2016 University of Arkansas and University of Arkansas at Pine Bluff Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

University of Arkansas System Division of Agriculture (Division of Agriculture) faculty, staff and facilities are located on five 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 and the Regulatory Science Center of Excellence. 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. Under this structure, 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 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 FY2016, Division of Agriculture research efforts resulted in the submission of 20 patent applications. Division of Agriculture and UAPB Extension educators delivered research-based education through 7,584,909 educational contacts with Arkansans. Division of Agriculture Extension educators employed diverse educational methods statewide including: 45,274 educational classes, 21,649 landowner visits, 69,285 individual consultations, 3,310 demonstrations, and 1,609 field days/tours/camps. County agents and specialists strive to provide the best science-based recommendations available. Information is readily available in the Digital Age but the Division of Agriculture and UAPB remains providers of information that are independent of financial or philosophical interests.

During 2016, the Division also delivered timely and responsive distance education webinars through the National Center for Agricultural Law on emerging issues including: Leasing Agricultural Land; Agricultural Labor Laws; Organic Aquaculture Standards; Induced Seismicity in Shale Development; and Industrial Hemp Production in the U.S. 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 8,866 participants in FY2016 through 52 course offerings.

The focus of work conducted by Division of Agriculture and 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

design and development of the 2011-2015 Strategic Plan, which was extended to 2016. Based on broad stakeholder feedback, the Division identified five emphasis areas to focus our efforts that include:

- 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.

2016 Arkansas Extension and Research Planned Program Impact Highlights

Agricultural Production & Processing

Agriculture contributes more than $20 billion per year to the Arkansas economy, and 1 of 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 2015 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 from 10% to 50% since 2011, with no turnaround in sight. Production costs have stayed at 2011 levels or increased slightly during the same period. This led to FSA analysts to predict in the fall of 2015, that up to 25% of current row crop farmers would not be able to farm the same land in 2016 either because of forced retirement, inability to secure adequate loans, or downsizing to address financial imbalance. If true, this would be the largest shift in row crop production operators since the 1980s. New pests continued to emerge in this sector with the third year establishment of the sugarcane aphid in sorghum, second year of detection of kudzu bug in soybean, 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. 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. An intense outbreak of avian influenza in the Midwest led to many new efforts in biosecurity extension, and the limited outbreak in north central Arkansas during 2015 resulted in widespread efforts in 2016 to reach not only commercial poultry growers, but hobby and non-traditional poultry producers as well. 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.

UA System Division of Agriculture and UAPB faculty and staff lead intense research and extension programs to provide relevant and timely best management practices to Arkansas crop producers. In 2016, after Division weed scientists confirmed PPO herbicide resistance in field populations of palmer amaranth in 2015, there were continued efforts to educate producers on best management practices based on Division research; including crop rotation and residue management strategies to reduce the weed seedbank in the soil; the use of glufosinate-resistant soybean crops in rotation with other technologies; and the judicious use of preplant and pre-emerge herbicides with different modes of action where possible. Division and UAPB extension educators worked with more than 78,319 farmers, consultants, workers and industry personnel during the year to assure increased adoption of these BMPs.

Arkansas had about 43,000 farms on 13.7 million acres and another 19 million acres in managed forests as of 2016. 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 and among the top 25 states in production of cotton, sweet potatoes, hogs, cattle, meat goats, and catfish. 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, 2015 inventory of 1.6 million head. Horses continue to increase in popularity with 60,000 households having horses.

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. UAPB Extension livestock programs focus on small and socially disadvantage farmers (SSDF) in southern and eastern Arkansas.

Commercial poultry production is a huge industry in the state, with Arkansas ranking 4th in broilers and 5th in turkeys, as of 2016. During 2016, we continued to see an increase as well in "non-traditional" and "backyard" poultry productions, now with local production of eggs and meat birds in free-range, organic, and pasture-based systems. At the same time, the avian influenza outbreak in the Midwest during 2015 and the single turkey farm discovery in Boone County, AR during the year dramatically elevated concerns about biosecurity in the state. In response, Division extension staff increased biosecurity education across the state by conducting presentations on biosecurity practices and dissemination of biosecurity information to individuals at seminars, county fairs, the Arkansas and Arkansas/Oklahoma state fair, short courses, 4H pullet chain delivery, and farm visits were done. Participants were informally surveyed and questioned as to increase in biosecurity knowledge, their current biosecurity practices, and intent to implement additional or more stringent practices. All participants practiced biosecurity to some degree with their birds. However, new information made available allowed a greater understanding by participants of biosecurity practices. 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. This year all 1400+ participants in the 4H pullet chain had to have education in biosecurity practices prior to their receiving their pullet chicks.

Nationally, Arkansas ranks 1st in rice production; 6th in cotton; 3rd in grain sorghum; 10th in soybean; and 21st in corn. The Division of Agriculture conducts extensive research and Extension programs to assist these industries and producers keep up to date and competitive. Our agronomic programs emphasize utilizations of new varieties in rice, soybeans and wheat; adoption of relevant best management practices, IPM and environmental quality practices. The Division of Agriculture has released 27 improved rice varieties since the beginning of the breeding program in 1980, contributing approximately $137 million to the agricultural economy of Arkansas. Since 1980, Arkansas rice yields have increased from 4,110 lbs per acre to 7,200 per acre in 2016. Sweet potato production continues to grow both nationally and within the state. In Arkansas, sweet potato production has grown from 2000 acres in 2008 to 4000 acres in 2016 with an annual production value of $20 million. The marked increase in domestic demand for sweet potatoes, due to their health benefits and fiber, is being well served by UAPB Sweet potato Foundation Seed Program. The program supplies disease and mutation free, generation zero sweet potato slips to support Arkansas sweet potato industry.

