virtually all of this training. The responsibilities of the Arkansas coordinator for PSEP include training, preparing, and equipping county agricultural Extension agents for their role in certifying and recertifying private applicators (farmers/ranchers).

Results

The PSEP coordinator and county agents have been heavily involved with the Arkansas Abandoned Pesticide Collection Committee since its establishment by the Arkansas legislature in 1999. The Committee oversees a program to collect old, unwanted, unusable, or abandoned agricultural pesticides and dispose of them properly at no cost to producers. As of spring 2018, all 75 counties have conducted collection events at least 3 times and over 3 million pounds of pesticides have been collected. The program is in the fourth round of collections for the state. An online training and certification module for dicamba application was revised. It included exams and a required passing rate of 90%. Over 200 applicators were trained via the online auxin training program. There was an 80% reduction in the number of dicamba complaints in 2018 versus 2017 and our online training and testing program plus other Division of Agriculture educational efforts definitely contributed to this reduction.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #15

1. Outcome Measures

# of small or socially disadvantaged farmers adopting crop best management practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	175

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Socially Disadvantaged Producers (SDPs) and Limited Resource Farmers (LRFs) rarely attend educational crop production meetings. These group are also less likely to call their local Cooperative Extension Service (CES) for information on production. They get their information from other farmers and ranchers and cooperatives stores. While information from other producers and cooperatives is better than obtaining no information, at times the information from others producers and cooperatives many not be research based. Consequently, the information may be incorrect. The fact that these groups were obtaining there information from other producers and cooperatives was of great concern for the UAPB Small Farm Project Staff.

What has been done

To address the information concerns of SDPs, and LRFs, the UAPB Small Farm Programs conducted educational meetings for the groups. Vegetable production meetings were conducted in eastern, southeast, and southwest Arkansas and livestock production meeting were conducted in the same areas. Row crop socially disadvantaged producers were encouraged to attend the many educational row crop meetings that were conducted in eastern Arkansas. The Small Farm Staff also conducted many one-on-one visits with both row and vegetable crop producers as well as livestock producers. Many CES Fact sheets were distributed to producers.

Results

Many SDPs and LRFs are currently using CES recommended production practices. Producers are using CES recommended varieties, planting dates, soil test, nematode test, and taking plant diagnostic samples. Most producers are familiar with the CES pesticides control manuals and they have copies of the manuals. Many producers also called the Small Farm Office to request production information. Consequently, about 20 producers reported increased yield as a result of using CES Production practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

216 Integrated Pest Management Systems

601 Economics of Agricultural Production and Farm Management

Outcome #16

1. Outcome Measures

# of Master Gardener participants trained, certified and re-certified.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Gardening continues to be a growing interest with Arkansans. Be it vegetable gardening or landscaping around the home, our stakeholders are looking for sound information in the consumer horticulture area. An issue that continues to be of concern is the lack of scientific based information found from the internet or the lack of how to search for scientific based information. Our program teaches volunteers to look for extension and research based information on the internet.

What has been done
The consumer horticulture program has improved the skills of our Master Gardeners, who help keep our science-based web pages current. Master Gardeners are engaged in state and county horticulture events in order to keep up to date on new research and plants. We have increased our blog activity and displays at educational events to engage more consumers interested in research based gardening. Our Facebook page has grown to over 2,811 likes as we share horticulture as well as Master Gardener information.

Results
The Master Gardener program has grown to 3272 trained volunteers who reported 162,879 volunteer hours as well as 98,879 educational hours for 2018. The yearly Master Gardener Conference was held in Sebastian County with 485 members in attendance. Our website pages continue to receive a high number of visits (771,497) showing that gardening is continuing to be a

high topic of interest. Our blog followers increased to 3,907. Posts are made to the blog three to seven times per week. ANR staff, county extension agents, Master Gardeners, and state horticulture staff hosted the extension educational display at the annual Flower and Garden Show held in Little Rock during March with 8,850 visitors over a three day period. Gardening and food interest continue to increase as does the need for research based information.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems

Outcome #17

1. Outcome Measures

# of small or socially disadvantaged farmers adopting more diverse crops

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sweetpotato is vegetatively propagated and can accumulate viruses that reduce quality and yield. It is affected by more than 30 viruses worldwide of which 3 major groups have been targeted to be of greatest concern in the U.S. In Arkansas, sweetpotato production has been growing steadily with a 66.7% increase in production from 3,000 acres to 5,000 acres between 2012 and 2018, and is mostly cultivated in the Mississippi Delta, which is located in the eastern region of the state. Sweetpotato is also an economically important crop for small-scale and limited resource farmers in Arkansas.

What has been done
UAPB initiated the Sweetpotato Foundation Seed Program and sought support for the program from the Arkansas Congressional Representatives and Arkansas legislatures. The state

recognized the crop?s economic potential and assisted in the construction of curing, storing, and packaging facility near Barton, AR. In 2009, the state provided $400,000 to support UAPB?s efforts towards the development of the Sweetpotato Foundation Seed Program for Arkansas.

Results
The funding from State and NCPN-SP helped to produce 1,200 tissue culture plants and 63,000 slips during the summer 2017-18. Through this program, UAPB also supplied 3 acres of G0 slips to one commercial grower in Arkansas and 2.0 acres of G0 slips were planted in two locations of the UAPB farm. In addition, G0 slips/G2 roots were supplied to eight small-growers from Arkansas. Further, UAPB provided training on the sweetpotato virus indexing protocols to six different graduate students and faculty members from the University of Guyana and helped to establish the tissue culture laboratory at the University of Guyana.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #18

1. Outcome Measures

# of small or socially disadvantaged farmers adopting livestock best management practices

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	60

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sheep and goats suffer from a blood sucking parasitic worm that is developing resistance to all chemical dewormers available in the U.S. On many farms, total failure of chemical dewormers is possible in the future. Death losses could be as high as 20 percent of a flock or herd, which would put sheep and goat producers out of business. Sheep and goat producers are turning to products

claiming to be more natural to control parasites because of the failure of conventional dewormers, as well as the desire to raise animals naturally or organically.

What has been done

Goats were placed on pasture and to become infected with H. contortus naturally and randomly assigned to receive ground black walnut hulls mixed in ground corn (10 g black walnut hull/head/day; n=10 goats) or ground corn only (n=10 goats). Goats were individually fed prior to grazing each day. FAMACHA scores and fecal egg counts were collected for each goat on Day 0, 7, 14, 21, 28, 35 and 42. Goats with a FAMACHA score of 4 or 5 were treated with Moxidectin (Cydectin®) and removed from the study.

Results

Results are currently being analyzed. Goats initially rejected the black walnut hull/corn mixture and picked out the ground corn. Molasses was added to the mixture to improve palatability and prevent goats from picking out the corn and rejecting the black walnut hulls. Last year, there was no migration of larva from fecal samples of either treated or control goats. We developed a method of incubating feces that resulted in migratory larvae. There appears to be no difference between treatment and control for FAMACHA scores, packed cell volume, fecal egg count or larvae migrating from the fecal pellets, however, statistical analysis and a final replicate will not be completed until Summer 2019.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

Outcome #19

1. Outcome Measures

# of new ideas/concepts for textile structures/end products from bio-fibers

Not Reporting on this Outcome Measure

Outcome #20

1. Outcome Measures

# of acres using improved crop best management practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9222180

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With the ever changing issues facing Arkansas soybean producers, the need for current, unbiased, research based production information is vital for the success of our producers. During 2018, Arkansas ranked 11th nationally with 3,280,000 acres of soybean planted, and a state average yield of 50 bushels per acre. Over the past several years, some of the production challenges that Arkansas soybean producers have faced are populations of Palmer amaranth that are resistant to glyphosate and the PPO chemistry, strobilurin-resistant frogeye leaf spot, increased numbers of corn earworms, more production fields exhibiting elevated chloride concentrations, proper irrigation practices, and new herbicide technologies.

What has been done
To educate soybean producers on current Division of Agriculture production recommendations for soybean production, producers can enroll in the Soybean Research Verification Program (SRVP). The 2018 growing season was the thirty-fourth year for the SRVP. The SRVP is an interdisciplinary effort between producers, county Extension agents, Division of Agriculture specialist, and researchers. The SRVP is an on-farm demonstration of all the research-based recommendations required to produce soybean profitably in Arkansas.

Results
To educate soybean producers on current Division of Agriculture production recommendations for soybean production, producers can enroll in the Soybean Research Verification Program (SRVP). The 2018 growing season was the thirty-fourth year for the SRVP. The SRVP is an interdisciplinary effort between producers, county Extension agents, Division of Agriculture specialist, and researchers. The SRVP is an on-farm demonstration of all the research-based recommendations required to produce soybean profitably in Arkansas. These results supported by producer groups are essential for adoption of practices by producers. Through direct contact over 18,000 soybean producers were reached

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #21

1. Outcome Measures

# of clientele adopting non-food plant best management practices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

205	Plant Management Systems
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The 2018 growing season in Arkansas was marked by natural and financial disasters. Cold and late spring, early floods, a mid-season drought, and record rain during the harvest created a situation where crops and forage had a difficult year. Late planting, dry right after germination, drought stress, and finally wet weather leading to difficult harvesting challenged the producers. Rutted fields, unharvested cotton, and poor soybean quality were the resulted in poor return in row crops. The weather also prevented good growth of bermudagrass for forage, low peach production, and poor fruit and vegetable production and quality. Hay production was about 1/2 the previous year.
To compound the production problems, the tariffs and trade war greatly decreased the demand and price of commodities. The poor quality of soybeans reduced prices even further. Fruits were difficult to find and vegetables were late. Producers who had hay from the previous bumper year or planted winter annuals did not have to buy hay but most fields were too wet to plant the annuals. Farm debt is growing and some less efficient farms are facing bankruptcy.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are essential to determine impact and to plan future educational endeavors. These evaluations may take several forms depending on research and extension programs and the form of the educational process. Almost all producer meetings have a knowledge survey and a descriptor of the farming enterprise of the attendee. Formal follow-up is generally lacking but County Exension Agents and Specialists involvement generally examines the acceptance practice. Impacts can often be measured by estimating acceptance of a practice and applying established cost savings. Video conferencing through Zoom is a unique opportunity to reach a large group of people during an meeting and after the meeting through web-based videos. Two beef cattle meetings had more participants for the recorded video than for the live.
An example of this is agent's program in Jefferson County. A corn variety trial averaged 204 bushels per acre, a 29% increase over the county average. Using best management

practices, $857.54 was saved as demonstrated on the (SRVP) field and rice multiplier field, by using integrated pest management recommendations. If used across 5,000 acres, this practice could potentially save $53,596.25.

In some studies it has been determined that 1 pound of weeds equals one pound of forage lost. Most pastures in Lawrence County are faced with pressure from weeds. As a result, of Extension efforts, 31 producers stated that they learned a new management tool to deal with weeds on their farm, and 9 producers evaluated used techniques that they learned on their personal farms. Over 4,000 acres of hay and pasture have been managed more intensively for weeds, and 16 producers representing over 2500 acres admitted that their fields were the cleanest than they have ever been. Producers increased the value of their hay by over $15,000. These results are typical for county programs.

The River Valley Conference topics included herd health, cattle facilities, marketing, and weed control. Over 100 people attended the meeting, and 88 evaluations were returned. Ninety-seven percent indicated the information was very to extremely helpful. The conference had a net promoter score of 60.

To help livestock and forage producers improve production and profitability of their operation, Baxter County Extension provided them with current research-based management practices. Educational programs conducted were: "Pasture Weed Control Demos,""Beef/Forage Educational Meetings,""Winter Hay Feeding Program,""Pesticide Applicator Trainings,""Stockpiling Forage Demos,""Woody Plant Control in the Landscape Demo" and "Horn Fly Control on Beef Cattle Demo." A total of 227 producers participated in these activities. Pesticide Applicator Training classes certified 57 producers. Those attending stated they planned on applying herbicides to 3,802 acres for weed control following Cooperative Extension recommendations. Given a savings of $10 to $15/acre by spraying versus bush hogging, this saved these producers $38,020 to $57,030. Beef cattle horn fly control demo provided control for 12 weeks. U of A research shows a 17 lb. reduction in calf weaning weights for every 100 flies feeding on the cow. By stockpiling forages, a beef producer was able to extend his grazing season 52 days.

Highly Pathogenic Avian Influenza (AI) and virulent Newcastle continue to be concerns for the poultry industry with outbreaks around the world. The current virulent Newcastle outbreak in California is of particular concern as it has now been detected in 5 commercial egg flocks and over 360+ backyard/exhibition flocks. The increasing popularity of keeping a small poultry flock compounds the concerns as individuals may have limited knowledge of poultry diseases and Biosecurity. Veterinary care for small flocks can be a problem as there are few veterinarians willing to practice on poultry. Health departments are concerned about small flock popularity due to a rise in Salmonellosis in small children correlated to the increase. Farm visits were made to 63 premises as requested by growers and small flock owners. Poultry questions were answered at the staffed poultry display at the Arkansas Flower/Garden show and 200 Fact sheets, 150 Biosecurity DVDs, and 500 Backyard Poultry course cards were distributed to visitors. Educational meetings for growers/owners/veterinarians were conducted across the state of Arkansas and in Oklahoma with a total of 1300 4H/FFA youth, 120 Tyson employees, 75 commercial testers, 65 private testers, and 236 veterinarians trained on poultry diseases and Biosecurity. Seven Extension Fact Sheets were developed and published in 2018 in Arkansas and Mississippi. 97 individuals completed the free on line Extension course titled Backyard Poultry in 2018. Biosecurity educational outreach to industry and hobby flock poultry growers is extremely important to prevent or reduce spread of a poultry disease in an outbreak in Arkansas and/or the nation.

Acreage devoted to catfish production in Arkansas has seen a significant reduction during the past years. With acreage decreases there is a need for improving production efficiency. Two production systems that can improve production efficiency are the split

pond system and the intensive aeration system.is use of the split-pond production system and intensive aeration production system. These systems allow for the production of 15,000 pounds per acre and move compared to the 4,000-5,000 pounds per acre using the traditional pond method to grow catfish. With fish growth concentrated in smaller area of the pond, feeding, harvesting, and aeration is improved. Also, disease treatments are less costly since smaller volumes of water are being treated. Currently 21 split ponds and 10 intensive aeration systems are in place currently. An additional 2 split ponds have been constructed and recently began operating. Producers are continuing operating the split pond and intensive aeration systems. Anticipated production utilizing these systems should exceed 4 million pounds of fish. Extension monitors water quality in these ponds. Value of that service is $60/acre or a total of $12,600.

When executed properly these evaluations demonstrate the impact of our programs. More work is needed to determine how to properly evaluate research and extension efforts, but the larger challenge is to incorporate those evaluations as an integral part of the program. It is common knowledge that the programs of the Land Grant System is invaluable and impactful. We however must continue to show those impacts to an audience that does not understand the mission.

Key Items of Evaluation

The emphasis on demonstrations of all areas have shown that farm profitability can be increased by following best management practices. The value ranges from $20 to $50 per acre. In corn, the demonstration based on research results increase yield to 29 percent over the county average with a comparable reduction in input costs.

Commercial and backyard poultry growers are better aware of biosecurity. Veterinarians and company employees are now trained to prevent the spread of infectious disease. Proper implementation will save the industry billions of dollars.

Created smaller ponds or splitting ponds have triple the production of catfish and have led to decreases in costs of medication. Water quality is key and UAPB Extension is monitoring water quality for $60/acre.

Better cattle management is nothing new but breaking tradition of herd and pasture management is on-going battle. Herbicide treatment saves $15 per acre in mowing cost and fly control increases weaning weight by 17 pounds. The River Valley Conference topics included herd health, cattle facilities, marketing, and weed control. Over 100 participants were surveyed with 88 returns. This information was shown to be extremely useful to 97 percent of those surveyed.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Environment, Energy & Climate

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	10%	0%	3%	0%
102	Soil, Plant, Water, Nutrient Relationships	12%	0%	14%	0%
111	Conservation and Efficient Use of Water	8%	25%	5%	20%
112	Watershed Protection and Management	8%	25%	9%	15%
123	Management and Sustainability of Forest Resources	15%	0%	6%	0%
133	Pollution Prevention and Mitigation	6%	25%	5%	15%
134	Outdoor Recreation	0%	10%	1%	5%
136	Conservation of Biological Diversity	2%	0%	2%	5%
141	Air Resource Protection and Management	2%	0%	1%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	11%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	20%	0%
204	Plant Product Quality and Utility (Preharvest)	5%	0%	6%	10%
402	Engineering Systems and Equipment	5%	0%	3%	0%
403	Waste Disposal, Recycling, and Reuse	3%	15%	1%	20%
511	New and Improved Non-Food Products and Processes	5%	0%	5%	0%
601	Economics of Agricultural Production and Farm Management	9%	0%	6%	0%
605	Natural Resource and Environmental Economics	5%	0%	2%	0%
610	Domestic Policy Analysis	5%	0%	0%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	18.3	1.3	127.3	2.9
Actual Paid	16.2	1.3	153.0	2.0
Actual Volunteer	1.2	0.0	4.2	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
216314	196251	979289	215481
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
216314	92847	13027828	225419
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2738701	0	3079323	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Division of Ag and UAPB conducted research and educational programs to protect the environment and to ensure sustainable use of soil, water and air. Research and educational efforts were targeted at all citizens of Arkansans, but emphasis placed on agricultural producers, private landowners, youth, homeowners, and land management professionals. These efforts are funded through a variety of external grant programs from public and private organizations, and in collaboration with many private, government, and non-government organizations. They resulted in scientific publications and presentations to scientists, natural resource professionals, policy makers, and the general public. Research was conducted on Experiment stations as well as on private farms through programs such as Discovery Farms. Education was delivered via farm visits, on-farm/site demonstrations, published materials, public meetings, workshops, social media, print, web resources, and other outreach methods to better inform clientele, generate change in behavior and improve protection and conservation of natural resources. Critical issues that were addressed included: 1) meeting competing water needs among agricultural, residential, recreational, wildlife, industrial and municipal, 2) Protecting and improving water quality of private, domestic wells, stock ponds, streams, rivers, lakes and, 3) Protecting and improving soil health, 4) Protecting air quality, 5) Enhancing the ecological services provided by forested lands, riparian zones and wildlife, 6) Protecting the health of aquaculture and aquatic wildlife, and 7) Environmental Sustainability. Meeting Water Demand. Competing meeting competing water needs among agricultural, residential, recreational, wildlife, industrial and municipal uses is a critical issue in Arkansas. Irrigation demand in Eastern Arkansas is resulting in critical groundwater decline while seasonal drought can effect municipal water supplies, homeowners, livestock producers and poultry producers who use evaporative coolers to maintain optimum conditions in poultry houses during summer months. For row crop producers, research focused on evaluating conservation practices that increase crop water use efficiency while education focused on proven water savings techniques such as computerized hole selection for designing furrow irrigation that increases uniformity and reduces tail water losses as well as multiple inlet design for flooding rice, using soil moisture sensors and apps for scheduling irrigation and using cover crops to improve soil infiltration. The cost of water is mainly determined by the cost of energy needed to pump water from the

ground. Workshops focused on helping producers increasing pumping efficiency saves money and conserves energy. For livestock producers who have been impacted by drought during the last several years, drought mitigation educational package was developed and delivered and alternative watering practices for livestock have been demonstrated. Homeowners have been targeted through outreach, Master Gardeners and mass media. Arkansas Discovery farmers help educate other farmers on emotional water quality issues by speaking at field days and educational meetings. Other educational efforts include providing online education for nutrient management planners and nutrient applicators in nutrient surplus watersheds as partial requirements for State certification, storm-water education for qualifying municipalities, informing decision-makers with science-based information on water quality to ensure policy based on sound science. The National Agricultural Law Center in Fayetteville provides education on water policy and legal matters. The Arkansas Water Resources Center offers water testing service and extension work with private landowners and homeowners in interpretation test results and recommendations for remediation practices.