The UAPB aquaculture and fisheries program conducted research in a variety of important areas including systems development, economics and marketing, nutrition and feeds, water quality, stress and reproductive physiology, and fish health. Most of the research was targeted at catfish, baitfish and sportfish - Arkansas is a major producer of all 3 categories of fish. The overarching goal was to develop more cost-effective methods of production that will increase profitability for farmers, and create superior products for end-users.

The Division of Agriculture and UAPB labs have continued to provide diagnostic services, not just

to those in Arkansas, but across the United States, for little or no cost. In 2016, the Division of Agriculture's Plant and Nematode labs processed 4,861 samples and distributed 29 newsletters to over 6,000 subscribers. The UAPB Fish Disease Diagnostic labs processed over 439 samples for disease testing, 121 water quality/aquatic weed cases, and 94 health certificates issued to allow inter-state/international transportation. The UAPB Health Inspection lab processed 20,000 samples for APHIS disease-free certification. This intense monitoring and quick feedback system helps the large and dynamic aquaculture industry in the state and the region stay productive, healthy, and risk-free as many fish are shipped nationwide from our area.

Commercial Horticulture encompasses the production of fruits, vegetables, turf, and ornamentals. Arkansas ranks in the top 25 states in production of at least 15 horticulture crops. The Division of Agriculture's blackberry breeding program is recognized worldwide, with nineteen varieties released to date, and planted throughout the US and in other countries. Total plants produced and sold to growers and home gardeners for 2012-2014 as reported by nurseries licensed to produce the Arkansas-developed blackberries was over three million plants. The potential crop area for these plants was over 1700 acres and wholesale fruit value of over $90 million annually. This production includes both the summer-fruiting floricane types and the innovative primocane-fruiting type, extending the production and marketing season for this high-value crop.

Over the past several years, there has been an overall decline in support for IPM education and emphasis at the national level. This has resulted in increased use of "blanket" or "preventative" pesticide applications to row crops in many states. UA Division and UAPB scientists and staff have battled this trend over the years, including 2016, in spite of declining resources. Division entomologists and plant pathologists initiated a new demonstration program in the Delta to compare blanket applications of insecticides and fungicides based on growth stage to applications based on IPM principles of scouting and using "only when needed". Results showed that blanket applications were less cost effective than IPM applications. This work will continue in several crops for two more years. Results were presented in 2016 to more than 55 planned crop production winter meetings and events, which typically host more than 3000 active row crop farmers and consultants in the Delta region. Given the increasing economic difficulties of row crop producers combined with the risk of resistance development by crop pests where blanket applications result in high selection pressure, this educational work is of critical importance and should serve as a model for a national initiative.

Water quality and water quantity continued to be critical areas of emphasis in agriculture production during 2016. The Division of Agriculture conducts research and evaluated edge-of-field water quality data from the thirteen Discovery Farm sites in the state. Data from these sites showed very low movement of nitrogen and phosphorus. These early results were shared at the state and regional level with stakeholders and regulators. They have also lead to the creation of best management practices for producers to implement. Irrigation efficiency was emphasized in a major effort to teach growers proper use of computerized hole sizing software with poly pipe in furrow irrigated systems. Follow-up demonstrations showed an average water savings of 22% using this simple tool.

Most consumers of agricultural products are far removed from production and the abundance of internet "information" can complicate their understanding of the challenges and benefits of our modern science-based food, feed and fiber systems. During 2015, Division educators launched two modular online courses on biotechnology crops. These courses were marketed for use by the public, schools, and community colleges. Another blended educational effort was the Arkansas Soybean Science Challenge project, funded through the Arkansas Soybean Promotion Board. In its third year, the project targeted high-school science students and included a five-hour online course, face-to-face lab instruction, incentive awards for high-school student initiated research, an Arkansas Department of Education approved online in-service training for teachers, a Pinterest site, and other online educational resources. Sixty-seven students completed the online course and ten teachers took advantage of the two online courses geared towards them.

Gardening and landscaping continue to be of strong interest to citizens of Arkansas. Both UA Division and UAPB faculty and staff are heavily involved in extension education of gardeners, landscapers, and interested community volunteers in local food production and beautification of our living

environment. A huge program in the state in this area is the Division of Agriculture's Master Gardener program. In 2016, this program certified 3,400 volunteers who logged 163,876 volunteer hours for their communities. The "In the Garden Blog" by Janet Carson has grown to 2,867 followers with 306 articles issued during 2016. This group led the efforts to highlight research-based gardening at the annual Arkansas Flower and Garden Show in February 2016. UAPB's Office of International Programs is also engaged in grant driven international Extension programs in South America, West Africa and Eastern Europe in an effort to increase small family run agricultural efforts

Environment, Energy and Climate

Arkansas has tremendous soil, water and air resources that provide a multitude of beneficial uses. These resources support a highly productive, efficient agricultural system that annually accounts for $20 billion of value-added to the Arkansas economy. Yet, Arkansas still remains the "Natural State," as its scenic beauty attracts many outdoor enthusiasts and generates over $5.9 billion in tourism expenditures annually.

Managing Arkansas's natural resources to protect and sustain these multiple beneficial uses for future generations is not without its challenges. Air and water quality concerns have evoked lawsuits, new state and federal regulations, as well as voluntary natural resource conservation programs, such as USDA-NRCS' and Mississippi Healthy River Basin Initiative (MRBI). Large-scale modeling studies of the Mississippi River basin point to agriculture as the leading source of excessive nutrients that cause hypoxia in the Gulf of Mexico. The State Assembly commissioned ANRC to update the State Water Plan while the Gulf of Mexico Hypoxia Task Force, consisting of 5 federal agencies and 13 states, held their Annual Spring Meeting in Little Rock in May 2015. The Division also jointly produces a regional newsletter entitled "Confluence" to provide information to the agricultural public on nutrient reduction and water quality protection efforts within the 13 states participating in the Gulf of Mexico Hypoxia Task Force. Other sectors of society, such as municipalities and urban areas also face nonpoint source water issues. Municipalities and urban areas are also required to address storm water management issues and provide education on reducing the impact of storm water on runoff water quality. Municipalities in three Arkansas counties have contracted with Extension to provide storm water education, providing research-based and unbiased information to Arkansans to assist with voluntary efforts to address nonpoint source water quality issues. In 2014, the State of Arkansas developed a process to update the State Water Plan, a comprehensive plan for addressing both water quantity and quality concerns.

The UAPB Aquaculture and Fisheries Department (AQFI) provided management training and assistance to private impoundment owners of Arkansas. Privately-owned impoundments can be used for numerous purposes and the management of those impoundments is affected by, and can have an impact on, the environment immediately surrounding the impoundment and its watershed. Proper management helps to ensure a healthy and productive environment within the impoundment and the surrounding area. In addition, research is underway to assist the Arkansas Game and Fish Commission in determining the success of their supplemental stocking programs with crappie and other important sportfish.

Monitoring water quality and nutrient levels on a tributary to the Buffalo National River was assigned to an environmental task force in late 2013 by the Arkansas Governor's office and a subcommittee of the Arkansas General Assembly. This action was in response to public interest in a state-permitted swine farm in the Big Creek Watershed. The Big Creek Research & Extension Team was formed in fall 2013 and received $340,000 from the governor's office to initiate the environmental study and monitor potential environmental impacts of the swine operation. Monitoring efforts have continued through FY2016. Members of this team, including the team leadership, include Division of Agriculture research and Extension faculty and staff. After three years of extensive monitoring, no impacts or consistent trends of farm operation on area water quality are evident.

Efforts to reconcile competing agricultural and environmental interests are often hampered by a lack of definitive best practices. The Division of Agriculture has created a multidisciplinary team approach to discovery, demonstration and promotion of agricultural/environmental best practices. The Center for Agricultural and Rural Sustainability (CARS), the Arkansas Water Resources Center and the Environmental Task Force represent team efforts that range from basic discovery to economic

consequences of implementing best practices.

Agricultural production and processing sustainability has been a focus of the Division of Agriculture and UAPB for many years. Evidence of this is the Division's hosting of the Center for Agricultural and Rural Sustainability (CARS), a nationally known center of excellence. Faculty associated with the Center have pioneered life cycle analysis of cropping practices, studied alternative production and marketing systems, organic agriculture, phytoremediation, alternative residue and water management, and trace gas emissions. The projects carried out by CARS faculty are diverse covering all major areas of agricultural production including animal and livestock, rice, forestry and timber, soybeans, specialty crops, local foods, etc. Their work provides the unparalleled support to the agricultural industries and rural communities to build sustainable, "green" agriculture in the State. In 2013, CARS was awarded a $3 million grant by the Walmart Foundation to improve fresh strawberry production in the U.S. Since then, CARS faculty have conducted research on the processing of various strawberry products to ensure retention of anthocyanins, which are attributed to the vivid red color of strawberries. In 2014, the Walmart Foundation donated an additional $3 million to fund the creation of the "Success in the Field" e-book, which outlines the accomplishments of the National Strawberry Sustainability Initiative. This e-book was completed and published in FY2016.

The Division of Agriculture's Nitrogen Soil Test for Rice (N-STaR) was merely a research tool just a few years ago. The N-STaR program for determining optimum site-specific Nitrogen fertilization rates on rice has been adopted quickly by Arkansas rice producers. In 2016, 2,510 N-STaR samples were analyzed and new producers are entering the program every year which increases the scope of N-STaR's impact on Arkansas rice production. For many fields, N applications were reduced without sacrificing yield, thus reducing potential greenhouse gas (GHG) emissions and reducing potential N losses to watersheds.

UAPB's agricultural production efforts continue to be focused upon serving small and socially disadvantaged producers in eastern and southwestern Arkansas. The programs provide research based information that is used for training and technical assistance to row crop, vegetable crop, and livestock producers. Assistance was provided in farm financial planning/business planning; vegetable and row crop production and marketing; livestock production and marketing; access to USDA assistance programs; food safety education; and housing. UAPB used the foundation sweet potato seed program to provide virus indexed sweet potatoes to the sweet potato industry in Arkansas. Also, UAPB conducted research trials that evaluated the potential for industrial hemp and other bio-fibers to be used in the commercial textile industry.