Protecting and improving soil health. In 2018, a group of farmers in Arkansas formed the Arkansas Soil Health Alliance (ASHA), a non-profit organization with the mission to educate other farmers of practices that improve soil health that potentially can reduce runoff, nutrient loss, reduce inputs and increase water storage and infiltration through practices such as cover crops, minimum tillage and practicing the 4 R's of fertilizer management: rice amount, right time, right place and right form. Division scientists are working to support the ASHA by conducting research on how to best implement soil health practices, how to determine or measure soil health and how it affects soil-water-plant relationships. Educational efforts include demonstrating practices that reduce soil erosion and improving plant nutrient use efficiency via soil testing and N-ST*R testing. The Division of Agriculture, ASHA, USDA-NRCS and the Arkansas Association of Conservation Districts delivered the first joint in-service training on soil health to over 200 Extension Agents, Conservation District Directors and employees, NRCS Field personnel, other conservation professionals as well as college students from four states.

Protect air quality Burning rice stubble to remove crop residue, greenhouse emissions from flooded rice production and ammonia-laden emissions from poultry house ventilation fans are all air quality concerns for the citizens of Arkansas. Research is being conducted to find alternatives to burning rice stubble and other surface residues that make agronomic sense and are not cost-prohibitive. Researchers are also investigating the reduction of methane and nitrous oxide production through alternative wetting and drying instead of continuous flooding of rice while others are investigating growing rice with furrow irrigation (row Rice) rather than flooding. Air improvement practices are being studied to determine how to best reduce emissions from poultry house ventilation using small-scale industrial scrubbing techniques.

Enhancing the ecological services provided by forested lands and riparian zones and protecting wildlife. Arkansas forest and natural resources are critical to the State's economy and to the well-being of its citizens: we are known as "The Natural State". Forested land in Arkansas provides tremendous timber products, recreation, scenic beauty and ecological services such as wildlife habitat, protection of water resources and carbon sequestration. The standing timber in Arkansas' forests has a value of more than $12.6 billion - that's in addition to the value of outdoor recreation and tourism. Raw materials from the State's forests support a vibrant forest products industry. The forest industry direct impact on the State's economy is tremendous. In 2017, this industry provided jobs directly to 27,914 employees. These direct jobs resulted in a total economic contribution to the state of 69,571 jobs, $3.7 billion in labor income, and $6.7 billion to the state's economy. Arkansas's economy is more dependent on forestry than any other state in the Southern United States. The Forest Management Program for Extension Forestry encompasses multiple education efforts aimed to further advance the overall health and productivity of forest and timber lands in the State and region. Research programs in forestry encompassed work in cellulosic nano-technology development, determining the invasion potential of emerald ash borer, enhancing the resiliency of forests to climate change, enhancing bottomland hardwood restoration for carbon sequestration and wildlife conservation, increasing problem-solving efficiency though better communication among natural resource professionals, estimating the economic contributions of forest management to the state's economy, and revealing how wildlife management affects forest health and productivity. The economics associated with riparian zones in the Ozark Highlands region of northwest

Arkansas have also been evaluated.
Wildlife education program areas are: (1) addressing nuisance wildlife problems, including Feral Hog Education Program and pesky wildlife around the yard and garden, (2) wildlife habitat management, (3) wildlife enterprises including habitat management for leasing lands for hunting and wildlife viewing, and (4) youth education through the 4-H Wildlife Program.
Protecting the health of aquatic wildlife. Recreation from sport fishing is an important part of Arkansas' tourism industry. Aquaculture, especially baitfish and catfish are important industries as well. UAPB houses the Division's Aquaculture Center for Excellence where much of the research and Extension activities are headquartered. The AGFC stocks hundreds of thousands of sportfish annually. Monitoring the return on investment requires the ability to track stocked fish after release to the wild. UAPB research is assisting the AGFS in developing no-lethal, quick method of assessing hatchery contribution to a year class in the field. Trout anglers contribute $180 million in expenditures to the Arkansas economy each year. They spend an average of 18 days/year trout fishing and their efforts are focused on the tail waters of the White and Little Red Rivers. UAPB research is focused on delineating areas used for spawning and to validate measurement techniques used to collect data. Techniques used returned quantifiable measurements that are easily compared between presence and absence sites. Arkansas is one of six states in the U.S. that have an established population of Northern Snakehead. Arkansas' population is the furthest inland and one of the least studied. Approximately 84 individuals have been implanted with radio transmitters and stocking into three tributaries of the White River: the Cache River, Wattensaw Bayou, and Bayou Des Arc. Stationary receivers and manual tracking every two weeks have been used to evaluate movement during the winter, summer, and fall seasons. UAPB continues to monitor the ecological effect of this invasive species. The Arkansas Game and Fish Commission (AGFC) uses stocking of hybrid Striped Bass to create diverse angling opportunities, especially in large reservoirs. A modest, but passionate, segment of the angling public focuses on Striped Bass and hybrids, contributing approximately $16.7 million annually to the State's economy. UAPB captured 50 hybrid Striped Bass in our study lake in November and December 2017. These fish were implanted with radio transmitters. We also implanted 50 Largemouth Bass with radio transmitters. Fish of both species have been tracked five days a week every other week for a year. The long-term goal of this research by UAPB scientists is to provide science-based information to increase understanding on the effects of invasive fishes on native fish assemblages in Arkansas waters. This will be accomplished by employing a multiple-gear fish assemblage assessment of previously studied oxbow lakes in the lower White River basin. The basic experimental design is conducive to a before-after comparison of these lakes. UAPB investigators collect fish assemblage data from the Lower Mississippi River (LMR) over a broad spatial scale for comparison to historical datasets collected 20+ years ago during the 1990s. With this study, there is a unique opportunity to examine fish assemblages over a significant period of time in a unique large-river habitat in response to multiple anthropogenic influences. Additionally, there is an opportunity to examine fish assemblage responses to establishment of large populations of Asian bigheaded carps. UAPB provides support and training for county Extension personnel and private landowners on the subject of private impoundment management. We evaluate the economic impact of the Wetland Reserve Program. Wetlands provide economic value in the form of direct benefits, such as harvestable timber and fish, and indirect benefits, such as water purification, flood abatement and wildlife habitat. To combat these losses, the Wetland Reserve Program (WRP) was introduced in the 1990 Farm Bill to provide financial and technical assistance to land owners to help facilitate the restoration of these converted agricultural lands back to their natural wetland state. We provide the estimate for the changes in housing prices resulting from proximity to wetlands restored through the WRP. We examine the importance of differing wetland characteristics on the housing prices. We conduct a back-of-the-envelope estimate on the overall impact of the WRP program. We estimate that the WRP program has generated a $120 million increase in housing prices for the state of Arkansas. UAPB scientists create methodologies to accurately assess habitat in lentic and lotic freshwater systems, quantify fish response to changing habitat conditions, and assess whether fish responses to changing habitat conditions are scalable across spatial and temporal scales and species. UAPB scientists conducted a reassessment of the amount of aquatic habitat along the Arkansas River to determine current habitat conditions, inform potential mitigation practices, and predict potential

influences of habitat change on the aquatic community. The primary objectives of the proposed work are to quantify 1) current aquatic habitat area along the main-channel and backwater areas of the Arkansas River, and 2) changes in aquatic habitat area from 1973 to present. Scientists at UAPB assess the feasibility of a microchemistry approach in identifying the origin and dispersal pathways of Asian carps and Northern Snakehead in the Lower Mississippi River basin within the Mississippi Alluvial Plain.

Environmental Sustainability

Large retailers and others have become increasingly concerned with protecting a sustainable supply of raw products needed in consumer products. Efforts such as Field to Market and the Cotton LEEDS program is placing new emphasis in environmental sustainability and profitability of producing raw products such as plant and animal materials. Division of Agriculture Scientists, including agronomists, agricultural engineers, agricultural economists, and administrators met with a team of poultry industry leaders and environmental groups to formulate goals and action items towards reducing the GHG contribution of corn in the poultry supply chain. The focus area of sustainability is conceptually and practically interwoven with production, economic, environment, energy and climate activities and concerns. As such, the Division of Agriculture has research and extension faculty making contributions to the Environment, Energy & Climate planned program in the focus area of Environmental Sustainability. Specific efforts, not reported to other focus areas, related to environmental sustainability are being made in alternative residue and water management practice effects of soil properties and crop production, trace gas emissions to the atmosphere from rice production, improving waste water quality through struvite creation to remove excess phosphorous and nitrogen, and quantification and modification of waste water treatment system appropriate for small diary milk centers. Since agricultural management practices are closely tied to the perception of long-term sustainability, the effects of alternative residue and water management practices on soil properties and processes and crop production in a wheat-soybean, double-crop production system on a silt-loam soil are being investigated. The effects of tillage and position in the field in furrow-irrigated rice production on methane and nitrous oxide emissions from rice are being investigated. Work continues to be conducted to improve feed efficiency in animal breeding stocks to maintaining viable and sustainable poultry and livestock industries in the United States. Research continues on poultry litter treatment using liquid anaerobic digestion technology to help poultry producers grow their production by minimizing the nutrient issues associated with poultry litter, to prevent pollution to surface and ground water resources due to nutrient leaching and runoff from land and soil receiving poultry litter application, and to help poultry producers transition to sustainable production practices. A part of the Arkansas Discovery farm effort has been and investigation and quantification of the sustainability of cotton production. There continues to be an extension effort to provide nutrient management planner, nutrient applicator, mortality management education. A particular area is the development of online educational courses to provide required certification training for nutrient planners and applicators. The online planner certification course has been completed with 16 individuals completing the course in 2018. The online applicator nears completion. A separate but overlapping component is the providing and maintenance of the nutrient management plan development tool that is used by most of the state's certified nutrient planners.

2. Brief description of the target audience

Youth
Agri Business
Row Crop Agricultural Producers
Small and limited-resource Farmers
Consultants
Forest Landowner Groups
Forest Industry
Loggers
Natural Resource Professionals

Geologists, US Geological Survey
Landowners
Educators
Agency personnel
Livestock producers
Watershed and other Not-for-profit organizations
General public
Researchers
Policy makers
Research funding personnel and agencies
Pond Owners
Fisheries Biologists with Arkansas Game & Fish Commission
Arkansas anglers,
U.S. Fish and Wildlife Service,
Dale Bumpers White River National Wildlife Refuge
Lower Mississippi River Conservation Committee.
Landowners enrolled and prospects for the Wetland Reserve Program.
U.S. Corps of Engineers.
Ecologists
Remediation/phytoremediation researchers/specialists/practitioners
Master Gardeners
4-H youth

3. How was eXtension used?

Reference material from eXtension is linked to webpages for addressing nuisance wildlife problems. Division wildlife specialist responded to some requests for information through the "ask the expert" feature.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	77836	286240	2612	1079

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

Patent Applications Submitted

Year:	2018
Actual:	2

Patents listed

9,957,520. Methods of Increasing Resistance of Crop Plants to Heat Stress and Selecting Crop Plants with Increased Resistance to Heat Stress. 5/1/18. Pereira.

9,936,633. Stalk Cutting Device and Method of Use. 4/10/18. TrentonRoberts.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	1	79	80

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational programs and events held related to Environment, Energy & Climate.

Year	Actual
2018	1203

Output #2

Output Measure

- Number of field days related to Environment, Energy & Climate.

Year	Actual
2018	159

Output #3

Output Measure

- Number of educational materials, curricula, newsletters, web-based modules and fact sheets developed, produced and delivered related to Environment, Energy & Climate.

Year	Actual
2018	178

Output #4

Output Measure

- Number of research-based, non-refereed publications published related to Environment, Energy & Climate.

Year	Actual
2018	28

Output #5

Output Measure

- Number of research-based scientific presentations at scientific or professional meetings related

to Environment, Energy & Climate.

Year	Actual
2018	177

Output #6

Output Measure

- Number of research projects on biomass crops conducted in Arkansas.

Year	Actual
2018	4

Output #7

Output Measure

- Number of research projects on biofuels performance and emissions conducted in Arkansas.

Year	Actual
2018	1

Output #8

Output Measure

- Funded research amounts (in dollars) related to Environment, Energy & Climate.

Year	Actual
2018	4808969

Output #9

Output Measure

- Number of current year Environment, Energy & Climate relevant research programs.

Year	Actual
2018	27

Output #10

Output Measure

- Number of current year Environment, Energy & Climate relevant educational programs.

Year	Actual
2018	39

Output #11

Output Measure

- Number of research projects on populations of important fisheries in Arkansas.

Year	Actual
2018	7

Output #12

Output Measure

- Number of clientele attending field day or workshops related to Energy, Environment and Climate

Year	Actual
2018	1275

Output #13

Output Measure

- Number of social media, web-based and communications tools related to Environment, Energy & Climate

Year	Actual
2018	51

Output #14

Output Measure

- Number of on-farm/on-site demonstrations and applied research trials

Year	Actual
2018	59

Output #15

Output Measure

- Number of educational events for forest landowners/managers on stewardship practices

Year	Actual
2018	20

Output #16

Output Measure

- Number of registered foresters that maintained certification

Year	Actual

2018	1133

Output #17

Output Measure

- Number of clientele who increased knowledge of Environment, Energy & Climate

Year	Actual
2018	1057

Output #18

Output Measure

- Number of farm/landowner visits

Year	Actual
2018	286

Output #19

Output Measure

- Number of publications distributed, aimed at improving air quality in Arkansas

Year	Actual
2018	2000

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Life cycle inventory methodology and data for row crops for greenhouse gases.
2	Number of N-StaR samples processed.
3	Number of new assessment and management tools developed, including models and measurements of greenhouse gas emmisions
4	Number of current year citations of climate related publications.
5	Number of program participants who indicate a change in behavior, based on lessons learned during Environment, Energy & Climate programs.
6	Number of participants (both youth and adult) indicating new knowledge gained as a result of Environment, Energy & Climate programs.
7	Number of program participants indicating new knowledge of water quality and conservation best management practices
8	Number of producers who changed or adopted new production and/or conservation management practices or technologies
9	Number of program participants indicating the adoption or implementation of new water quality and conservation best management practices.
10	Number of farm pond owners who indicate new knowledge of pond management
11	Number of fisheries biologists indicating new knowledge of populations of important Arkansas fisheries
12	Number of acres and/or stream miles on which wildlife/ fish habitat is improved
13	Number of acres on which woodland is improved as self-reported
14	Number of acres using best practices for water quality and nutrient management
15	Number of water samples submitted
16	Number of forest landowners and managers trained to develop forest stewardship plans
17	Number of forest stewardship plans initiated, supported or developed

18	Number of nutrient management planning tools developed
19	Number of research papers reporting on reduced GHG emissions in AR rice production
20	Number of research projects focused on mitigation of soybeans to climate change
21	Number of graduate students working on bioenergy or biofuels projects
22	Number of biofuels projects with research conclusions
23	Number of forestry professionals who maintained certification through training
24	Number of forest industry manufacturing projects developed as a result of educational efforts

Outcome #1

1. Outcome Measures

Life cycle inventory methodology and data for row crops for greenhouse gases.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The United States (US) rice industry has come under recent scrutiny regarding potential elevated methane and other greenhouse emissions associated with rice production due to the flooded-soil conditions under which rice is grown. While a large amount of data is available from Asian countries, where production practices vary greatly from those typically used in the mid-southern US, few direct, field-observation studies are available from the mid-southern US to substantiate the recent claims against the rice industry. For example, the drill-seeded, delayed-flood cultural system practiced in the mid-south decreases the flood duration and timeframe during which methane can be produced as compared to water-seeded or transplanted rice. Additionally, only

one crop is grown per year on the bulk of US commercial rice production, as compared with up to three in some Asian countries, resulting in less straw or crop residue to be decomposed to provide the carbon source as a precursor to produce methane. Therefore, with Arkansas being the leading rice-producing state in the US, Arkansas needs to be a leader in investigating the potential impact of trace gas emissions to the atmosphere and evaluating the potential environmental effects of rice production and its carbon footprint so that the future sustainability of rice production can be ensured.