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

Access to Safe and Nutritious Food

Food Safety

The Division of Agriculture continues to have a strong emphasis on food safety with efforts in both basic and applied research and supporting extension efforts for youth, the public and the food industry. Research efforts are focused mostly on gaining a better understanding of the ecology of food pathogens, improving food processing systems to minimize food pathogens and improving detection systems for Listeria, Salmonella, EColi and other major food pathogens. An example of current research is the exploration of management strategies to prevent enteric diseases in organic chicken, which is a product gaining popularity each day. Studies were conducted in 2016 to examine the efficacy of the natural compound, resorcylic acid against Campylobacter colonization in broiler chickens and the ability of select probiotics to reduce enteric Campylobacter colonization in broiler chickens. The study results are being analyzed and will be published.

Arkansas has a large food industry with a need for food safety education of its workforce. These food safety educational programs help food processing companies remain nationally competitive and prevent foodborne illness. One such program is the Better Process Control School which has certified over

3,000 food processing employees since its inception in 1973. In 2015, BPCS were offered in Arkansas and surrounding states (Oklahoma and Missouri) and 38 individuals received certification. For the Cooperative Extension Service, the Better Process Control School has served as a springboard to other food-related workshops for industry to include food safety, food defense, food labeling, microbiology, sensory evaluation and other courses under development. The Division of Agriculture also offers restaurant managers, employees and food handlers the opportunity to take classes and an exam to become a Certified Food Protection Manager. In FY2016, 38 food industry employees received certification in Better Process Control, food service managers and associates took a ServSafe class from the Division of Agriculture with 295 passing to become a Certified Food Protection Manager. Improvements in restaurant and food service food safety have the potential to save Arkansas money and time by way of reducing cases of foodborne illnesses.

Food Processing Innovation

The State of Arkansas has a large food manufacturing sector that needs a qualified workforce. To meet this need, Division of Agriculture faculty have developed programs addressing the needs of the industry. Of particular importance is the development of culinary training for research & development (R&D) personnel working in the poultry industry. The curriculum developed has allowed numerous employees to achieve the status of Certified Culinary Scientist. This experience is meant to enable the food technologist to understand what the R & D chef wants to ensure the chef's vision and taste are translated to the production plant floor. The Division of Agriculture also contributes to the state's economic development by providing assistance to entrepreneurs. The Arkansas Food Innovation Center (AFIC) assists small food processing companies and entrepreneurs by providing necessary education and services such as: product development assistance; sample production; FDA process approval (FDA form 2541a); measurement of pH and water activity (Aw); provision of nutritional labels; development of food labels; delivery of food-related workshops; and other forms of technical and business assistance, much of which is available through a dedicated website for entrepreneurs. AFIC generally assists 15-25 entrepreneurs each year, as well as a number of non-profit organizations. In 2016, 12 small businesses started as a result of the food entrepreneur assistance program. The efforts of the program and making the Division of Agriculture's food pilot processing plant available to entrepreneurs has resulted in five different start-up food companies launching food products in FY16. Over the past several years, several food companies have emerged with the assistance of the program.

Division of Agriculture faculty also conduct innovative research in food processing. Research activities in food chemistry and food processing include work to improve the quality of rice and improve rice processes; expand the utilization of soybeans and its co-products; assess the health benefits associated with fish, vegetables and other processed foods; and improve the sensory quality of processed foods

The Aquaculture/Seafood Marketing team at UAPB developed several pragmatic economic models and analytical tools that can be used to produce thorough analyses of seafood markets at regional, national and global levels. At the global level, the UAPB team collaborated with the International Food Policy Research Institute, the World Bank Group and the Food and Agriculture Organization of the United Nations under a project "Fish to 2030 Project" to forecast the commodity supply, demand and trade in the next 15 years for 115 countries/regions, including the United States. At the regional and national levels in the United States, the team analyzed consumers' preferences for seafood products based on weekly scanner data from ten regional markets, and developed a U.S. fish supply, demand and trade simulation model (USFish model). Preliminary findings have found U.S. consumers are likely to meet their increased demand for seafood by imported products, which is relatively cheaper in price, and will probably decrease their consumption of U.S. farm-raised catfish during the period up to 2030. In order to expand the market for U.S. farm raised catfish products in the United States, there is a need for marketing strategies that favor product distinctiveness and branding (independently or co-labeling with retailer) as well as identifying segments of market that are willing to pay a price premium for the U.S. farm-raised catfish products. Based on these findings, several U.S. aquaculture farmers and processors have started redesigning their business and marketing plans to expand their market size and share.

Nutritious Food, Food Security and Childhood Obesity

Arkansans face challenges when it comes to obesity and food insecurity. According to Centers for Disease Control and Prevention (BRFSS), in 2015, 69.5% of adults (age 18 and over) in the state of Arkansas were classified as either overweight or obese. In 2015, Arkansas was the sixth most obese state in the United States with 34.5 % of adults being obese. Five of the ten leading causes of death in the U.S. have been linked to diet and lifestyle as contributing factors. Poor diet and obesity remain common problems especially among under-served populations. To compound the issues already present in the state, Arkansas has the third highest poverty rate in the nation, with one in four children living in poverty. Food security is defined as access at all times to enough nutritional foods for an active and healthy lifestyle. Arkansans in many areas of the state have limited access to nutritious and affordable food. To address these issue the Division of Agricultural and UAPB conducted Expanded Food and Nutrition Education Program (EFNEP) and Supplemental Nutrition Assistance Program - Education (SNAP-Ed). The Division of Agriculture and UAPB's EFNEP programs were delivered in 18 counties in Arkansas. The Division of Agriculture's SNAP-Ed program was delivered in every Arkansas county in FY2016. They provided Arkansas's most vulnerable families and youth with hands-on opportunities to address food security challenges. SNAP-Ed programs were conducted at a variety of locations throughout Arkansas including schools, Head Starts, senior centers, food banks and pantries, shelters, DHS offices, WIC offices and grocery stores. Lessons focused on: making healthy choices within a limited budget, learning how to read food labels, cook, grocery shop and increase physical activity.

Extension program evaluations identified some of the significant impacts of these programs. For example, 50% of EFNEP and SNAP-Ed adult participants reported they less often ran out of food before the end of the month after participating in Division of Agriculture and UAPB programming. With a focus on practical food preparation, cooking, tasting, and shopping, the Division of Agriculture and UAPB Extension programming is having a measurable impact on reducing food insecurity in Arkansas.

Research within the Division of Agriculture focuses on various aspects of adult and children health with hopes of reducing the incidence of these diseases within the state and nationally. For example, studies conducted by the University of Arkansas System Division of Agriculture show that diets higher in protein can spare muscle mass and increase fat loss as well as lower plasma triglycerides in both men and women. High protein diets have also been found to improve glycemic regulation and post meal glucose and insulin response in type 2 diabetics. Our research has identified whey protein as the most ideal protein source, compared to pea and beef protein, for increases postprandial energy expenditure (calories burned after the meal). Based on this finding, we believe that whey protein-based beverages are ideal for breakfast, especially for children. In addition, Division of Agriculture and UAPB faculty are conducting novel research to determine the impact of diet and food composition and functional food components on body weight and health.

Aquaculture

UAPB Researchers and others have studied how declines in marine fish supply will affect human health. Results were reported in a paper entitled "Fall in Fish Catches Threatens Human Nutrition" published in Nature (Vol 534, 16 June, 2016). Researchers coupled two databases ("Global Expanded Nutrient Supply" and "Sea Around Us" databases) from 2010 (most recent data from both). Nearly 11 % of the current global population could become deficient in iron, zinc or vitamin-A by 2050 if current trajectories in fish catch declines continue. The negative health impact of fisheries decline will be felt more severely in some countries than others. Low-latitude developing nations are at high risk because human nutrition in these areas depends mostly on wild capture fisheries.

Increasing Opportunities for Families and Youth

The Division of Agriculture and UAPB are parts of the land grant system that focuses on the human dimensions of food and agriculture through programs in the areas of Health and Aging, Strengthening Families, Family Resource Management, and 4-H Youth Development. UAPB's initiative areas include the Arkansas AG Awareness Adventures Program and 4-H Youth Development. As a result of intensive programming in these areas, program participants gained knowledge based on educational lessons, experienced changes in behavior, enhanced skills, and adopted new research-based practices learned from Research and Extension programs.

In the areas of Health and Aging, Division of Agriculture Extension faculty delivered 6,310 program sessions geared to improving Arkansans' health in 2016, which reached 70,057 Arkansans. The Extension Wellness Ambassador program trained 35 new Ambassadors and engaged 4,889 people in addressing local health issues by implementing projects and conducting health improvement activities.

Individuals who participated in family economics educational programs gained the knowledge and skills they need to increase financial security and build wealth. Extension's personal finance educational programs gave 4,156 Arkansans the knowledge and skills they need to build financial security. Program participants learned the basics of financial management for spending, saving, credit management, and retirement and estate planning. They developed skills such as creating a spending plan, checking a credit report, shopping smartly, setting financial goals, etc. County FCS Agents conducted educational outreach across the state including programs, such as: Navigating Your Financial Journey (basic financial management); Your Farm, Your Legacy (estate planning seminar); and Get Real - Here's the Deal (youth personal finance simulation), just to name a few of the many topics and educational opportunities offered. Participants in these family economics educational programs reported increasing knowledge (87%) and the intention of implementing at least one positive money management behavior (59%).

A key to happiness in family life is learning how to be an emotionally healthy individual, a good partner, and an effective parent. The Division of Agriculture Extension provided in-person and web-based educational resources and training in the areas of personal well-being, couple relationships, and parenting. Extension educators trained 1,156 people in our personal well-being, relationship and parenting programs.

Child Care Provider Education programs were delivered through Extension's statewide network. Our programs, supported through $535,000 in external funding, are available in multiple formats (e.g., face-to-face, online, and self-guided) to accommodate different learning styles and work schedules. The RAND Institute, in a review of benefits and savings of early childhood intervention programs, calculated that for every dollar invested in such programs, there is an estimated return of $2.50 to $4.00. That means that the return on investment within the state of Arkansas for our child care professional training programs is between $1.19 and $1.90 million. In 2016, 4,070 child care professionals successfully completed 44,479 hours of training. As a result of the training, 88% of participants indicated they intended to change at least one behavior or practice.