What has been done

Field studies were conducted in 2015, 2016, and 2017 to quantify the effects of water management scheme (full-season flood, mid-season drain, and intermittent flooding), cultivar (pureline and hybrid), and tillage practice (conventional tillage and no-tillage) on weekly methane (CH_4) and nitrous oxide (N_2O) fluxes and season-long emissions from a silt-loam soil at the Rice Research and Extension Center near Stuttgart, AR.

Results

Based on direct field measurements, results have demonstrated that the mid-season-drain water management scheme can reduce CH_4 emissions relative to the full-season flood. The mid-season-drain/hybrid combination can lower CH_4 emissions per unit grain yield compared to the mid-season-drain/pureline and full-season-flood treatment combinations. Nitrous oxide emissions have large spatial variability, thus, despite season-long N_2O emissions being statistically unaffected by water management scheme or cultivar, the global warming potential (GWP) was significantly lower from the hybrid than the pureline rice variety, while the GWP was numerically lowest from the intermittent-flood/hybrid compared to the other three treatment combinations evaluated. Both CH_4 and N_2O fluxes appear to be less sensitive to tillage practice than other rice production practices, such a cultivar and water management scheme. Collectively, season-long CH_4 and N_2O emissions measured from Arkansas-produced rice under a variety of production practices appear to be lower in magnitude than what has been reported recently from other rice-producing states under their common production system and practices. Consequently, if actual, more-direct data support lower greenhouse gas emissions than previously estimated for Arkansas rice production, then the position of Arkansas rice in the marketplace and consumer viewpoint of the sustainability of rice production could be strengthened.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
136	Conservation of Biological Diversity
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

Number of N-StaR samples processed.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Profitable rice production in the Mid-South requires annual applications of Nitrogen fertilizer (N). Until recently the N recommendations were based solely on previous crop and soil texture from data that was collected from a limited number of research locations. These recommendations, while adequate for many situations, do not account for "reserve" N which is available to rice on certain soil types and crop rotations. Over fertilizing is not only undesirable economically, but can enhance rice diseases, lodging, and allow for environmental N losses. Rice producers seek field-specific recommendations for N applications.

What has been done
The University of Arkansas Division of Agriculture's soil fertility team were the first to identify a novel method of soil testing and analysis to customize N recommendations on silt loam soils of Arkansas. A series of laboratory experiments and field trials led to the development of N-STaR (Nitrogen-Soil Test for Rice), a field-specific soil N test for rice in Arkansas. N-STaR is a soil-based N test that quantifies the N that will become available to rice during the growing season. Using a steam distillation procedure and analyzing an 18? deep soil sample (in contrast with a typical 4? sample), researchers were able to accurately predict the N needs of rice produced on silt loam soils 89% of the time. N-STaR samples submitted by rice growers ensure proper N recommendations to achieve optimum rice yields on a field-specific basis.
-N-STaR recommendations should optimize rice yields on all fields, but yields can be increased substantially where native soil N is very high or very low.
-N-STaR rates will be close to standard recommendations in many fields, but even small reductions in N applications affect the bottom line for rice producers.
-N-STaR has been available for rice produced on silt loam soils in Arkansas since the 2012 rice crop. N-STaR for clayey soils was on a limited release in 2014 and is now available for all soils in Arkansas.

Results
N-STaR has been adopted quickly by Arkansas rice producers. Since its inception, there have been ~22,000 samples representing more than 200,000 acres submitted to the N-STaR soil test lab. Significant reductions in the N rate recommendations are seen in for both clay and silt loam soils, where roughly ~78% and 69% of the samples analyzed suggest that on average 39 lb N/acre could be removed from the season total N program with no reductions in yield. The benefits of the N-STaR program are numerous, but knowing exactly how much N is required to maximize yield for each individual field is a great tool that has both agronomic, economic and environmental impacts.
The success of N-STaR technology in rice has led researchers to explore similar programs targeting wheat and corn in Arkansas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Number of new assessment and management tools developed, including models and measurements of greenhouse gas emmisions

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
How does water quality change? It is improving, getting worse, or just staying the same? These are questions that often asked for many reasons, including the State?s investment in water-quality monitoring, best management practices, and other voluntary actions. The Arkansas Water Resources Center continues to monitor water quality in streams in Northwest Arkansas to answer these questions.

What has been done
The Arkansas Water Resources Center, funded by the 319 Nonpoint Source Program of the Arkansas Natural Resources Commission, collects water samples from streams in the Upper Illinois River Watershed, Upper White River Basin and the Poteau River Watershed. These water samples were analyzed for chloride, nitrogen, phosphorus, sediment and sulfate at its water quality lab, which is certified by the Arkansas Department of Environmental Quality. The data was organized, and then water quality trends were evaluated using flow-adjusted concentrations and cool statistical techniques.

Results
The Arkansas Water Resources Center noticed four distinct findings that were important to the State. First, short-term changes in water quality (measured via flow adjusted concentrations) are influenced by variation in climate and hydrology. Second, the recent reductions in phosphorus from the City of Springdale's wastewater treatment plant has reduced phosphorus concentrations in Spring Creek, however, these improvements have not been observed further downstream in the Illinois River yet. Third, there is an increasing trend in chloride and sulfate concentrations in some streams - why is an important question, but it might be related to salt use during winter. Last, the site specific criteria form minerals in streams might need to be revised to consider underlying geology and biological response. These data are critical to our understanding of how we influence water quality with what we do in our watersheds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Number of current year citations of climate related publications.

2. Associated Institution Types

- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2018	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

Number of program participants who indicate a change in behavior, based on lessons learned during Environment, Energy & Climate programs.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3408

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is limited field-based information on the role of agricultural production systems on water quality in Arkansas. This continues to challenge farmers, farm advisers, and State agencies provide sound advice on if remedial measures are actually needed in the first place, what measures would be most cost effective, and where these measures would provide the great benefit at a watershed scale. This is of particular importance for nutrient management and erosion, which are two primary reasons for water-use impairment designations in Arkansas and in providing sustainable production systems and ecosystem resource protection.

What has been done

Division scientists have undertaken the following major tasks:
a.Implement and conduct monitoring and research on conservation practices that limit nutrient runoff from poultry production facilities, adoption of rotational grazing on soil health and water quality, and use of cover crops to minimize sediment and nutrient runoff from row crop settings.
b.Assess the impact of farming operations (effluent holding ponds and land-application of effluent) on the quality of critical water features on and surrounding the C&H Farm including springs, ephemeral streams, creeks and ground water.

Results

Across all twelve Discovery Farms, conservation practices (i.e., conservation tillage, cover crops, and riparian buffers) decrease nutrient runoff; however, there is a large annual variability in reduction efficiencies related to year-to-year rainfall fluctuations. Measured losses of nutrients, are less than losses predicted by nonpoint source models, which NRCS use to identify watersheds for conservation funding Mississippi River Basin. Measured losses are also less than losses predicted by models used in in nutrient trading assessment. Clearly, less nutrients are running off the farms we are monitoring than prior predicted estimates, which will negatively affect farmer eligibility in conservation cost share and nutrient trading programs.

In the Ozark Mountain karst region, nutrient concentrations in streams of the Buffalo, Upper Illinois, and Upper White River Watersheds increase as the percent of land in pasture and urban use increases. Averaged over the last three years, nutrient concentrations in Big Creek above and below the C&H Farm are similar to concentrations found in other watersheds where there is a similar amount of pasture and urban land use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
136	Conservation of Biological Diversity
403	Waste Disposal, Recycling, and Reuse
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Number of participants (both youth and adult) indicating new knowledge gained as a result of Environment, Energy & Climate programs.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wetlands provide economic value in the form of direct benefits, such as harvestable timber and fish, and indirect benefits, such as water purification, flood abatement and wildlife habitat. To combat these losses, the Wetland Reserve Program (WRP) was introduced in the 1990 Farm Bill to provide financial and technical assistance to land owners to help facilitate the restoration of these converted agricultural lands back to their natural wetland state. While many studies have taken a look at quantifying direct benefits, ways of quantifying indirect benefits have proven to be a much more complicated process. Due to this level of complexity, there is no prior investigation into the return on investment of the WRP. The goal of this study is to quantify the financial benefits that wetlands provide to homeowners and provide an estimate for the overall impact of the WRP on housing prices within the Lower Mississippi River Basin Region. Our work in the current reporting period focuses on the impact of WRP in Arkansas.

What has been done
In this project, we propose to monetize improvements attributed to constructed wetlands supported by the ACEP (formerly the WRP) program through the housing market. In accomplishing this task, we will review previously completed research, collect wetland restoration and housing transaction data. We will then build a hedonic model and use different identification strategies to estimate the impact of WRP on housing prices. For our study we utilize three main data sources. Our first collection of data was provided by Zillow that contains the most complete universe of property information. The dataset contains two major groups, transaction and assessment data. The transaction data is a collection of data sets that contain information about individual transactions of houses and how much these houses were sold for. The information

collected from these data sets was the transaction prices of the house, the address, the longitude and latitude coordinates for each house. The assessment data is a collection of data sets that contain information about the houses that were assessed by Zillow. These data sets included the information that we needed to create our housing characteristic vectors, such as the number of bathrooms, number of fireplaces, square footage, lot size, and year built. Additionally, this data set contained locational information like full property address (street address and zip code), longitude, latitude, state, and county. For our second data set we worked with the National Resource Conservation Service (NRCS) to obtain the WRP easement information through a data agreement. The data base contains information for all easements enrolled in either the WRP program from 1992 to 2017. The information provided is the state, county, agreement number, enrollment type (easement, 30-year contract with Indian land, and restoration cost-share agreement), enrollment duration (30 year, permanent or cost share agreement), the first year of enrollment, the agreement status (active or completed), the acre count, the amount of acres that are crop acres, the completion date, the first year of restoration, the closing date, the application date, the longitude, the latitude, and whether or not the easement's enrollment was part of a group project. There are 666 easements in the State of Arkansas. Our final data set provided information about the types of wetlands that are present at each easement was determined using the National Wetlands Inventory (NWI) produced by the Fish and Wildlife Service (FWS). This data set includes information about the longitude and latitude of all documented wetlands within the United States, as well as the type of wetland as determined by the FWS determination system. The differing wetland types that we see in our data set are riverine, freshwater forested/shrub, freshwater emergent, freshwater pond, and lake wetlands.

Our main modeling strategy is using a Difference-in-Difference method (DID). We also perform robustness checks using a fixed model with varying buffer sizes, a falsification test in which we alter the date of restoration, and a regression discontinuity model to determine the significance of our housing price changes at the time of restoration.

Results

Our estimated average treatment effects range from 5-7% depending on the model specifications. The robustness checks indicate that our assumptions hold true. Overall, we estimate that the WRP program has generated a $120 million increase in housing prices for the state of Arkansas. We will further generate an estimate for the whole Lower Mississippi River Basin Region. Our results have important implications for evaluating the cost-effectiveness of the WRP and provide potential recommendations for more efficient conservation policies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
136	Conservation of Biological Diversity
204	Plant Product Quality and Utility (Preharvest)
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes

601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #7

1. Outcome Measures

Number of program participants indicating new knowledge of water quality and conservation best management practices

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	8139

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
511	New and Improved Non-Food Products and Processes

Outcome #8

1. Outcome Measures

Number of producers who changed or adopted new production and/or conservation management practices or technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2093

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
136	Conservation of Biological Diversity
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #9

1. Outcome Measures

Number of program participants indicating the adoption or implementation of new water quality and conservation best management practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	135

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Socially disadvantaged Producers (SDPs) operate some of the most un-improved land in the state. A large portion of their crop land is non-irrigated, not precision leveled, and it has no underground pipe with risers to enhance irrigation. Much of the pasture land lack cross-fencing and water troughs which prevents them from practicing rotational grazing. Most SDPs do not leave adequate crop residue on the surface after harvesting to prevent erosion and few are using cover crops in an attempt to build soil health. The failure to use conservation practices like (329) residue and tillage management, (328) Conservation Crop Rotation, (340) Cover Crops, (382) Fence, (430) Irrigation Pipeline, (464) Irrigation Land Leveling, (528) Prescribe Grazing, and (590) Nutrient Management have resulted in an increase in the environmental degradation on many of these farms and ranchers.

What has been done

The University of Arkansas at Pine Bluff (UAPB) partnered with the Natural Resources Conservation Service (NRCS) to help SDPs use the Environmental Quality Incentive Program (EQIP) to install environmentally friendly conservation practices on their farm and ranches. This involved working with NRCS to educate SDPs about the EQIP Program, eligibility requirements, different EQIP Conservation Practices, building trust between some participants and NRCS, and in some cases assisting SDPs in signing up for the EQIP Program

Results

Many SDPs have learned about the EQIP Program. These producers now realized how important it is to use the program to improve their land. They also realize the environmental benefits that comes from using the program. Despite having problems with heir property (no clear title and cannot participate in the program), we estimate that at least 20 SDPs signed-up for the program and received approximately $250,000 in EQIP Funds to install environmentally friendly conservation practices on their land.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management

Outcome #10

1. Outcome Measures

Number of farm pond owners who indicate new knowledge of pond management

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	81

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
134	Outdoor Recreation
601	Economics of Agricultural Production and Farm Management

Outcome #11

1. Outcome Measures

Number of fisheries biologists indicating new knowledge of populations of important Arkansas fisheries

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Trout anglers contribute $180 million in expenditures to the Arkansas economy each year. They spend an average of 18 days/year trout fishing and their efforts are focused on the tailwaters of the White and Little Red Rivers. Brown Trout are naturalized in the Little Red River tailwater and no stocking is required to maintain the fishery. This is a high-profile fishery. Regulations are scrutinized by the public and a lack of data on spawning characteristics currently exists.

What has been done
The first year of the study (i.e., fall 2017 to spring 2018) two goals were undertaken for this objective. The first goal was to validate or expand areas currently thought to be used for spawning. Areas thought to be used by fish for spawning were validated and two new spawning locations were found. The second goal was to validate measurement techniques used to collect

data at redd sites. Techniques used returned quantifiable measurements that are easily compared between presence and absence sites. These techniques will be used in the next three years of the study.

Sampling to characterize temporal and spatial use of available spawning habitats began during the second year of study (i.e., fall 2018). River surveys are to be conducted every other week. The accumulation of redds both spatially and temporally are being monitored and recorded using GPS.

Results

Generalized suitability curves constructed from literature data do not often utilize the reported sample size. By not explicitly considering sample sizes, observations are considered equal potentially creating bias when curves are formed. We propose a new method for creating suitability curves from literature data that directly incorporates sample size into curve construction. We created redd distributions for depth, velocity, and substrate size by simulating distributions using sample sizes and summarizing using graphical methods. We constructed suitability curves for spawning site selection using general additive functions and calculated probable (>0.5 probability) and possible (>0.1 probability) redd locations. We collected habitat data from Brown Trout redds in Greers Ferry Tailwater, AR to compare our suitability curves with prior suitability curves from the literature. Our curves for depth, velocity, and substrate size independently classified 81.6, 89.8, and 93.9% of redds correctly. The overall correct classification rate for our curves was 69.4%, which is 10% higher than suitability curves that did not incorporate sample size. When considering possible red locations, overall correct classification was 93.7%. The incorporation of sample size increased curve accuracy offering a more accurate approach for estimating spawning habitat for Brown Trout.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
134	Outdoor Recreation
601	Economics of Agricultural Production and Farm Management

Outcome #12

1. Outcome Measures

Number of acres and/or stream miles on which wildlife/ fish habitat is improved

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4007356

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
134	Outdoor Recreation
136	Conservation of Biological Diversity

Outcome #13

1. Outcome Measures

Number of acres on which woodland is improved as self-reported

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3650

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources

Outcome #14

1. Outcome Measures

Number of acres using best practices for water quality and nutrient management

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	32000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation

Outcome #15

1. Outcome Measures

Number of water samples submitted

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	366

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #16

1. Outcome Measures

Number of forest landowners and managers trained to develop forest stewardship plans

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	216

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
134	Outdoor Recreation
136	Conservation of Biological Diversity

Outcome #17

1. Outcome Measures

Number of forest stewardship plans initiated, supported or developed

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
134	Outdoor Recreation
136	Conservation of Biological Diversity

Outcome #18

1. Outcome Measures

Number of nutrient management planning tools developed

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The production of animal derived food and products generates manure byproducts. The management of these byproducts has potentially significant impacts on food production, societal economic wellbeing, human and animal health, as well as environmental quality. Concerns regarding these potential impacts on farmers, neighbors, and consumers has resulted in numerous regulations and policies that livestock producers and those that manage manure byproducts must adhere too. Central to most of these is the development of farm specific Nutrient Management Plans based on farm conditions, phosphorus and nitrogen runoff risk, and crop agronomic requirements.

What has been done

In keeping with the land grant mission of dispersal of research based information and service, a Microsoft Excel workbook based nutrient management planning tool (ARNMP) has been developed and refined over a number years. In the past the tool has been provided to nutrient management planners to facilitate and expedite their plan writing process. Over time, both the Arkansas Department of Environmental Quality, the Arkansas Natural Resources Commission, and the Natural Resources Conservation Services have come to expect plans be written using ARNMP. In the past ARNMP was distributed via email. This year the latest version was posted to www.uaex.edu/manure. This posting was advertised via email to key personnel within the agencies listed above with a request to forward to their appropriate internal and external personnel.

Results

This long term effort developed the state's primary nutrient management planning tool that is focused at Arkansas landowner and nutrient planner needs. The tool is provided at no charge to potential users. This provides Arkansas' limited number of certified planners a tool targeted at the writing of nutrient management plans that meet certification requirements. In addition the tool coupled with Extension's planner certification train helps to ensure that written plans are structurally uniform which facilitates agency review. Both of which helps to reduce the development/approval time of a plan as well as increase the number of plans that can be written/revised. A benefit to Arkansas landowners and their downstream neighbors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #19

1. Outcome Measures

Number of research papers reporting on reduced GHG emissions in AR rice production

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is estimated by some that rice cultivation worldwide contributes 11% of the global CH4 (methane) anthropogenic emissions. Arkansas is the largest rice production state, with about half of U.S. total rice production. One potential solution to the CH4 challenge is the Alternate Wetting and Drying (AWD) irrigation practice, which conserves water while reducing CH4 emissions through the deliberate, periodic introduction of aerobic soil conditions. This method has been studied as a CH4 reduction practice with chamber-based approaches mostly in experimental plot trials, but has not been examined using eddy covariance (EC).

What has been done
The EC method provides continuous, direct observations over a larger footprint than in previous studies. This work is necessary to connect the carbon and water cycles in these agricultural systems, as farmers are increasingly testing different water-saving irrigation strategies. These strategies include multiple inlet irrigation using lay-flat poly-pipe, furrow irrigation, and zero-grading fields, as well as the use of more productive hybrid varieties to maximize harvest yield for the same water inputs.

Results
Research is underway on the AWD method and related water saving strategies for rice production in Arkansas. A recent paper is the first to report the impact of AWD on rice field CH4 emissions with the eddy covariance method. Seasonal CH4 emissions from a pair of adjacent, production-sized rice fields under delayed flood (DF) and AWD irrigation were compared from 2015 to 2017. Correcting for field-to-field differences in CH4 production, the AWD practice reduced seasonal CH4 emissions 64.5 ± 2.5%. No significant differences in harvest yield were determined between the two practices. The AWD practice is increasingly implemented and incentivized for water conservation in the U.S. Mid-South; however, this study shows it also has great potential for reducing CH4 emissions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation

Outcome #20

1. Outcome Measures

Number of research projects focused on mitigation of soybeans to climate change

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop yield depends upon a tremendous amount of water from the soil. Weather variability associated with climate change will likely intensify the need for crops that efficiently use water resources. In soybean, and some other crops, the ratio of the carbon with a molecular weight of 13 relative to carbon with a molecular weight of 12 is closely associated with how efficiently different genotypes use water to produce plant dry matter. However, collecting plant tissue from hundreds or thousands of genotypes during a growing season is difficult. In contrast, seed are typically harvested in most agronomic experiments but it is unclear if there is a relationship between water use efficiency and the 13C to 12C ratio in soybean seed.

What has been done
Experiments were established at Fayetteville and Pine Tree, Arkansas and at Columbia, Missouri using 20 genotypes that previous research demonstrated differences in 13C: 12C in shoot tissue. When soybean was blooming, from each plot, three types of tissue were sampled: the entire shoot, the center leaflet from each main-stem node and
the uppermost fully expanded trifoliolate leaf. Plant tissues were dried, ground, and analyzed for 13C: 12C and compared with 13C:12C from mature seed. Statistical analysis indicated that differences among genotypes made up the majority of variation in 13C:12C for all of the tissues (57 to 84%). The variation in 13C:12C due to environment ranged from 3 to 24% of the total variation, but for seed, the genotype effect (84%) was the greatest among the tissues and the environmental effect (3%) was the least. There was no significant interaction of 13C:12C between genotype and environment for any tissue, but there were significant correlations of 13C:12C from whole shoot (r = 0.69), center leaflets (r = 0.82), and upper leaflet (r = 0.78) with 13C:12C from seed.

Results

These results indicate that genotypic rankings in 13C:12C measurements from different tissues should remain relatively constant, which makes breeding and selection efforts considerably less difficult. That seed 13C:12C values were closely associated with 13C:12C values from other tissues taken during the growing season indicates that seed samples routinely harvested at maturity can be used reliably as a surrogate measure of water use efficiency.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water

Outcome #21

1. Outcome Measures

Number of graduate students working on bioenergy or biofuels projects

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Local biomass such as pine needle or sweet potato stems can be converted to biochar as value added products to improve soil quality and promote plant growth. This study shown both pine needle biochar and sweetpotato stems biochar can be used to reduce the phytotoxicity and mobility Cu (common fungicides) therefore promote sweetpotato production and soil health.

Pine needle and sweet potato stems are abundant biomass in Arkansas. These biomass can be converted to biochar as value products for soil amendment to improve soil fertility and protect agriculture environment quality. However biochar made from different feedstock may have different properties (nutrient content, alkalinity, CEC, sorption capacity) which are important for agriculture practice.

What has been done

This study converted agriculture waste into biochar as a value added products, characterized their essential properties related to agriculture (pH, CEC, nutrient content); investigated copper phytotoxicity to sweet potato through greenhouse study; Examined the effect of pine needle and sweetpotato residue biochar as a soil amendment to improve soil structure and fertility; examined copper mobility in soils through column leaching experiments.

Results

The results showed that biochar amendment significantly raised soil pH and decreased water soluble Cu and exchangeable For Cu the contaminated soils remediation, sweet potato residue biochar (550ºC) are more effective than pine needle biochar (550ºC). After biochar application, most of the bioavailable Cu was converted into more stable Cu fractions. 50 days greenhouse sweet potato rooting experiment indicated the presents of biochar can reduce Cu phytotoxicity is can be reduced Cu phytotoxicity. However, excess amount biochar added to soil can also have adverse effect for plant health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #22

1. Outcome Measures

Number of biofuels projects with research conclusions

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are some 61 sawmills located in Northwest Arkansas that employ 5,306 workers in largely rural areas outside of the Fayetteville-Springdale-Bentonville metropolitan area. The City of Fayetteville has a goal of 50% clean energy by 2030 and 100% clean energy by 2050. There exists an opportunity to use sawmill residues in northwest Arkansas to generate clean electrical energy and heat that will increase jobs and revenue in rural northwest Arkansas and provide clean energy to the cities of the region.

What has been done
All 61 wood processing facilities (mills) in northwest Arkansas were surveyed for their production of woody mill residuals - defined as material converted from logs that did not go into a primary product such as lumber or railroad cross-ties. If the mills were able to sell the residuals, the price was obtained. From this data, supply curves were developed for woody residuals in the region.

Results
A total of 430,535 green tons of mill residue are produced annually in the region. However, much of the material was already being sold for a variety of purposes, from animal bedding to charcoal production. For electrical generation to be cost effective, the price of this biomass at sawmills must be less than $9.50 per green ton. At this price, 193,488 tons of wood biomass are available in the region. This supply is sufficient to power a 5 MW electrical generation facility. The supply curves were inelastic, meaning that increasing the quantity would result in rapid price increases of the woody biomass.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #23

1. Outcome Measures

Number of forestry professionals who maintained certification through training

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	515

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Division of Agriculture, Arkansas Forest Resources Center (AFRC) serves as lead partner in providing continuing forestry education credits (CFEs) to registered foresters in Arkansas and a major partner in regional CFE programming. Registered foresters are required by State law to obtain "8 CFEs each year to maintain their license for practice."

What has been done

AFRC faculty and county Extension personnel, working with the Arkansas State Board of Registration for Foresters and the Society of American Foresters (SAF), hosted a series of meetings that provided CFEs for Registered Foresters, with attendance averaging about 200 per meeting. Additionally, AFRC Forestry Extension conducted special topics short course trainings utilizing UA Agricultural Experiment Station based forest research projects for professional education programming. Center faculty served as program coordinators, meeting planners, organizers, and speakers at all programs designed to meet the educational needs for registered foresters. Extension faculty members in collaboration with the AR Division of the Ouachita Society of American Foresters and the AR Board of Registration for Foresters planned and implemented 3 Registered Foresters Workshops.

Results

In FY18, over 390 registered foresters attended and maintained their certification which represents 88% of the state's registered foresters and potentially impacted 5.0 million acres of forest land. Special topics courses in hardwood management and forest herbicides resulted in training 125 professional foresters. Approximately 4 million acres were potentially impacted through special topics training. Additionally, these meetings resulted in the potential impact of 20 dollars per managed acre through improved forest management decision-making and planning efforts by forest managers, with a total direct impact of 3.0 million dollars in the short term. Benefit to cost ratio was tremendous with a calculated return on investment of 191/1.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
605	Natural Resource and Environmental Economics

Outcome #24

1. Outcome Measures

Number of forest industry manufacturing projects developed as a result of educational efforts

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Arkansas Wood Utilization Council is a collaboration between the Arkansas Forest Resources Center, forest industries, numerous state and federal agencies, and forest landowners. The Wood Utilization Council conducts research and monitoring of Arkansas' forest industries, reports on industry contributions to the state's economy, and works to identifies new markets and market opportunities for forest industry and forest landowners.
Arkansas forest industries contribute 69,571 jobs, $3.7 billion in labor income, and $6.7 billion to the state's economy. Forest product manufacturing facilities exist in every county in the state and Arkansas' economy is more dependent on forestry than any other state in the Southern United States.

Some 214,000 private forest landowners depend on wood markets to provide income and a means to maintain forest health through management activities. More than 2,000 natural resource professionals and business owners in the state rely on the research generated by the Wood Utilization Council to assist in their decision-making about investment and expansion of the forest industries in the state.

What has been done

The Wood Utilization Council has collaborated with various partners to put on workshops, short courses, and presentations for natural resource professionals. The Council publishes timber outlook and economic contribution information and distributes this data throughout the state. When requested, specific information on timber supply and wood markets are provided to interested state agencies and directly to industries considering new or expanded forest-based economic development in the state.

Results

The Wood Utilization Council trains federal foresters in southern timber markets annually as part of the USDA Forest Service National Advanced Silviculture Program, and more than 400 registered foresters in the state were provided data from the Council in 2018.

Data on forestry's contribution to Arkansas's economy was delivered through workshops and short courses to more than 500 professional natural resource managers in the state in 2019.

Criteria for sustaining a viable wood market for landowners was delivered to 50 landowners representing more than 50,000 acres of forest land in southwest Arkansas in 2019.

Annually, the Wood Utilization Council's timber outlook is disseminated to more than 200,000 private forest landowners that own more than 11 million acres of forestland in the state.

Four private industries requested market information and timber supply data in 2018. These industries are developing projects with the potential to add 1710 jobs in forest-based manufacturing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The availability of federal sources of funds for research related to Environment, Energy & Climate has not changed dramatically in recent years, yet the demand for answers has increased dramatically. The frequency of heat stress, particularly high nighttime temperature stress in rice, has caused led to several projects aimed at mitigation to a changing climate.
The price of crude oil and the resulting retail prices of gasoline, has led to a general apathy among growers and researchers regarding alternatives to fossil fuels. There is little incentive or interest in biofuels from a public priority standpoint.
The public has high expectations for science-based answers regarding environmental problems, but little patience for the time-consuming, peer-reviewed process to find the solutions.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Surveys of participants and stakeholders are utilized to provide both direction to future programs and to evaluate current programs. Surveys are conducted during workshops to determine current knowledge levels and to determine any changes in knowledge as a result of the program.

UA Extension utilizes input from a survey results of AR Tree Farmers regarding their preference in topics in program planning. Based on a survey of Tree Farmers the top four topics of interest were: 1) how to harvest timber (45%); selling and marketing timber (43%);

3) protecting woodlands from insects and disease (42%); and 4) managing wildlife habitat and wildlife problems (42%). Members of the Tree Farm System are often the most motivated of landowners. Working closely with the State Tree Farm board provides valuable program direction and ensures that our Extension efforts are based upon key stakeholder input. A series of workshops focused on marketing timber and certification options for private landowners was developed based on this input.

In 2018, over 390 registered foresters attended and maintained their certification which represents 88% of the state's registered foresters. Special topics courses in hardwood management and forest herbicides resulted in training 125 professional foresters. Approximately 4 million acres were potentially impacted through special topics training. Additionally, these meetings resulted in the potential impact of 20 dollars per managed acre through improved forest management decision-making and planning efforts by forest managers, with a total direct impact of 3.0 million dollars in the short term. Benefit to cost ratio was tremendous with a calculated return on investment of 191/1.
In 2018, the Farm Pond and Aquatic Vegetation Management in-service was held in Mountain Home. Nine agents received training on a variety of topics including aquatic plant ID and herbicide application. Six agents completed an online evaluation. All six considered the in-service "very valuable" and were satisfied with the preparedness and performance of the instructors. While enrollment in the in-service remains low, agents who receive the training appear to be satisfied and they believe that they will be better prepared to handle pond-related issues in the future.

Key Items of Evaluation

The number of publications distributed and website hits on subjects that inform to Environment, Energy & Climate are good indicators of stakeholder interest.
Adoption of N-STaR can be predicted and quantified by the number of soil samples submitted for N-STaR analysis. The number of new N-STaR enrollees indicates that more farmers are adopting the N-STaR recommendations, which frequently call for reduced rates of N on rice.
Patents awarded are a good evaluation of novel research discoveries, but the full impact of those discoveries is best measured by the number of successful commercial licenses and revenue from those licenses. We find no logical place to capture that data in this report.
The amount of funded research from federal, state, local and commercial partners indicates the relevance of the research programs conducted by the Division of Agriculture and UAPB, as well the competence and stature of the investigators. In 2018, Division and UAPB investigators were responsible for over $4.8 million in research related to Environment, Energy & Climate.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Access to Safe & Nutritious Food

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	5%	0%	0%	10%
502	New and Improved Food Products	0%	0%	21%	15%
503	Quality Maintenance in Storing and Marketing Food Products	0%	0%	1%	5%
504	Home and Commercial Food Service	10%	0%	1%	0%
701	Nutrient Composition of Food	0%	0%	10%	0%
702	Requirements and Function of Nutrients and Other Food Components	10%	40%	20%	15%
703	Nutrition Education and Behavior	25%	5%	10%	30%
704	Nutrition and Hunger in the Population	15%	0%	0%	0%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%	0%	9%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%	45%	23%	25%
723	Hazards to Human Health and Safety	0%	0%	5%	0%
724	Healthy Lifestyle	15%	10%	0%	0%
806	Youth Development	10%	0%	0%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	51.1	0.5	80.0	4.3
Actual Paid	79.6	0.5	56.7	3.6
Actual Volunteer	5.7	0.0	2.3	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
576594	3804	795105	182163
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
576594	0	4625059	217751
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
7300110	0	513378	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Division of Agriculture and UAPB faculty developed, evaluated, and disseminated education programs and curricula, incorporating new research and emphasizing healthy lifestyles to prevent and/or reduce adult and childhood obesity and other diet related diseases. Programs included but were not limited to:

- Supplemental Nutrition Assistance Program Education (SNAP- Ed and FFNews) Adults and Youth
- Expanded Food and Nutrition Education Program (EFNEP) Adults and Youth
- Healthy weight programs
- Arkansas Farm to You
- USDA Eat Healthy, Be Active Workshops
- Living Well with Diabetes
- Cooking schools

Division of Agriculture and UAPB faculty conducted novel research to determine the impact of diet and food composition and functional food components on body weight and health.
UA Division of Agriculture researchers continue to work with UA Fayetteville, the University of Arkansas for Medical Sciences (UAMS), and the Arkansas Children's Research Institute examining the link between childhood obesity outcomes and features of the food, social, and built environment. The Arkansas Children's Research Institute and the UAMS Arkansas Center for Health Improvement (ACHI) provide access to a unique individual-level dataset on obesity outcomes. Access to these data allows research to be conducted at a level of detail and accuracy that is not possible with national-level datasets.
The Division of Agriculture and UAPB faculty and staff developed, evaluated and disseminated education and curricula incorporating research and teaching for food safety and processing. Programs included:

- Quarterly HACCP Roundtable meeting
- HACCP workshops
- Food safety and preservation workshops for consumers
- Better Process Control School.
- ServSafe workshops
- Culinary arts training for food industry personnel
- Online distance education in food safety and manufacturing
- Assistance to small food companies and entrepreneurs in the form of services, workshops, and consulting.
- Science-based information on catfish production, processing and economics to USDA-FSIS to assist with development of the new food safety inspection.

Research activities in food safety included work to better understand the ecology of food pathogens, improve food processing systems to minimize food pathogens and to improve detection systems for Listeria, Salmonella, E. Coli and other major food pathogens.
Research activities in food chemistry and food processing included work to (1) improve the quality of rice and improve rice processes, (2) expand the utilization of soybeans and its co-products, (3) assess the health benefits associated with fish, vegetables and other processed foods, and (4) improve the sensory quality of processed foods.

2. Brief description of the target audience

Youth
School personnel
Parents
Adults
Child Care Providers
Researchers
Food Manufacturers
Farmer's Markets
Farmers
Limited resource farmers
Entrepreneurs and Restaurants
Food Service Employees and/or Food Handlers
Employers & Employees
Health Professionals
Consumers
State & federal agencies
College Students
Catfish farmers and processors

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	150947	623461	317879	19036

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

Patent Applications Submitted

Year:	2018
Actual:	3

Patents listed

9,913,893. Vaccine Vectors and Methods of Enhancing Immune Responses. 3/13/18. Bottje, et.al.

10,004,798. Compositions and Methods of Enhancing Immune Responses. 6/26/18. Hargis, et.al.