The Arkansas Extension Homemakers Council and the Division of Agriculture Cooperative Extension Service are partners in providing education to families throughout Arkansas. The Arkansas Extension Homemakers Council's mission is to empower individuals and families to improve their lives through continuing education, leadership development, and community service. The organization is one of the largest nonprofit volunteer groups in the state with a membership of 4318 in over 350 clubs. A total of 3,017 Extension Homemakers served as volunteers, contributing a total of 656,404.5 volunteer hours of time, with a value of $15,464,890.02.

Both the Division of Agriculture and UAPB are uniquely positioned to teach and demonstrate scientific exploration. In 2016, 151,517 young people in Arkansas's 75 counties were reached through some aspect of the Arkansas 4-H youth development program. Seven hundred eighty-seven 4-H Clubs across Arkansas involved young people in hands-on education and service learning opportunities that enhanced their life skills, including decision making, problem solving, critical thinking, communications, service learning, and healthy lifestyle choices. In 2016, the 4-H program focused on three initiative areas: Healthy Living, 4-H Science and Citizenship Leadership. Impact programs were delivered in each of the areas (Yoga for Kids, ATV Safety, Robotics, Shooting Sports, Citizenship/Leadership Camp, One Day of Service, 4-H Day at the Capital, and Civic Engagement activities). As a result of Division of Agriculture and UAPB 4-H youth programs, 35,861 expressed an interest and engaged in science-related activities.
The Arkansas AG Awareness Adventures programs from UAPB has aided in youth having a better understanding of agriculture, its industry and communities. UAPB conducted the 2016 Youth Fishing Outreach Program: The Arkansas Collegiate Series attracted 92 students from 13 institutions in Arkansas, Missouri and Texas. The ratio of return on the Fisheries Center investment in the tournament to Arkansas was $37.62 - $56.54 for every $1 invested.

Volunteer leaders are essential in the delivery and execution of programs with community clubs, project clubs, spin clubs, service learning and special interest activities. During 2016, 10,078 volunteers

contributed 109,619 hours of time to the 4-H program, which was valued at $2,582,623.64.

Economic and Community Development

Business resource support provided by the Division of Agriculture is delivered through the following programs: entrepreneurial development for both youth and adults; specially tailored programs for Hispanic audiences; and programs for agricultural businesses identified with Agri-tourism, cottage food production and farmers' markets. Other business-centered Extension education and program support is delivered through the Arkansas Procurement Assistance Center (APAC) and annual Income Tax Schools for accountants and professional tax preparers. These programs are focused to the needs of both established and start-up business professionals in ethnically and economically diverse communities.

Entrepreneurial development efforts are focused on the potential within the Latino community, individuals interested in downtown revitalization, and e-commerce opportunities. These programs have a broad youth and adult audience. Program participants developed business plans, learned about rules and regulations governing small business, experienced the application of new technologies, explored financing options, and learned financial management and accounting principles.

Community and economic development programming through APAC's procurement assistance counseling continues to produce significant value for Arkansans. In 2015, 845 local, state and federal contacts were awarded Arkansas' client businesses, worth approximately $118.5 million in contract value. The federal formula for economic activity related to jobs credited this program with producing nearly 2,372 jobs in Arkansas. The most recent five-year program review reflects a return on investment of 142 to 1.

The Division of Agriculture community development efforts are targeted to strengthen and build local capacity for both economic well-being today and prepared resiliency for dealing with future issues. Programs included visioning, strategic planning, and strategies for effective economic development. These programs are based on multi-state collaborative efforts including: established and reported commonly used metrics for the Southern Region; program outcome aggregation at the regional level; and shared investment in the Southern Rural Development Center and the Program Leadership Network.

Public Policy education is the newest formal component of the Division's Community and Economic Development effort. The Division of Agriculture's Public Policy Center houses the core capacity for this effort and includes both Extension and research responsibilities. The base effort is centered in statewide issue elections and the public understanding of ballot measures whether proposed by the legislative process or public referendum. Citizens are engaged through in-depth analysis of issues which is policy-neutral and without the language of advocacy. Educational materials and program components are developed in collaboration with the National Center for Agriculture Law and the UA Center for Agriculture and Rural Sustainability.

Policy research and education remain important program components, in terms of training county agents to deal with controversial issues, developing unbiased policy representative educational materials and educating the public regarding complex ballot questions and policy issues. The Center also supported education efforts regarding local ballot initiatives and controversial policy issues conducted by county Extension agents statewide. In 2016, a large focus of the Public Policy Center also included the November 2016 national elections and the six state level initiatives that would appear on their ballots. The 2016 Voters Guide and accompanying resources and marketing were created and in the process of being distributed towards the end of the 2016 program year.

The impact of the Division of Agriculture on leadership development in Arkansas communities has been evident since the early days of the 20th century through county Extension agent mentoring of farmers and rural people. Leadership program support is currently accomplished through both local and statewide leadership training seminars and fellowships. This system engages resources of the UA Division of Agriculture at every level. Leadership efforts span the program emphasis areas and demographics of Extension clientele. LeadAR, our core leadership program, is connected to an international network of leadership programs (IPAL) and alumni of the LeadAR program are connected through the International Leadership Association Conference (ILAC). The LeadAR program has proven effective in educating a diverse pool of leaders from the public, non-profit and private sectors. The network of trained leaders now counts over 430 graduates as LeadAR alumni.