9,894,920. Yeast Fermentation of Rice Bran Extracts. 2/20/18. Hettiarachchy

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	5	41	46

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of 4-H/Youth Food, Nutrition and Physical activity programs delivered related to eating healthy, being active, and safe food handling
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of youth contacts in youth Food, Nutrition, and Physical Activity programs related to eating healthy, being active, and safe food handling

Year	Actual
2018	59147

Output #3

Output Measure

- Number of adult contacts from educational events (educational classes, workshops, group discussions, one-on-one interventions, demonstrations and other educational activities) related to eating healthy, being active, and safe food handling

Year	Actual
2018	122094

Output #4

Output Measure

- Number of Online Master of Agriculture (Food Safety Emphasis) students enrolled in courses

Year	Actual
2018	33

Output #5

Output Measure

- Total competitive federal Grant $ for program area

Year	Actual
2018	2590597

Output #6

Output Measure

- Total non-federal competitive grant $ for program area

Year	Actual
2018	2671079

Output #7

Output Measure

- Number of participants in educational programs leading to graduation from the Better Process Control School

Year	Actual
2018	67

Output #8

Output Measure

- Number of participants in educational programs leading to ServSafe certification for managers

Year	Actual
2018	152

Output #9

Output Measure

- Number of participants in quarterly HACCP roundtables

Year	Actual
2018	127

Output #10

Output Measure

- Number of culinary workshops for food technologists

Year	Actual
2018	5

Output #11

Output Measure

- Number of participants in culinary workshops for food technologists leading to certification as Certified Culinary Scientist

Year	Actual
2018	18

Output #12

Output Measure

- Number of culinary workshop participants completing 120 hours of required contact time for the Certified Culinary Scientist recognition

Year	Actual
2018	10

Output #13

Output Measure

- Number of food processing laboratory services provided

Year	Actual
2018	10

Output #14

Output Measure

- Number of nutritional labels developed

Year	Actual
2018	273

Output #15

Output Measure

- Number of food processing approvals developed (2541a)

Year	Actual
2018	35

Output #16

Output Measure

- Number of adult nutritional programs delivered related to eating healthy and being active

Year	Actual
2018	120184

Output #17

Output Measure

- Number of briefings to catfish farmers and catfish processors
  Not reporting on this Output for this Annual Report

Output #18

Output Measure

- Number of presentations to catfish farmers and processors
  Not reporting on this Output for this Annual Report

Output #19

Output Measure

- Number of emails, phone calls, and conference calls to catfish farmers and processors
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants receiving certification in Better Process Control
2	Number of participants receiving certification in ServSafe
3	Number of participants in other workshops related to Food Safety including HACCP, food safety, food defense, food labeling, and food microbiology workshops receiving attendance certification
4	Number of growers and producers receiving GAP certification or equivalent (gaining access to new markets)
5	Number of youth demonstrating improved knowledge of food safety or hand washing
6	Number of Online Master in Food Safety graduates employed in the food industry
7	Number of viable technologies developed or modified for the detection and characterization of foodborne pathogens
8	Number of viable prevention, control and intervention strategies for foodborne threats in the food system
9	Number of culinary workshop participants passing the examination to become a Certified Culinary Scientist
10	Number of viable technologies developed or modified for improving food processing systems
11	Number of viable technologies developed or modified to improve the nutritive quality of foods
12	Number of small businesses started as a result of the food entrepreneur assistance program
13	Number of children that reported eating more of healthy foods.
14	Number of children who increase physical activity
15	Number of adults who improve food preparation skills
16	Number of adults who decrease sodium intake
17	Number of adult participants who increase consumption of foods recommended by the Dietary Guidelines for Americans

18	Number of adult participants who decrease consumption of foods recommended by the Dietary Guidelines for Americans
19	Number of public agencies personnel, aquaculture industry personnel, and general public individuals with increased understanding of food security and safety issues related to fish consumption in imported catfish and catfish-like products as compared to U.S. farm-raised catfish
20	Number of adults who report improved food security after participating in a nutrition education class

Outcome #1

1. Outcome Measures

Number of participants receiving certification in Better Process Control

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of participants receiving certification in ServSafe

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	152

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Most foodborne illness is preventable by the actions of the person preparing food and it needs to be part of their thought process of how to prepare food properly. In retail foodservice establishments, it must be the manager that behaves that way each and every day. Having Active Managerial Control in the foodservice environment is a key component of the Model Food Code issued by FDA and adopted in part by all states.

What has been done
During 2018, Extension conducted ServSafe training in partnership with representatives of the

Arkansas Department of Health to both foodservice managers and to food handlers.

Results
Through the ServSafe program, 152 managers were certified and an additional 205 food handlers received foundational training.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Number of participants in other workshops related to Food Safety including HACCP, food safety, food defense, food labeling, and food microbiology workshops receiving attendance certification

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	74

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The poultry industry is a mature industry that is both commodity market and value-added consumer products with higher profit margins. Food safety is an issue that will always be of concern as long as we continue to produce, distribute and consume foods of animal origin.

What has been done
To serve as an educational resource for the poultry industry, the Center of Excellence for Poultry Science and the U of A System Division of Agriculture offered both a Basic HACCP workshop that is required by USDA regulations as well as an Advanced HACCP workshop and the Food Safety Preventive Controls for Human Foods workshop that is the approved curriculum for FDA regulated facilities.

Results

The impact of Food Safety educational efforts are usually difficult to measure by the absence of a problem and the education does not necessarily change the unsafe condition (meat and poultry that has pathogenic bacteria that are controlled by proper handling and cooking). Success is measured by the low incidence of foodborne illness, not the complete absence.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Number of growers and producers receiving GAP certification or equivalent (gaining access to new markets)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	219

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Produce which will not be cooked prior to consumption can cause severe illness and death if the produce is exposed to birds, rodents or contaminated surface waters.

What has been done
Both UAPB and UACES address this issue with Extension activities to deliver programming to farmers, growers, processing sheds, farmers markets, and consumers. Prevention is through Good Agricultural Practices (GAP) and Good Handling Practices (GHP).

Results
UAPB focuses on training local farmers on GAP and GHP via manuals, on-site presentations at individual farms and Field Day Activities. UACES utilizes the Produce Safety Alliance curriculum to deliver the equivalent training related to developing a food safety plan for produce production and handling. UACES documented 219 participants who successfully completed the Produce Safety Alliance curriculum recognized by FDA to satisfy training requirements in the Produce

Safety Rule.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Measures

Number of youth demonstrating improved knowledge of food safety or hand washing

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2329

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
724	Healthy Lifestyle
806	Youth Development

Outcome #6

1. Outcome Measures

Number of Online Master in Food Safety graduates employed in the food industry

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food Safety remains an important national issue for the public and the food industry. With the advent of the Food Safety Modernization Act, there is increased depend for food safety professional to receive food safety education and gain credentials in food safety while employed in the food industry.

What has been done
Faculty in the Division of Agriculture developed a distance education based graduate degree in food safety. The program is one of a handful in the nation to be delivered via distance. Since its inception, the program has served over 150 food safety professionals and the demand for the program continues to grow.

Results
There are currently 33 students enrolled in the program and the University of Arkansas had 8 students graduating from the program in 2018.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #7

1. Outcome Measures

Number of viable technologies developed or modified for the detection and characterization of foodborne pathogens

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Salmonella is a known pathogen that we expect at some level in all raw foods of animal origin. The USDA Salmonella Performance Standard is based upon percent positive where one cell will be positive. This is difficult to manage because very little is learned from percent positive, but enumeration is also expensive in not as precise.

What has been done
One research group has a novel approach to the classical way to actually count Salmonella by using the Most Probable Number (MPN) technique combined with quantitative PCR and using a shorter incubation time.

Results
For Salmonella Typhimurium, the new method could quantify the organism in less time than the MPN alone with a lower detection level than with normal qPCR. This may someday provide better information to processors to fine tune interventions and establish process control.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #8

1. Outcome Measures

Number of viable prevention, control and intervention strategies for foodborne threats in the food system

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Salmonella, Campylobacter and human Norovirus are 3 of the leading causes of foodborne illness. Most of the interventions put in place up to now have reduced the organisms, but the rate of illness in humans remains low but unaffected significantly.

What has been done
The research is focused on better understanding of the environment of these organisms and what might work to impact their ability to survive food distribution

Results
Feeding chickens a specific secondary bile acid reduced colonization of C. jejuni by at least 93% while another secondary acid and a primary bile acid had no effect. A prebiotic trial to inhibit Salmonella colonization has shown that Salmonella may adapt to feed treatments and the response to treatments are multivariable. A third research trial used ozonated water to batch-wash produce to reduce E. coli, Salmonella and Listeria by 99.99%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #9

1. Outcome Measures

Number of culinary workshop participants passing the examination to become a Certified Culinary Scientist

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The food industry is a mature industry that is part commodity market and part value-added with higher profit margins. Individual company growth in profits can be expected from increased percentage of value-added, convenience and foodservice markets. This is typified by the acquisition of Hillshire Farms and Advance Pierre by Tyson Foods in order to leverage the strong performance of Hillshire's category leading brands in several value-added and convenience segments.

What has been done
UACES has offered this program for 14 years, starting with the poultry industry locally. The program expanded in 2008 to a public offering and has become the only public offering available in the US for all 120 hours required to become certified. Because the Research Chefs Association requires involvement of an educational body, UACES also is part of the team that does 120 hours a year in Wisconsin for a corporate client.

Results
Passing the certification exam is the final milestone of recognition and that is administered at testing centers separate from the UACES program. UACES was the provider of at least 40 hours of the 120 hours required for 14 of 47 persons becoming certified internationally in 2018.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service

Outcome #10

1. Outcome Measures

Number of viable technologies developed or modified for improving food processing systems

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rice kernels are subjected to extensive mechanical stresses during harvesting, drying, dehulling, and milling. The head rice yield is usually in the range of 55-65% for regular rice. Parboiling, which involves soaking, steaming and drying, is a method of precooking rice within the hull to improve head rice yield (usually above 70%). The increase in head rice yield in parboiled rice has mainly been attributed to the changes from cooking, however it is not known the influence of rice components on head rice yield.

What has been done
UA researchers found that parboiled rice had a significantly greater density than the non-parboiled rice, and the density of rice kernels was positively correlated with the breaking force. The results demonstrate the importance of rice chemical components and their arrangement on density and head rice yield. Any approaches, e.g. breeding and processing, to increase density will improve head rice yield.

Results
A project titled "Applying A Material Science Approach to Optimize Rice Processing Performance" has been awarded by UADA-AFRI for $256,195 for three years to understand how rice chemical components affect rice kernel density and how processing conditions affect their arrangements. The study provides benchmark information on how chemical composition and starch structure affect head rice yield. The information is to be used to provide guidelines for use in developing rice cultivars with improved mechanical properties and in optimizing processing conditions to improve yield and to reduce waste.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products

Outcome #11

1. Outcome Measures

Number of viable technologies developed or modified to improve the nutritive quality of foods

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumption of energy-dense snacks contributes to arise of obesity cases nationwide. Consumers are becoming more health conscious than ever before and are shifting toward natural food and healthy nutraceutical food products. Germinated rice and green grams have potential for use to develop healthier snack chips with less dense calorie.

What has been done
Rough rice and green gram were soaked and germinated. The germinated rice and green gram were analyzed for their moisture, protein, lipid and starch contents, lipoxygenase-1, lipoxygenase-3 and trypsin inhibitor activities as well as their estimated glycemic indexes. The rice and green gram flour combinations with the optimum nutrition properties and low glycemic index were used to prepare healthy snack chips. The prepared chips were analyzed for their estimated glycemic index (GI) value and consumer sensory acceptability.

Results
Chips made from germinated rice and green gram had higher consumer sensory attributes (5.3 on 9-point hedonic scale versus 4.8 of chips from non-germinated rice and green gram) and lower glycemic index value (4% lower) in comparison to chips made from non-geminated flours. Germination of rough rice and gram green decreased starch, trypsin inhibitor, lipoxygenase-1 and lipoxygenase-3 activity, and glycemic index value. These germinated rice and green gram, as

ingredients, with lower starch content contributes to lower glycemic index that can minimize the risk of obesity. The findings have been published in an open access scientific student journal for exposure to the public and other interested researchers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components

Outcome #12

1. Outcome Measures

Number of small businesses started as a result of the food entrepreneur assistance program

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Improving food processing

What has been done
Assisted entrepreneurs in food safety, scale-up, and sifting through regulations in order to receive a State-issued food manufacturing permit. The Arkansas Food Innovation Center (AFIC) continues to provide increased productivity options to its food producers; helped find better produce to maximize the marketability of the finished product and streamlined production through process changes with existing equipment or new equipment

Results

AFIC brought on seven new clients. The products they produced include spices, bagels, infused honey, lentil crackers, salsa, hot pepper caramel, and valued-added mushroom products. All companies were educated in food safety, GMPs, scale-up processes, and sifting through regulations in order to receive a State-issued food manufacturing permit. The standouts are the lentil crackers and mushrooms. As a single person manufacturer, the lentil cracker client can produce 3400 units in an 8-hour period. The mushroom client is working with a local chef on mushroom jerky and broths. Both of which will fill an untapped niche market. With investment of $1000, processing duration was decreased by 30% for a $400K/yr client. With a smaller client, new vacuum pan was used to reduce cooking duration from 18 hours to 1-3/4 hours.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
504	Home and Commercial Food Service

Outcome #13

1. Outcome Measures

Number of children that reported eating more of healthy foods.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	14291

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas has the ninth highest obesity rate in the nation for youth ages 10 to 17. To combat the high childhood obesity rate, it is important for children to eat healthy and incorporate physical activity into their daily routines.

What has been done
The University of Arkansas at Pine Bluff Cooperative Extension Program hosted a youth enrichment summer camp to encourage local children, ages 6 to 11, to eat healthier meals and snacks through hands-on cooking experiences. The camp focused on basic cooking skills, good nutrition, food safety and fun ways to be physically active.

Results
Twenty-five children participants learned about topics including kitchen safety, basic cooking measurements and the nutritional content of different foods and beverages. They prepared foods such as pizza, chicken quesadillas, tacos, pudding, shakes and breakfast treats. During a class on vegetable production, they planted their own tomato plants. Physical activities included dancing and 4-H yoga. Upon the camp's completion, all participants stated they enjoyed the camp and would be interested in participating in future camps.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development

Outcome #14

1. Outcome Measures

Number of children who increase physical activity

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	11196

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas children and teens are falling short of nutrition and physical activity recommendations. The childhood obesity rate has doubled over the last couple of decades and is now one of the highest in the country.

What has been done
Division of Agriculture Extension researchers are examining the link between childhood obesity outcomes and features of the food, social, and built environment and interventions are targeted to those children most at-risk for obesity.
SNAP-Ed partners with schools that have 50% or higher of students receiving free or reduced

price lunch. Lessons emphasize MyPlate guidelines, physical activity, Arkansas grown foods, and simple food preparation skills.

Results

Research is providing a better understanding of the effect of food retail access, the proximity of fast foods around schools and residences, and the role of peers on childhood obesity outcomes.
51% of youth participants indicated they intend to follow MyPlate guidelines
50% of youth participants reported increased physical activity and/or reduced sedentary time
50% of youth participants reported increased knowledge of Arkansas food
53% of youth participants reported improved food preparation skills.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development

Outcome #15

1. Outcome Measures

Number of adults who improve food preparation skills

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1570

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #16

1. Outcome Measures

Number of adults who decrease sodium intake

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1036

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #17

1. Outcome Measures

Number of adult participants who increase consumption of foods recommended by the Dietary Guidelines for Americans

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	10093

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas has a high percentage (>60%) of overweight or obese citizens. Research shows that even small changes in diet and small decreases in weight can lower health risks for heart disease, diabetes, and hypertension.

What has been done
Through multiple education approaches, Extension has responded to issues related to chronic disease and obesity. Two specific programs, EFNEP and SNAP-Ed, offer participants opportunities to learn 1) label reading, 2) food shopping on a budget, 3) healthier cooking techniques, and 4) how to choose healthy snacks. Both programs are offered to adult and youth participants.

Results
80% of adult participants in EFNEP reported adopting healthier nutrition practices

53% of adult participants in SNAP-Ed reported more often using food/nutrition labels to make food choices

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #18

1. Outcome Measures

Number of adult participants who decrease consumption of foods recommended by the Dietary Guidelines for Americans

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3133

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #19

1. Outcome Measures

Number of public agencies personnel, aquaculture industry personnel, and general public individuals with increased understanding of food security and safety issues related to fish consumption in imported catfish and catfish-like products as compared to U.S. farm-raised catfish

Not Reporting on this Outcome Measure

Outcome #20

1. Outcome Measures

Number of adults who report improved food security after participating in a nutrition education class

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	903

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas has a high rate of food insecurity with 17.5% of households and 26.3% of children lacking access to enough food for an active & healthy life.

What has been done
The Expanded Food and Nutrition Education Program (EFNEP) addressed food insecurity by teaching low resource households with children in the home how to better manage their food resources, handle their food safely, make healthier food choices and be more physically active. In FY18, trained program assistants in 17 counties taught more than 12,829 lessons to 2,085 adults. We also reached more than 11,390 unduplicated adults through SNAP-Ed.

Results
As a result of participating in UA nutrition education programs:
79% of adult EFNEP program graduates adopted one or more food resource management practices
70% of adult SNAP-Ed program participants adopted one or more food resource management practices
48% of adult EFNEP program graduates ran out of food less often
39% of adult SNAP-Ed participants ran out of food less often
48% of adult EFNEP program graduates increased food security
53% of adult SNAP-Ed participants reported saving money on groceries
222 EFNEP participants enrolled in public programs to assist them in feeding their families better

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

State budgets have been flat for 10+ years and with $3 million dollars of "one-time" funding in recent years have created a climate that makes funding, hiring, and keeping employees difficult. Cost savings and attrition has kept most research and extension programs continuing but not all positions have been filled.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UA Extension Nutrition programs uses pre and post program surveys or retrospective pre-post surveys with similar evaluation questions to assess impact of multi-session educational programs. Data below are compiled across programs (general nutrition, SNAP-Ed and EFNEP) and totals are reported below. Note not all participants complete evaluation surveys.

UACES Nutrition

50% (1202/2398) participants decreased consumption of salt/sodium as a result of completing a program.

61 % (6977/11446) participants increased average daily consumption of fruits and/or vegetables as a result of completing a program.

48 % (3133/6467) participants decreased consumption of fat, saturated fat and/or trans-fat as a result of completing a program

EFNEP (Adult):

91% (1437/1585) reported improvement in one or more diet quality indicators (I.e. eating fruits or vegetables, drinking less sugar-sweetened beverages).

79% (1237/1567) reported improvement in one or more food resource management practices

76% (1196/1569) reported improvement in one or more physical activity behaviors

EFNEP (Youth):

41% (1013/2465) of 3-5 graders reported improvement in eating healthier snacks

32% (336/1053) of 6-12 graders reported an increase in number of days active for one hour or more

SNAP-Ed (Parents of Youth)

83% said their child talk to them about healthy foods

74% said their child asked for healthier foods

71% said they were trying new foods

57% said they were more physically active

56% said the family was eating healthier

UAPB Nutrition

SNAP-Ed (Youth)

91.0% of the participants ate vegetables more often each day.
99.1% of the participants ate more fruit more often each day.
98.3% of the participants are doing physical activity every day.
99.1% of the participants are choosing healthier snacks every day.
99.1% of the participants are eating more whole grains every day.

EFNEP (Adult)

92% of participants showed improvement in one or more diet quality indicators (i.e. eating fruits & vegetables, cooking dinner at home).
71% of participants showed improvements in one or more physical behaviors (i.e. exercising for at least 30 minutes, doing workouts or making small changes to be more active).
75% of participants showed improvement in one or more food safety practices (i.e. washing hands before preparing food or using a meat thermometer).
83% of participants showed improvement in one or more food resource management practices (i.e. cook dinner at home, plan meals before shopping, or make a list before shopping).

UAPB Food Safety

The clients gave a very positive feedback about the one-on-one discussions and indicated that most of the information provided to them was new
We had two peer reviewed papers have been published in ranked journals
Successful contribution to multiple conferences either as an oral or poster presentation with a very good feedback from professional fellows in food safety.
We were able to open new channels of collaboration nationally and internationally with different institutions.
The availability of funding requires more grants to support our current activities and to expand our research.

Key Items of Evaluation

UACES Nutrition

As a result of completing an Extension program 55.7% (11312/20311) participants reported a change in their diet by decreasing salt/sodium and/or decreasing intake of total fat and/or the use of saturated or trans-fat and/or increasing intake of fruits and vegetables

UACES Food Security

After participating in an Extension program 34% (903/2668) unduplicated adults reported running out of food before the end of the month **less often** and 53% (619/1164) unduplicated adults reported saving money on groceries.

AFIC Food Processing

Arkansas Food Innovation Center - 23 Companies; 460 Production Runs; 70 different products produced with a retail value of $780,000.

UAPB Food Safety

Scientific publications and conference presentations on research findings are a measure of the research component success.
Self-evaluation will also include a review of our projects goals, expected outcomes, and the attainment of objectives.
All data corrected will be tabulated and analyzed quantitatively and qualitatively to determine the success of the project.
Customer and client feedback and evaluations forms are a key item in the evaluations
Follow up communications with the targeted audiences helps in the evaluation of success

and assessment of the outcomes of the extension activities.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Increasing Opportunities for Families & Youth

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
607	Consumer Economics	10%	0%	23%	0%
724	Healthy Lifestyle	20%	10%	0%	0%
801	Individual and Family Resource Management	10%	0%	0%	0%
802	Human Development and Family Well-Being	18%	45%	12%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	2%	0%	2%	0%
806	Youth Development	40%	45%	1%	0%
902	Administration of Projects and Programs	0%	0%	6%	0%
903	Communication, Education, and Information Delivery	0%	0%	56%	0%
	Total	100%	100%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	132.2	3.3	1.8	0.0
Actual Paid	141.3	7.0	17.5	0.0
Actual Volunteer	394.2	0.0	0.8	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1282717	339866	66150	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1282717	511606	1269058	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
16240167	0	1358784	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

In the area of **Health and Aging**, the University of Arkansas System Division of Agriculture and the University of Arkansas at Pine Bluff: provided programs to improve health at every stage of life by educating and engaging Arkansans to address locally relevant health issues. Programs like Extension Get Fit and Walk Across Arkansas helped young and mature Arkansans increase physical activity, improve health, and improve quality of life. The Extension Wellness Ambassador Program trained and engaged community volunteers to address local health issues by implementing projects and conducting health improvement activities. Extension Health and Aging programs worked to help Arkansans of all ages achieve optimal physical, mental, and social health, which can result in significant savings in healthcare and treatment dollars each year

In the area of **Strengthening Families**, the University of Arkansas System Division of Agriculture and the University of Arkansas at Pine Bluff: offered invaluable resources to parents, couples, and individuals who seek to improve their psychological and relationship health and their overall quality of life. We also offered free, researched-based professional development training to childcare providers and afterschool care workers to help them met their annual state required training hours, improve their job performance, and improve quality of care given to our youngest citizens. The Division of Agriculture and UAPB parenting programs offer parents tools to improve relationships with their children and partners.

In the area of **Family Resource Management**, the University of Arkansas System Division of Agriculture: provided practical, researched-based information to Arkansans to increase financial well-being, equipped adults and youth with the skills needed for financial stability, and explored strategies that can be used to help Arkansans improve personal finance and consumer practices.
In the area of **Empowering Youth**, the University of Arkansas System Division of Agriculture and the University of Arkansas at Pine Bluff:

- Expanded access to quality 4--H programming in Arkansas.
- Taught life skills to prepare youth for adulthood.
- Helped youth explore career and entrepreneurship possibilities.
- Provided programs that involve youth in science, technology, engineering and math.
- Provided programs that encourage healthy living for Arkansas youth.
- Provided programs that engage youth in citizenship and leadership development.

2. Brief description of the target audience

Employers and Employees
Consumers
Health Professionals
School personnel
Child Care Providers
Adults
Youth
Jr Master Gardeners, Extension Homemakers (Councils)
Homeowners
State and Federal Agency Personnel
General Public
Project and program funding organizations
Public Health Officials
Policy Decision-makers
Civic leaders and organizations
Married couples or those considering marriage
Business leaders
Parents, Grandparents, caregivers, volunteers, 4-H members
Low income youth
Minority youth and families

3. How was eXtension used?

eXtension was used at the University of Arkansas at Pine Bluff to provide for professional development and for source information.
University of Arkansas Division of Agriculture Personal Finance faculty lead a Community of Practice that is linked from the eXtension website.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	824464	2055535	485851	458492

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total

Actual	21	0	21

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of organized 4-H clubs and other youth groups supported by Division of Agriculture Research and Extension and 1890 Extension resources.

Year	Actual
2018	3484

Output #2

Output Measure

- Number of volunteers working with organized 4-H and other youth groups

Year	Actual
2018	6091

Output #3

Output Measure

- Number of organized adult clubs and other groups supported by Division of Agriculture Research and Extension and 1890 Extension resources.

Year	Actual
2018	321

Output #4

Output Measure

- Number of volunteers working with organized adult and other groups

Year	Actual
2018	3773

Output #5

Output Measure

- Number of grant dollars generated by grant and contract development efforts

Year	Actual
2018	3263022

Output #6

Output Measure

- Number of unique visitors to Health and Living webpage

Year	Actual
2018	78057

Output #7

Output Measure

- Number of unique visitors to 4-H Youth Development webpage

Year	Actual
2018	127388

Output #8

Output Measure

- Number of Health & Aging programs delivered

Year	Actual
2018	4702

Output #9

Output Measure

- Number of participants in Health & Aging programs

Year	Actual
2018	43470

Output #10

Output Measure

- Number of youth participating in 4-H Healthy Living learning opportunities

Year	Actual
2018	55565

Output #11

Output Measure

- Number of youth participating in science, engineering and technology program and activities

Year	Actual
2018	142671

Output #12

Output Measure

- Number of youth participating in Citizenship/Leadership programs

Year	Actual
2018	59642

Output #13

Output Measure

- Number of youth participating in UAPB 1890 educational programs (4-H Science, Arkansas Ag Awareness Adventures Program and Aquaculture programs)

Year	Actual
2018	20

Output #14

Output Measure

- Number of youth participating in 4-H mentoring programs

Year	Actual
2018	60

Output #15

Output Measure

- Number of volunteers participating in 4-H mentoring programs

Year	Actual
2018	20

Output #16

Output Measure

- Number of high schools with UAPB 1890 fishing teams
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of students participating in Arkansas Collegiate Series fishing tournaments

Year	Actual
2018	120

Output #18

Output Measure

- Number of Extension Wellness Ambassadors graduates

Year	Actual
2018	24

Output #19

Output Measure

- Number of participants in an Extension Wellness Ambassador programs and projects

Year	Actual
2018	1726

Output #20

Output Measure

- Number of participants trained in family life programs (personal well-being, couples relationship and parenting)

Year	Actual
2018	3200

Output #21

Output Measure

- Number of child care providers trained

Year	Actual
2018	5963

Output #22

Output Measure

- Number of participants in a Family Resource Management program

Year	Actual
2018	6783

Output #23

Output Measure

- Number of Individual and Family Resource Management programs delivered.
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Estimated dollar value of program support volunteers provide to the organization and communities (includes: EHC; 4-H, Jr. Master Gardeners).
2	Number of mentoring program participants who increase their knowledge about agriscience and STEM related topics (1890)
3	Number of youth engaged in Citizenship/Leadership opportunities
4	Number of youth adopting behaviors to prevent injury prevention behaviors such as: seatbelt use, helmet use, distraction-free driving, ATV use, bicycle, shooting sports safety, etc.
5	Number of youth indicating healthy physical activity habits
6	Number of youth that practiced positive communication skills
7	Number of youth that increased their understanding of the consequences of risk behaviors
8	Number of youth that express interest and engage in sciences related activities, 4-H Science, Arkansas Ag Awareness program and Aquaculture programs
9	Number of Extension Wellness participants who report conducting programs or accepting new leadership roles as a result of the program
10	Number of participants who changed at least one personal well-being, couple or parenting practice as a result of participating in family life programs
11	Number of child care provider training program participants who changed at least one behavior/practice (Best Care,4-H Afterschool).
12	Number of participants who intended to change at least one well-being, couple or parenting practice as a result of participating in family life programs.
13	Number of child care professionals who increased their knowledge as a result of child care professional programs (Best Care, Best Care Connected, Guiding Children Successfully,4-H After-School)
14	Number of participants improving functional fitness after participating in Extension Exercise program
15	Number of participants reporting an increase in physical activity after completing an Extension Exercise and/or health education program
16	Number of youth adopting behaviors to reduce sedentary activity
17	Number of mentoring program participants who increase their social competencies through leadership, community service or group projects.

18	Number of participants who report increased knowledge as a result of participating in Individual and Family Resource Management programs.
19	Number of participants who report intended behavior change as a result of participating in Cooperative Extension Service Individual and Family Resource Management programs.

Outcome #1

1. Outcome Measures

Estimated dollar value of program support volunteers provide to the organization and communities (includes: EHC; 4-H, Jr. Master Gardeners).

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	23697239

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Volunteers are vital for all of Extension programs (4-H, UAPB Fishing, Master Gardeners, Wellness Volunteers, and AEHC). Without them Extension programs would not have the reach.

What has been done
Volunteers at both Universities are trained to assist with their particular program of expertise. These volunteers assist at the UAPB fishing events, answer gardening questions/provide community beautification, lead clubs, lead events, provide fitness classes etc.

Results
Volunteers are more numerous than paid employees. As a result of volunteers we have expanded our reach to provide hundreds of man hours of assistance and reached twice as many clients for educational purposes. In FY2018, Division of Agriculture volunteers provided over 959 thousand hours, valued at over $23 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
802	Human Development and Family Well-Being

806 Youth Development

Outcome #2

1. Outcome Measures

Number of mentoring program participants who increase their knowledge about agriscience and STEM related topics (1890)

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of youth engaged in Citizenship/Leadership opportunities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	59605

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since its inception, 4-H has placed emphasis on the importance of young people being engaged well-informed citizens. By connecting to their communities and leaders, youth understand their role in civic affairs and are able to expand their role in decision-making process. It's clear that civic engagement provides the foundation that helps youth understand the big picture of life and learn the skill sets that will allow them to become wise leaders for the 21st century.

What has been done
Citizenship training is a part of every club meeting and special event. Arkansas 4-H Camping Coordinator added community service projects to summer camp sessions. Campers packed 60,672 meals through a local food nonprofit distributor - The Pack Shack and a $15,000 AR Blue Cross Blue Shield sponsorship. The 60,672 meals were distributed to 7 food pantries in 6 counties.

Results
Nine hundred fifty-one participants were surveyed using 4-H Common Measures that indicated: 61% were more aware of their community needs, 57% were more likely to volunteer in a

community service project, and 76% increased their skills and leadership abilities through the 4-H program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Number of youth adopting behaviors to prevent injury prevention behaviors such as: seatbelt use, helmet use, distraction-free driving, ATV use, bicycle, shooting sports safety, etc.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1240

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The U.S. Consumer Product Safety Commission reports Arkansas ranks 14th in the nation for deaths associated with All Terrain Vehicles (ATV) with a cumulative percent of 55% for reported deaths 1982-2013. In 2014, there were an estimated 101,200 ATV-related emergency department treated injuries in the United States. Nationwide, 3,232 ATV-related children younger than 16 years of age, 42% were younger than 12 years old. The Arkansas Children's Hospital reports nearly 90% of ATV crashes in Arkansas occur with drivers under age 16 driving adult-sized ATV. Research shows that children under age 16 suffer a disproportionate share of the injuries, do not wear helmets, and fail to receive formal ATV training. Helmets have been shown to reduce the risk of fatalities in ATV accidents by 42% and reduce the risk of non-fatal head injury by 64%.

What has been done
Arkansas 4-H has the capacity to reach youth and adults in every Arkansas County with ATV safety education. The ATV Safety Institute's (ASI) RiderCourse program is designed to help youth and adults learn to safely and property ride ATV's. Faculty and staff are trained to teach the four-hour course and are trained to teach ATV safety curriculum in the classroom.
4-H ATV Safety education has reached over 40,000 individuals in the last five years. One thousand six hundred eight (1,068) youth are enrolled in the ATV safety project.

Results
Educational efforts directly reached 1,379 youth. Of the 635 youth surveyed, 82.5% reported increased knowledge of personal responsibility and 80% learned decision making skills to reduce risk of ATV related injury.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Number of youth indicating healthy physical activity habits

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of youth that practiced positive communication skills

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of youth that increased their understanding of the consequences of risk behaviors

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Number of youth that express interest and engage in sciences related activities, 4-H Science, Arkansas Ag Awareness program and Aquaculture programs

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	92

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
UAPB goal was to keep younger anglers interested and engaged in sport fishing through entertaining and affordable tournament options.

Division of Ag Extension (1862) found that 63% of American high school graduates are not prepared for college-level math and science courses and anywhere from 25-60% are placed in remedial classes once they enter college. Nearly two-thirds of American teens have never considered a career in engineering.

What has been done
The Arkansas Collegiate Series attracted a total of 120 students from 16 institutions in Arkansas, Missouri, Mississippi and Texas. This was a 41% increase in participation from 2017. The series hosted three qualifier tournaments and a two-day championship, averaging 34 two-person teams and 65 students per tournament. The net economic benefit produced by the ACS in the 2018 season was between $38,174.65 and $50,914.65. The ratio of return on the AQFI's investment into the program to the state of AR was between $46.25 and $61.69 for every $1 invested. Fourteen of the sixteen who responded to the annual evaluation survey had a positive opinion of the ACS. Five out of the sixteen survey takers indicated that without bass tournaments, like those provided by the ACS, they would fish less often.

Arkansas has a statewide movement to incorporate coding in every public school system and is well on its way to achieving this goal. Increased youth engaged in 4-H Science activities, hopefully will lead to a career in STEM areas and increasing the aptitude for science. Arkansas 4-H is poised to compliment school programming efforts with curriculum and activities that reinforce coding, engineering and general science. The 4-H Science program in Arkansas has used workshops in robotics (such as Junk Drawer & SeaPerch) to energize youth about Science. Through Seaperch, robotics, the Veterinary Science program, animal science experiences, and other projects these STEM related skills are enhanced.

Results
The program accomplished its outcome goals of steadily increasing awareness of the program to its target audience of collegiate anglers in Arkansas, maintaining participation rates in the program and finally providing a stable tournament circuit that satisfies the majority of those who participate. The net economic benefit produced by the ACS in the 2018 season was between $38,174.65 and $50,914.65. The ratio of return of the AQFI's investment into the program to the state of AR was between $46.25 and $61.69 for every dollar.

The 4-H SeaPerch program is growing rapidly. Through this training youth are energized over STEM related activities. Increased participation by girls is evident. Registration numbers for

2019 are double from 2018. and by increasing community partnerships, participation should continue to rise. 4-H Common Measures indicated out of 1,801 participants surveyed that 94% indicated interest, engagement, and positive attitudes toward science. 83% indicated they were able to apply science skills and abilities learned in a 4-H program to everyday tasks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

Number of Extension Wellness participants who report conducting programs or accepting new leadership roles as a result of the program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the 2015, the AHL (Arkansas Health LIFE: Lifestyles Involving Food & Exercise) initiative was launched in response to a cooperative agreement with the Centers for Disease Control and Prevention (CDC) to address high obesity rates in six counties (Chicot, Ouachita, Jefferson, Monroe, Woodruff and Craighead) in Arkansas. This initiative included: outreach and education around healthier behaviors; local coalition engagement; increased access to healthy food retail; and increased access to safe opportunities for physical fitness.

What has been done
AHL focused on policy, systems, and environment (PSE) approaches working closely with County Extension Agents and other key stakeholders to assess local coalitions, establish new coalitions where needed, and conduct quantitative and qualitative community assessments using the following methods: Nutrition Environment Measures Survey (NEMS), Rural Active Living Assessment (RALA), Physical Activity Resource Assessment (PARA), and focus groups.