The efforts of the University of Arkansas System Division of Agriculture and University of Arkansas Pine Bluff research scientists and Extension educators in the five identified focus areas described in this Report of Accomplishments have continued to contribute to the discovery of new knowledge, the dissemination of needed educational programs and the well-being of Arkansans and their communities in 2016.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	329.5	16.5	477.1	15.1
Actual	374.4	23.1	470.6	28.6

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

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 2015 and 2016 (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 Director of the Agricultural Experiment Station and/or 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 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 department or programmatic and cut across departments. Reviews are scheduled on a five to seven-year cycle and conducted concurrently for research, Extension and instruction. All reviews have been 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. As a result, annual progress is reported to Division and University administration.

External review of the University of Arkansas Pine Bluff Agriculture Department was conducted during Fall 2011 and concluded in Fall 2012. One of the suggestions for the review was that the Department should develop an advisory board for review of academic programs. Although there is an advisory board for research and Extension programs, none exists for academic programs. The Regulatory Science Program which is a component of the Agriculture Department, successfully underwent an external review in Fall 2014. Reviewers suggested including distance education courses to the program's future priorities. The Aquaculture/Fisheries program underwent a program review in 2015.

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 Director uses formal stakeholder input developed by the Agriculture Research & Extension Council. Aquaculture and Fisheries is in the process of reformulating their advisory Board, and relied on meetings with Producer Association Groups and Arkansas Game and Fish Commission for research and extension input in 2016. All stakeholder groups provide meaningful suggestions for programmatic improvements. The Agriculture Research and Extension Council met summer and winter 2014 and summer 2015.

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 2016, 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. This program is under new leadership, and we are reconstituting our advisory Board. 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. Both the Chicot and Lonoke County Extension programs derive their input from this committee's advice.

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 2016, 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 2016 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 2010, the University of Arkansas System Division of Agriculture updated its strategic plan. The 2011-2015 strategic plan for the Division included input from internal and external stakeholders statewide. A total of 780 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 most recent stakeholder meeting resulted in suggestions by the group for conducting research that will provide a foundation for introducing additional herbicides for weed control in sweet potato production. Both graduate research projects and a faculty research program have been developed to address this stakeholder issue. Conversely, an individual stakeholder suggested that the research we currently conduct with straight head disease in rice was not important for our clientele. This is an instance where the Director must weigh the comments of the individual with the needs of the overall state and other agricultural clientele. Other suggestions included holding additional meetings each year during Agriculture Field Days, and taking care not to shift a disproportionate amount of the attention to the new foundation sweet potato seed program to the detriment of other 1890 agricultural programs.

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. The most recent stakeholder meeting resulted in suggestions by the group for conducting research that will provide a foundation for introducing additional herbicides for use in sweet potato production. Both graduate research projects and faculty research programs have been developed to address this stakeholder issue. 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 2011-2015:
• 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 2011-2015 Strategic Plan outlines the specific objectives for each area and is based on what we learned from our stakeholders. The 2011-2015 strategic plan was extended one year, while the 2017-2022 strategic plan was being developed.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
5999855	1928090	4292337	2331779

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	4092424	1947904	4292337	2132381
Actual Matching	5999855	1913505	54655192	2331779
Actual All Other	46587587	0	8386471	0
Total Actual Expended	56679866	3861409	67334000	4464160

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	4717460	213691	0	291235

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%	13%	0%
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%	0%
204	Plant Product Quality and Utility (Preharvest)	6%	17%	9%	8%
205	Plant Management Systems	20%	21%	4%	15%
206	Basic Plant Biology	0%	6%	0%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	1%	0%	1%	0%
212	Pathogens and Nematodes Affecting Plants	1%	0%	1%	0%
213	Weeds Affecting Plants	7%	0%	8%	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%	5%	8%
303	Genetic Improvement of Animals	2%	0%	4%	0%
306	Environmental Stress in Animals	4%	0%	8%	0%
307	Animal Management Systems	2%	37%	5%	44%
311	Animal Diseases	4%	16%	7%	5%
601	Economics of Agricultural Production and Farm Management	4%	2%	6%	9%
603	Market Economics	0%	1%	0%	8%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	0%	0%	0%	3%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	110.3	11.6	264.0	9.0
Actual Paid	120.0	17.0	273.0	21.0
Actual Volunteer	5.7	0.0	3.7	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**
1668283	1393362	2603478	1732156
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2445850	1393248	34477683	1838963
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
18991501	0	3788391	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Arkansas is a rich state in terms of natural resources. Agriculture is one of the largest Arkansas industries having an annual value-added economic impact of over $20 billion and contributes 17.7% of Arkansas' economy. Agriculture accounts for about one in six jobs in the state (280,959 jobs) and an annual labor income of $11.5 billion (17% of the state's total labor income). Agriculture in Arkansas consists of agronomic and horticultural crops, animal agriculture and forestry. In terms of agricultural cash receipts, in 2012, Arkansas ranked 16th, with a value of $9.8 billion. Over one-half of Arkansas is in forests, much of which is owned by private landowners. Agriculture (13.8 million ac) and forestry (19 million ac) are critical as they occupy more than 90% of the total state land base. Arkansans and visitors greatly benefit from these land's diversity and ecology. Nationally, Arkansas ranks 1st in rice, baitfish, and sport fish production; 2nd in broilers; 3rd in ornamental fish and catfish; 4th in cotton and turkeys; 5th in grain sorghum and rabbits; 6th in sweet potatoes; 9th in soybean; and in the top 25 in another 21 commodities. The diversity of Arkansas agriculture also includes fruits, vegetables, nuts, beef, corn, wheat, oats, hay forage and many other crops. The state ranks fourth nationally in saw-log timber production. This diversity is a major asset in helping the state's agriculture sector to weather downturns in a specific commodity. Food processing also adds much value to the commodities grown in the state.