Results
Over the duration of the AHL project, access to fresh healthy food was increased and impacted approximately 23,570 individuals and their families through establish: four farmers markets and

eight community gardens. Community gardens consist of 81 garden beds and 800 square feet of row crops managed by over 200 volunteers. Their efforts yielded in 376 pounds of produce distributed to communities and schools. Increase to healthy beverage options was established through the installation of water bottle refill stations in: eight local parks. In six school districts over 6,100 students have daily access to the water bottle refill stations resulting in nearly 17,500 bottle refills per month across all school districts. AHL installed 18 bike racks to encourage bicycle friendly routes. Daily average impression rate is 131,400 residents. Walking trails were established and made pedestrian friendly benefiting 3,000 residents. In addition to PSE changes, policy changes were put into place to create culture of health including sidewalk ordinances, complete street master plans, bicycle/pedestrian plans, healthy meeting food policies, and healthy food donation policies. Funds totaling nearly $342,00 through 20 state level and 61 local level partnerships.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #10

1. Outcome Measures

Number of participants who changed at least one personal well-being, couple or parenting practice as a result of participating in family life programs

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Number of child care provider training program participants who changed at least one behavior/practice (Best Care,4-H Afterschool).

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2290

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Child care providers in Arkansas are required to have educational training to obtain and maintain employment. Licensed facilities and providers must insure that all workers obtain the require number of hours each year to retain their license.

What has been done

The Division of Agriculture offers 10 hours of Best Care face-to-face training, 5 hours online training through Best Care Connected, and up to 38 hours of online or correspondence training through Guiding Children Successfully, and 5 hours of face-to-face training for Afterschool providers through 4-H Afterschool.

Results

These programs are funded through the Arkansas Division of Childcare and Early Childhood Education. Best Care reached 2623 participants in FY18. Of those participants, 84% reported knowledge gained, and 85% stated that they will change at least one behavior or practice. In 2018, over 50 trainings were offered statewide. Best Care Connected awarded 6375 training hours in FY18. Of those completing the program, 91% reported knowledge gain, and 91% stated that they will change at least one behavior or practice. Guiding Children Successfully reached 1598 participants in FY18 and awarded over 13,000 training hours. 4-H Afterschool trained 60 afterschool providers and trainers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #12

1. Outcome Measures

Number of participants who intended to change at least one well-being, couple or parenting practice as a result of participating in family life programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1661

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Arkansas has the highest teen birth rate in the US, the highest rate of divorce, suicide among the 10 highest, and one of the lowest rates of overall health. The importance of free, accessible, trustworthy resources to improve knowledge of relationships and health cannot be overstated. The Division of Agriculture Extension programs offer invaluable resources to parents, couples, and individuals who seek to improve their psychological and relationship health.

What has been done

Programs such as Farm Stress, Managing Stress, Your Blueprint for Happiness, and the Marriage Garden engage individuals and couples in self-reflection and teach healthy relationship practices and coping strategies that can improve well-being. Many of these courses are available online through our Guiding Children Successfully as well as handed out at health fairs and other meetings. Parenting and child guidance programs such as See the World through My Eyes, Family Time Tips, and early childcare providers to engage parents. Parents Forever and How Much Is Too Much offer tools for parents to improve their parenting practices. Over 200 Arkansans participated in the Marriage Garden program, and over 1000 See the World publications were distributed statewide.

Results

In FY18, 87% of participants who completed an evaluation instrument in our personal well-being programs increased knowledge, and 83% stated they would change at least one behavior. New partnerships were created to facilitate How Much is Too Much and Farm Stress programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #13

1. Outcome Measures

Number of child care professionals who increased their knowledge as a result of child care professional programs (Best Care, Best Care Connected, Guiding Children Successfully,4-H After-School)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9493

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Early childhood professionals in Arkansas are required to earn at least 15 hours of continuing education professional development training each year. With the Division of Agriculture's grant-funded childcare training programs, participants have the option of earning all 15+ hours with us. The programs offer updated, research-based curriculum using several delivery methods.

What has been done
The Best Care offers 10 hours of face-to-face, PDR verified training for childcare professions across the state in 26 multi-county clusters. 4-h Afterschool/Best Care Out-of-School-Time offers 5 hours of face-to-face, hands-on training to care providers who work with school age children. These trainings are offered statewide by interested agents.

Results
Best Care reached 2623 participants in FY18. Of those participants, 84% reported knowledge gained, and 85% stated that they will change at least one behavior or practice. In 2018, 50+ trainings were offered statewide. Best Care Out-of-School-Time reached just under 100 providers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #14

1. Outcome Measures

Number of participants improving functional fitness after participating in Extension Exercise program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	315

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Only 66% of Arkansans have adequate access to locations for physical activity. This attributes to the 32% of the population that report being physically inactive. According to the CDC lack of

physical activity can cause excess weight gain leading to obesity. Arkansans need affordable exercise programs and increased physical activity availability in rural areas.

What has been done

The Extension Get Fit program offered affordable exercise classes teaching strength training, aerobics, balance, and flexibility to 1,726 participants in FY18. County Extension Agents lead the program for 12 weeks before a trained volunteer leader continues the classes. This format fosters community ownership, provides sustainability, and allows for the Agent to stat another program site. Extension Get Fit programs are held in Community Centers, churches, schools, extension offices, libraries and worksites.

Results

Extension Get Fit assessments resulted in: $2.3 million estimated hospitalization cost savings from fall prevention, $881,000 estimated hospitalization cost savings from hip fracture prevention, $1.1 million estimated nursing home cost savings over one year from hip fracture prevention, $2 million estimated treatment cost savings from hip fracture prevention, 69% increased upper body strength, 80% increased energy, 78% decreased joint pain, and 92% became more physically active. Participants said: "I have nerve damage from hip surgery and have problems with balance and movement in my right foot and leg. This class is helping me regain balance and movement." "Since I began, I have been able to walk and move easier. My balance has gotten better too!" "After just a couple of weeks, I could increase the dumbbell weights."

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #15

1. Outcome Measures

Number of participants reporting an increase in physical activity after completing an Extension Exercise and/or health education program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	315

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #16

1. Outcome Measures

Number of youth adopting behaviors to reduce sedentary activity

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2906

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many children and adolescents are not active enough according to CDC standards. Yoga as a form of exercise can help kids reach the recommended levels of physical activity, and yoga helps improve children's physical fitness by increasing strength, flexibility, and aerobic capacity

Yoga is much more than physical activity. The practice of yoga promotes a connection between the mind and body. Studies of yoga with youth suggest practicing yoga can help reduce stress, improve stress management and coping skills, increase confidence, promote healthy body image, and improve social skill.

What has been done
Across the state, 211 Extension personnel and volunteer leaders have been trained to lead Yoga for Kids resulting over 200 sessions being taught to more than 4,000 youth. These sessions include practicing poses, improving coping mechanisms with emotions and stress, social skills activities, and breathing exercises. Yoga for Kids training has been delivered to nearly 200 Extension personnel in 9 states besides Arkansas. Students learn not only about the importance of yoga to improve flexibility, balance, and muscular strength, but also they learn self-awareness and the mental and behavioral benefits through controlled breathing and guided relaxation.

Results
As a result of teaching Yoga for Kids: 4,889 youth participated in the program, 81% indicated positive attitudes towards physical activity, 70% indicated healthy physical habits, 54% say yoga helps them relax, 72% improved emotional balance, and 67% improved stress coping skills.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
806	Youth Development

Outcome #17

1. Outcome Measures

Number of mentoring program participants who increase their social competencies through leadership, community service or group projects.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	113

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Arkansas Mentoring program is supported by the U.S. Office of Juvenile Justice - Delinquency prevention/national mentoring program. The objective is to provide direct one-on-one, group, or peer mentoring services to undeserved populations. The program provides mentoring opportunities using the 4-H program structure.

What has been done
Four Arkansas counties reached 90 undeserved youth and 23 mentors. Programs in Veterinarian Science, STEM education (drones, rockets, coding) and Healthy Living were used.

Results
Mentors and mentees gained knowledge and self-confidence through working together through issues that arise during the mentoring process. They believe the relationships they gained through this experience will help them transfer these life skills to better relationships now and in the future.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #18

1. Outcome Measures

Number of participants who report increased knowledge as a result of participating in Individual and Family Resource Management programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	6301

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #19

1. Outcome Measures

Number of participants who report intended behavior change as a result of participating in Cooperative Extension Service Individual and Family Resource Management programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5515

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research from the Employee Benefit research Institute shows that Arkansans have the 48th worse financial behavior and the 49th worse financial literacy among all states. Much of Arkansas' population is economically vulnerable. Arkansas has the 7th highest poverty rate at 18.7% in the country. Pockets of extreme poverty remain throughout the state, and 16 counties in the state had a poverty rate 25 or greater.

What has been done
The Cooperative Extension Service continues to be a leader in non-formal, personal finance education. Our programs help consumers learn ways to stay financially sable during tough economic times. We are uniquely situated to respond to Arkansans needs for financial literacy. Division of Agriculture county agents are trained in both the subject matter and and in educational methods that meet the needs of adult learners. The Cooperative Extension Service helps consumers build financial stability by providing non-formal education across the state.

Results
Six thousand seven hundred and eight-three individuals participated in face-to-face Extension consumer economics educational programs. Participants reported increasing knowledge (92.9%) and intention to make at least one, positive money management behavior change (81.8%). Participants reported a total of $358,422 in increased savings and/or decreased debt.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

State budgets have been flat for 11 years. Cost savings and attrition has kept key research and extension programs continuing but at the cost of meeting other needs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Several strategies will initiated and used for collecting program assessment information to determine program results, outcomes and impacts. Extension educators will use a variety of recommended methods to gather needed information. Collection methodology and assessment tools will be program and audience centered. Programs focusing on physical activity will use skill-based assessments, before and after program assessments, behavioral changes, observation, and questionnaires. Health and Aging related activities will use anecdotal information, pre-test assessments, and self-report of practice change. Unobtrusive means (request for additional information, purchase of videos and materials, increased participation and observation) will also be used to capture information. Each of the Strengthening Families core programs area has a brief evaluation instrument. These instruments are administered to the program participants immediately at the end of a given program. The instruments allow county agents to gather data about the number of program participants, whether their knowledge increased, whether they intend to make a change as result of their program participation, and if so, what they plan or hope to do. Participant contact information is also collected. The contact information allows county agents to contact program participants one month following program completion to see what changes have actually made. The Youth Development program uses the National 4-H Outcome, the 4-H Common Measure evaluation to report the change in social competencies of youth participants. Comprehensive program and departmental evaluation reviews for Research, Extension and Teaching programs are conducted on a five to seven year cycle by various researched based evaluation.

Key Items of Evaluation

Extension Get Fit volunteer leaders were trained through 10 workshops (5 basic training sessions with 58 participants; plus 5 advanced training days divided into two independent trainings each with 89 participants). An "agent trainer" structure is used, with 7 county Family & Consumer Science agents selected to serve as trainers across the state. Volunteer

Get Fit leaders contributed 16,003 volunteer hours valued at $395,114 instructing 2,679 exercise sessions. Of the 459 participants with pre and post data from the Senior Fitness Test: 67% increased upper body strength; 60% increased aerobic endurance; 61% increased lower body flexibility; 58% increased upper body flexibility; and 60% increased agility and dynamic balance. Based on these results it can be estimated that the program resulted in $2.3 million in hospitalization cost savings from reduced fall risk and $1.1 million in nursing home cost savings.

Extension Wellness Ambassador program has graduated 161 trained health-focused volunteer leaders representing 18 counties since the program started; 24 graduated in 2018. In FY18, 3,156 volunteer hours valued at $77,921 were contributed by Wellness Ambassadors; 247 educational sessions were reported reaching 695 Arkansans.

Arkansas Health LIFE (Lifestyles involving Food and Exercise) was a CDC funded program. Over the duration of the project access to healthy food increased and impacted 23,570 individuals and their families through the establishment of 4 farmers markets and 8 community gardens. Increase access of healthy beverages because of the installation of water bottle refill stations in 8 local parks and 6 school districts which impacted 6,100 students.

Best Care, Best Care Connected and Guiding Children Successfully, childcare providers trainings, impacted 5,963 participants. As a result 85% reported their knowledge of childcare issues has increased and 85% plan to change at least one childcare behavior practice.

In Family and Consumer Economics 6,783 individuals participated in face-to-face educational programs. Ninety-two percent of the participants reported increasing knowledge and 92.9% intended to make at least one, positive money management behavior change. Participants reported a total of $358,422 in increased savings and/or decreased debt.

4-H Healthy Living (1862) reached 3,193 participants. Using the 4-H Healthy Food Choices and Physical Activity Common Measure tool youth indicated 81% awareness of food and beverages consumed, 91% practicing healthy behaviors and 81% positive attitudes toward physical activity.

4-H Healthy Habits Grant (1890) results revealed; boys spend longer hours in sleeping/relaxing which is a great indicator of healthy living. The comparisons of the grade level were analyzed using Krus-Wallis, and significant level were rated at .05 and asymptotic statistical significance were read on the follow variables; healthy food choices, eating breakfast, and sugary foods eaten every day. The study revealed that very few children across various age levels spend less hours informing and sharing limited information with their families regarding 4-H healthy living activities, ways of promoting healthy living, and the need of experiential learning thru 4-H. Youth confidence noticeable increased in every group served.

4-H Science projects (excluding agriculture projects) 1,801 participants were surveyed using the 4-H Common Measures 4-h Science measurement tools and found that 94% indicated interest, engagement and positive attitudes toward science and 83% indicated they were able to apply science skills and ability.

4-H Citizenship/Leadership initiative area, 826 participants were surveyed using 4-H Common Measures Citizenship measurement tools and found that 61% indicated that they were more aware of community needs, 57% indicated that they were more likely to volunteer in community service projects and 76% indicated they increased their skills and leadership abilities through 4-H programs.

The Arkansas Collegiate Bass Fishing Series (1890) saw a 41% increase in participation from 2017, totaling 120 students in 2018. The net economic benefit produced by the ACS in the 2018 season was between $38,174.65 and $50,914.65. The ratio of return of the

AQFI's investment into the program to the state of Arkansas was between $46.25 and $61.69 for every $1 invested. Fourteen of the sixteen who responded to the annual evaluation survey had a positive opinion of the ACS. Five out of the sixteen survey takers indicated that without bass tournaments, like those provided by the ACS, they would fish less often. A total of 323 photos, announcements and posts were published on Facebook through the Arkansas Collegiate Series' private member group and public page resulting in 61,161 views.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Economic & Community Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	0%	0%	18%	0%
602	Business Management, Finance, and Taxation	47%	0%	0%	0%
603	Market Economics	0%	0%	27%	0%
605	Natural Resource and Environmental Economics	6%	0%	0%	0%
606	International Trade and Development Economics	0%	0%	21%	0%
607	Consumer Economics	0%	0%	20%	0%
608	Community Resource Planning and Development	19%	0%	0%	0%
610	Domestic Policy Analysis	7%	0%	10%	0%
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	3%	0%
703	Nutrition Education and Behavior	0%	0%	1%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	14%	0%	0%	0%
805	Community Institutions, Health, and Social Services	6%	0%	0%	0%
806	Youth Development	1%	0%	0%	0%
	Total	100%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	16.5	0.0	2.0	0.0
Actual Paid	17.3	0.0	14.6	0.0
Actual Volunteer	16.0	0.0	0.7	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
229959	0	422606	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
229959	0	1364489	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2911456	0	244673	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Economic and Community Development programs conducted in 2018 include:

• LeadAR (Lead Arkansas), a two-year statewide adult leadership development program to teach participants about issues impacting Arkansas and develop leadership skills.
• Assistance in developing, conducting and evaluating local leadership programs.
• Breakthrough Solutions, a visioning, strategic planning and implementation process for communities or regions that is asset based, community driven, technology enabled and results focused. In addition to technical assistance, the program features an annual Breakthrough Solutions Conference and an electronic newsletter (Breakthrough News) to support vibrant, sustainable communities in the 21st century economy.
• In-depth analysis of regional socio-economic conditions, opportunities and strategies for development. Some topics include: development capacity, changing economic base, cluster industries, economic and fiscal impact, enhancing retail trade, and retiree in-migration.
• Assistance in using a 15-year database of county government revenues and expenses, along with demographic and economic changes, to develop strategies for the provision of county services and infrastructure.
• Customized technical assistance in developing and implementing economic development strategies, including entrepreneurial support and business development.
• Arkansas Procurement Technical Assistance Center (Arkansas PTAC), a program to provide training and one-on-one assistance for businesses that want to sell products or services to the government through federal, state and local government contracts.
• Create Bridges, a project to help regions address workforce and other needs of retail and tourism sector businesses and workers.
• Income Tax Schools that provide 16 hours of continuing education credit for income tax preparers.
• Public Policy Center that provides education on local and state ballot issues, works with state agencies to encourage public involvement on water and other public issues, and helps Arkansans understand and interpret new laws and regulations.
• Introduction to County Government in Arkansas, an online course for citizens.
• National Agricultural Law Center (NALC) that serves as the nation's leading source of non-partisan agricultural and food law research and information, in partnership with the USDA Agricultural Research Service, National Agricultural Library. NALC leads the Agricultural & Food Law Consortium, a first-of-its-kind 4-university partnership designed to expand and enhance the delivery of objective and relevant agricultural and food law research and information to the nation's agricultural community. NALC maintains

a formal partnership with the National Association of State Departments of Agriculture (NASDA), and works closely with other state, regional, and national organizations. In FY18, the NALC partnered with the National Association of Attorneys General and the Office of the Arkansas Attorney General to host a first-of-its-kind national conference, "Advancing American Agriculture: Ag Technology & The Law" that had more than 150 attendees from 35 states.

2. Brief description of the target audience

Audiences vary by categories of activity (see above). For each activity we try to involve all stakeholders relevant to the topic at hand; not all of the audiences listed below may be engaged during every activity.

- Attorneys
- Businesses/Industry - small, large, rural, urban, agricultural, non-agricultural, consultants, and other
- Farmers/Producers - small, large, limited resource, retirement, and other
- Non-Farm private landowners
- Lenders
- Potential business owners (youth and adult)
- Elected officials - city, county, state, and federal
- Unelected community and business leaders
- Emerging and existing leaders
- Industry, trade and commodity organizations
- Civic, nonprofit, environmental, conservation, health and community organizations
- Organizational boards
- Federal, state and local policy makers - public agencies, administrators and other personnel
- Voters
- Research, extension and teaching professionals
- Educators
- General public
- Youth

3. How was eXtension used?

The National Agricultural Law Center is the lead institution for the eXtension Agricultural & Food Law Community of Practice (CoP) and coordinates with other eXtension CoPs in the provision of agricultural law research and information. During FY18, the Agricultural & Food Law Consortium continued to serve as the Agricultural & Food Law CoP Management Team. Other economic and community development staff serve on the leadership team for the Enhancing Rural Community Capacity CoP and are engaged with the Community, Local and Regional Food Systems and Enhancing Rural Community Capacity CoP.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	103990	462671	5475	11167

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

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	21	1	22

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of clientele contacts resulting from education classes, workshops, group discussions, one-on-one interventions, demonstrations, and other educational methods

Year	Actual
2018	51512

Output #2

Output Measure

- Number of educational materials, curricula, newsletters, web-based modules and fact sheets developed

Year	Actual
2018	1110

Output #3

Output Measure

- Number of dollars received to support programs (grants and other)

Year	Actual
2018	1282424

Output #4

Output Measure

- Number of Tax Preparers certified through Tax Schools

Year	Actual

2018	403

Output #5

Output Measure

- Number of web visitors on program-related web pages

Year	Actual
2018	230333

Output #6

Output Measure

- Downloads from website
  Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of educational materials, curricula, newsletters, web-based modules and fact sheets distributed

Year	Actual
2018	116523

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants (youth and adult) who report conducting programs, community service projects, adopting new skills or accepting new leadership roles as a result of economic & community development programs
2	Estimated dollar value of program support volunteers (includes: EH; 4-H; Master Gardeners; conferences; etc.)
3	Dollar value of government contracts received by APAC business clients
4	Number of jobs created/retained as a result of economic & community development programs
5	Number of businesses created, retained, or expanded
6	Number of participants implementing new strategies, tools or technology as a result of economic & community development programs
7	Number of participants who indicate new knowledge gained as a result of economic & community development programs
8	Dollar value of grants generated by organizations, communities or regions as a result of economic and community development programs
9	Number of plans (new or revised) adopted and begun to be implemented (community, agency, local government, business or disaster) as a result of economic and community development programs
10	Number of new alliances or networks formed through some type of formal agreement or MOU
11	Dollar value of other in-kind resources contributed to organizations, communities or regions as a result of economic and community development programs

Outcome #1

1. Outcome Measures

Number of participants (youth and adult) who report conducting programs, community service projects, adopting new skills or accepting new leadership roles as a result of economic & community development programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	266

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is important for rural counties to have people step up in the community to improve the quality of life and access to resources and to work together to reach their common goals. With a population of less than 7,000 and 26 percent of residents living below poverty, Lafayette County needs strong leadership, engaged citizens, and residents and businesses working together to build on local assets and find opportunities for a better future.

What has been done
County Extension Agents worked diligently to get people interested in becoming community leaders in several organizations through recruitment to LeadAR (Extension's statewide leadership program), raising awareness among clientele in all our program areas about the need for volunteer leaders in the community, and providing support to individuals interested in stepping into leadership roles.

Results
Lafayette County had two people apply and be accepted into LeadAR Class 18, which began in February 2018. One of our 4-H leaders joined the fair board and recently became elected Vice President. One of our Farmers Market vendors stepped up and became involved with grant writing for the market. Two others volunteered to become new market managers and another was elected as Treasurer. Our Farmers Market voted to work in collaboration with the Life Coalition to strengthen both organizations and. As a result, the group obtained $1000 in grant money to improve the Market and is working to obtain SNAP and WIC status. Our 4-H youth completed a community project by painting trash cans and other cleanup at the fairgrounds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #2

1. Outcome Measures

Estimated dollar value of program support volunteers (includes: EH; 4-H; Master Gardeners; conferences; etc.)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	23697239

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Volunteering provides vital help to people in need, worthwhile causes, and the community, but the benefits can be even greater for the volunteer. Volunteering can help reduce depression and stress as well as provide mental stimulation and a sense of purpose.

What has been done
The Cleburne County Extension Service trains both youth and adult volunteers. These volunteers provide educational outreach and service through Master Gardeners, Extension Homemakers Clubs, 4-H Youth Development and other programs to help enrich the lives of others. Volunteers have been hard at work this year on many different projects. Extension volunteers help with county, city, non-profit, charitable, and civic groups in the community.

Results
Cleburne County Extension Volunteers provided 16,580 hours to 25 projects in the county, value

of just over $400,000. 4-H Teen Leaders prepared 100 personal hygiene kits for family members of patients at our local hospital ICU. Volunteers contributed time and supplies to support several local shelters, benefiting the people staying there. Volunteers also provided almost 2,000 hours beautifying our county to help create quality of place for residents and 694 thousand visitors who come to our county each year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #3

1. Outcome Measures

Dollar value of government contracts received by APAC business clients

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	138385508

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Identifying new market opportunities is an important task for most businesses. One extremely large potential market is government. Local, state, and federal governments spend hundreds of billions of dollars each year. Many of the products and services government buys are produced within Arkansas, creating market potential. However, navigating the world of government contracting can by difficult and overwhelming for businesses with limited experience doing so.

What has been done

The Arkansas Procurement Technical Assistance Center (PTAC) is funded in part through a cooperative agreement with the Defense Logistics Agency (DLA). We offer free training and technical assistance to Arkansas businesses interested in selling goods or services to public agencies. We do this through one-on-one counseling, seminars, bid-matching services, a monthly newsletter and other methods.

Results
In FY2018, the Arkansas PTAC offered (or partnered with other organizations to offer) 74 training events attended by 2,132 participants. We also provided one-on-one counseling sessions with 686 Arkansas businesses. Collectively, clients reported receiving 1,456 contract awards valued at nearly $138.4 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

Outcome #4

1. Outcome Measures

Number of jobs created/retained as a result of economic & community development programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3031

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Women have always served a crucial role in the operation of farms and ranches. According to the USDA Census of Agriculture, 32 percent of Arkansas farmers are women. In Boone County, there are 610 female farm operators with 105 farms having a woman as the principal operator. Farming is a complex business and with women taking more active roles in running their business, there is a need for training and support for women making this career choice.

What has been done
Participants from Boone, Carroll, Newton, Marion and Searcy Counties participated in Annie's Project. The goal of Annie's Project is to empower farm and ranch women who want be more

knowledgeable about their agricultural enterprises and contribute to business success. Annie's Project focuses on the five agricultural business risk areas: financial, human resources, legal, marketing, and production. Programs were held in Harrison with Extension staff from the 5 counties and guest speakers conducting sessions.

Results

In addition to learning from experts about the technical aspects of running an agricultural business, Annie's Project focuses heavily on participant networking and peer learning. In post-training evaluations, all participants reported they would use what they learned. Several specific benefits were share by participants:

"I enjoyed listening to others experiences. The marketing and production information will be very helpful."

"I benefited from hearing new ideas."

"I will definitely use the information - especially the estate planning and black berry production."

"The variety of subjects covered will be very helpful in our operation."

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Number of businesses created, retained, or expanded

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	48

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rural isolation and lack of industrial growth has prompted Scott County to embrace methods of regional sustainability in West-Central Arkansas over the past few years. However, the sudden

announcement in 2017 of the local Wal-Mart store closing developed an immediate crisis to the economic well-being of Waldron and Scott County.

What has been done

In 2017, county and state Extension personnel along with the City of Waldron, and ARCO conducted two community meetings to present the current situation, announce plans to help displaced workers, and present suggestions for future economic development. After the community meetings in 2017, a Downtown Revitalization Committee formed to address concerns of the downtown area of Waldron. With support from Extension, the work of that committee has continued through 2018.

Results

Local leaders, the county Extension office and community members have conducted a number of activities, including Shop Local Campaigns in 2017 and 2018 to support local businesses; public viewings of Roger Brooks videos focusing on branding, tourism, downtown development and marketing efforts; placement of historical signs placed in the downtown area; a Pack Shack Funnel Party with 250 volunteers; three new downtown festivals; an Opioid Summit and Cooking Matters programs; and public restrooms secured in downtown area. As a result of these efforts, there are seven 7 new or expanded businesses in Waldron area.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #6

1. Outcome Measures

Number of participants implementing new strategies, tools or technology as a result of economic & community development programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3655

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are 89 cemeteries located within Dallas County, many in disrepair. County residents were interested in learning how to better care for local cemeteries and requested assistance from the Dallas County Extension Agents. This was felt to be important to boost community pride and show respect to families and residents in the area.

What has been done
The Dallas County Cooperative Extension Service collaborated with the Arkansas Historical Preservation Program and Rusty Brenner with Texas Cemetery Restoration LLC to provide a hands-on Cemetery Restoration Workshop. The event was publicized through 10 news agencies, Facebook, emails, websites and flyers. Topics included: proper cleaning procedures, repairing broken stones, re-leveling stones, fire ant abatement and fence row herbicide treatments for weed and brush control.

Results
Fifty people attended the workshop from seven different counties, and two people came from Texas. Among participants, 75 percent indicated they would use the knowledge gained to restore gravestones in their community cemeteries. A second workshop was held in neighboring Cleveland County with an additional 30 people in attendance. Knowledge gained is now being put into action. Three cemeteries are using herbicides for fence row weed and brush control and three cemeteries are now using the strip method of fire ant abatement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #7

1. Outcome Measures

Number of participants who indicate new knowledge gained as a result of economic & community development programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	8667

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With candidates dominating most election season coverage, it is possible that voters walk into the voting booth with little knowledge of the ballot issues before them. Decisions might be based on the last campaign sign they saw or voters end up skipping the ballot issue all together because they don't want to vote on something they don't understand. Election season is also an excellent time for youth to see citizenry in action and learn about government and policy making.

What has been done
The Public Policy Center helps Arkansans better understand the financial, social and policy implications of a proposed law by publishing easy-to-read fact sheets and other educational resources on statewide ballot measures so voters have a better understanding of what is being asked of them. Lonoke County Extension distributed over 750 voter guides across the county, and conducted 9 meetings focused on citizenship with the Lonoke 4th Grade 4-H Club.

Results
Our efforts reached citizens across the county through voter guides at libraries in Lonoke, England, and Cabot, the Carlisle Community Center, and the County Courthouse. Twenty-five county leaders were also provided with unbiased educational materials to be distributed among local groups. Of the 113 4th Grade 4-H Club members, 84% indicated they understand how a bill becomes a law, 78% recognize the responsibilities of being a citizen, including voting, and 71% understand the basics of our United States government.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #8

1. Outcome Measures

Dollar value of grants generated by organizations, communities or regions as a result of economic and community development programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4796501

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Downtown Helena is in dire need of a health hub where residents can obtain food, get more physical activity, and attend classes. Residents, local government, and State/Federal agencies have developed a plan to make this happen. A Local Foods Local Places grant will improve living standards for people with few jobs, 47% SNAP eligibility, and 32% food insecurity.

What has been done
Phillips County Port Authority purchased & put a roof on the old Bus Shed, which improved the looks of the corridor into town. Grant funds will be used to repurpose the structure to house community gardens, edible landscaping, a Farmers Market and a Food Pantry. There are to be walking trails & outdoor fitness equipment, providing opportunities for physical activity. The kitchen & classrooms will provide space for meetings & healthy living classes, while incubating small business and downtown merchants.

Results
The area surrounding the proposed Shed is surrounded by low-income housing. Many of the residents have no transportation and must walk to the Dollar Store for groceries. This spot will

provide space for people to learn to grow their own food. There will be a new Food Pantry, a summer & after school feeding program, and a Farmers Market that will accept EBT. Classes will be offered to teach nutrition, economics, and parenting. Regular health screenings will also be offered. The multi-agency partnership allows dollars to be leveraged from many sources. These resources and education will allow Phillips County residents to make better choices and improve lifelong health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #9

1. Outcome Measures

Number of plans (new or revised) adopted and begun to be implemented (community, agency, local government, business or disaster) as a result of economic and community development programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	51

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A city left reeling from the departure of Allen Canning in 2013, Alma is looking to find their new identity at the crossroads of Interstate Highway 40, US Highway 71, and, once completed, Interstate Highway 49. Less than 10 miles to the west, a river port/intermodal facility will be completed soon. Planning for the future and being prepared to take advantage of opportunities is crucial toward creating the economic base and quality of life residents want for their future.

What has been done
Each year the Cooperative Extension Service partners with the Community Development Institute (CDI) at the University of Central Arkansas to offer a hands-on experience for graduates of CDI to work with a community to develop a "Kick Start" five-year action plan through the Advanced Year CDI program. Communities apply to participate. A coalition of local leaders submitted an application, and the City of Alma was selected as the 2017 Kick Start community.

Results
After a five-day, intensive workshop where a team of CDI graduates created a research-based report for Alma, Extension faculty work with the community to create and launch an action plan. In October 2017, five action teams were formed and began work focusing on Education/Workforce, Infrastructure, Quality of Life/Place, Economic Development/Jobs, and Community Health/Well Being. The Kick Start Alma Action Plan was released to the public on May 7, 2018 with more than 150 members of the Alma community in attendance, and implementation is now well underway.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #10

1. Outcome Measures

Number of new alliances or networks formed through some type of formal agreement or MOU

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	22

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The City of McCrory had a desire to further develop several projects listed in the Woodruff County Health Improvement Coalition's strategic plan. Woodruff County has been a part of a Center for Disease Control grant awarded to Extension to address obesity. The coalition was formed by a group of county citizens concerned about the health of Woodruff County.

What has been done
The city partnered with the Cooperative Extension Service to request assistance through the Local Foods, Local Places program to develop an action plan that would help the city advance the high priority projects identified by the Woodruff County Health Improvement Coalition's strategic plan. These were well-aligned with the goals of the Local Foods, Local Places program.

Results
McCrory was one of 13 communities across the United States selected for the Local Foods Local Places program in 2018. The program is supported by the U.S. Environmental Protection Agency, the U.S. Dept. of Agriculture, the Centers for Disease Control and Prevention, and the Delta Regional Authority. The city and the Extension Service formed a steering committee of community partners to prepare for the technical assistance award. Support was given by a team comprised of consultants and multiple federal and state agency partners. Developing a farmers market, planning a central gathering space to connect people and inject life into downtown, construction of new sidewalks, and strategies for building a strong local food system are goals of the community.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #11

1. Outcome Measures

Dollar value of other in-kind resources contributed to organizations, communities or regions as a result of economic and community development programs

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1990880

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Comprehensive strategic planning is vitally important to ensure the sustainability of many small towns in Arkansas. Planning that includes broad-based community involvement helps community leaders identify the most important issues and opportunities facing a town, and provides the greatest probability of long-term success.

What has been done
County agents and state specialists began working with leadership in Manila, AR in late 2016. Online surveys and a series of town meetings were used to identify needs and interests of the areas. Based on these results, citizens have initiated efforts to increase community activities in the downtown area, develop partnerships with the city government, attract visitors from surrounding areas, and generate revenue for the newly formed Moving Manila Forward community development organization.

Results
Through partnerships with the Manila Volunteer Fire Department, the Manila City Council, the Manila Pilots Association, and several other groups, 21 events we conducted by the Moving Manila Forward team. Outdoor movie nights, main street music programs, farmers markets, educational garden plots displaying exotic species of cotton, a regional Main Street BBQ contest, and several other activities attracted over 6,500 people to Manila's downtown area during the 2018 season. Nearly 700 volunteers assisted with activities and programs contributing 13,703 hours valued at $338,327. Other donations, gifts and in-kind contributions accounted for approximately $17,950 in additional support for the initiative.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

805 Community Institutions, Health, and Social Services

806 Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

When thinking about agriculture, we often focus on the "product" - quantity and quality of commodities or specialty crops. Even as technology and innovation help improve efficiency and effectiveness in production, a strong agricultural and natural resources sector is equally dependent on people. As researchers and educators on the front-line of helping agricultural producers be successful, Cooperative Extension Service faculty and staff see first-hand the needs of our farmers and their families. Those needs extend beyond research and education specific to food and fiber production and environmental impacts on those systems. Equally important are investments to strengthen the communities in which farm families live.

We continue to see increased demand for community and economic development programs, particularly in rural counties struggling with population decline, deterioration of tax base, and budget cuts at the state and federal levels. Challenges identified include broadband and cellular access, housing, physical infrastructure improvements (roads, sewer, water, etc.), health, entrepreneurship and business development, education and workforce, visionary and effective leadership, civil discourse, and quality of place amenities to keep/attract young people.

Historically, resources to support the land-grant mission have skewed more heavily toward production needs rather than people and community needs. This is true at the local, state and federal levels. This imbalance in resource investment significantly hinders our efforts to holistically address the needs of the people and communities that provide the foundation for a strong agricultural and natural resource production system.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A variety of methods were used to evaluate programs including the use of advisory groups, participant questionnaires, pre-and post-tests, interviews with program participants, required reporting mechanisms and informal feedback. Examples of evaluation results in 2018 include:

- Over 8,600 program participants reported new knowledge gained as a result of our programs.
- Over 3,600 program participants reported implementing new strategies, tools or

technology as a result of our programs.

- Over 260 program participants reported conducting programs, community service projects, adopting new skills or accepting new leadership roles as a result of our programs.
- Procurement Technical Assistance Center clientele reported receiving over $138 million in government contracts.
- Over 3,000 jobs were created or retained.
- Forty-eight businesses were created, retained or expanded.

Key Items of Evaluation

Economic and community development programs have resulted in knowledge gained and behavioral changes among 12,200 Arkansans. Businesses have increased revenues through $138 million in government contracting and from adopting new strategies, tools and technology resulting in business and job growth. Communities and regions across Arkansas have increased capacity and leveraged their assets to generate over $7.6 million dollars in grants, gifts, in-kind contributions and volunteer time to create positive change in small and large ways.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
14291	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
10	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
187086	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
5	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.