Our natural resources attract about $6 billion per year in tourism dollars. ANR science and education contribute strongly to productivity, efficiency, preservation of natural resources, and sustainability. Natural resources and manufacturing remain critical to the state's economy, but the service sector accounts for the largest source of employment in both urban and rural areas. Agriculture contributes more than $20 billion per year to the Arkansas economy, and 1 of 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 2015 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 from 10% to 50% since 2011, with no turnaround in sight. Production costs have stayed at 2011 levels or increased slightly during the same period. Arkansas

had about 44,600 farms on 13.8 million acres and another 19 million acres in managed forests as of 2013 (most current data available). The state ranked 16th in agricultural cash receipts of $9.8 billion. Of this amount, crop production totaled $4.8 billion and livestock/poultry $4.6 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.

Arkansas has abundant natural resources which drive a vibrant agricultural sector. There exists a host of economic, social and environmental motivations to maintain and protect those resources which are sometimes in competition. Balancing socioeconomic development with environmental protection is a complex, dynamic integrated system. The challenges of unique water demands, changing land ownership patterns, scrutinized regulations, and an often diverse public perception requires heightened scientific understanding and demonstration of sustainability issues.

Through a collection of activities across multiple disciplines, the University of Arkansas seeks to develop sustainable and regionally appropriate agricultural production systems that are economically viable. Activities engaged training growers on using field calculators and understanding a number of sustainability matrixes to aid in evaluation and demonstration of production efficiency and conservation for agricultural applications. Specific efforts related to sustainability are alternative production systems, alternative marketing approaches, organic agriculture, soil fertility, phytoremediation, alternative residue, water management and waste treatment technologies.

Arkansas' agriculture and food sector, when expressed as a percentage of total GDP, is much greater (11% of Arkansas' GDP) than for any of the contiguous states, and is 2.7 times higher than for the U.S. as a whole. Animal production cash receipts (which measure income and sales from marketing) in Arkansas saw an increase from $5.1B in 1997 to $5.3B in 2014, representing a 4.6% gain in value.

Peaking at $4.6B in 2005, the poultry and egg sector dropped 14.3% to $4.0B at the start of the 2007-2009 recession. The sector grew during the recession period and peaked again at $4.1B in 2010 before dropping 14.7% to $3.5B in 2011, the lowest value of the period. Although there were some periods of slight growth, the hog and pig and dairy products sectors showed a steady decline throughout the seventeen year period from 1997 to 2014. After peaking at $233M in 2001, the hog and pig sector declined 65.2% to a period low of $81M by 2012 before increasing 28.4% in 2013. The rebound was short lived as the hog and pig sector value fell to $83M in 2014, the second lowest value of the period. From a value of $137M in 1997 to a low of $20M in 2013, the dairy products sector declined 83.4% between 1997 and 2014 with no clear sign of recovery. The Division of Agriculture assists the state's producers with objective research and Extension programs to assure improved efficiency, sustainability and environmental stewardship. The following research and extension activities were completed in FY16:
1) enhancement of wellbeing and animal handling methods to minimize stressors in food animals;
2) determination of the impact of common stressors (castration, parasite load, disease, etc.) in livestock production that will aid in development of on-farm best management practices;
3) improvement of meat safety while maintaining product quality characteristics;
4) improvement of the environmental sustainability (reduction of greenhouse gasses, and nitrogen cycling/use) and input efficiency of livestock production;
5) enhancement of reproductive performance in livestock;
6) animal and forage management effects on animal health and performance;
7) reduction of feed/forage needs and costs utilizing 300 days of complimentary forage systems for beef cattle.

Presentations on biosecurity practices and dissemination of biosecurity information to individuals at seminars, county fairs, the Arkansas and Arkansas/Oklahoma state fair, short courses, 4H pullet chain delivery, and farm visits were done. In addition, the impact of a disease outbreak on the Arkansas poultry industry and state economy was discussed. Participants were informally surveyed and questioned as to

increase in biosecurity knowledge, their current biosecurity practices, and intent to implement additional or more stringent practices. All participants practiced biosecurity to some degree with their birds. However, new information made available allowed a greater understanding by participants of biosecurity practices. 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. This year all participants in the 4H pullet chain had to have education in biosecurity practices. All 1400+ participants had to complete the training conducted by the county agent prior to their receiving their pullet chicks. All participants received a packet of information with their birds at delivery.

Integrated Pest Management (IPM) activities within the Division of Agriculture are varied, including efforts to develop and disseminate management practices for insect, disease, and weed pests of agronomic and horticultural crops. The pesticide safety education program is responsible for training and certifying private and commercial pesticide applicators for the state of Arkansas. The Plant Health Clinic and the Arkansas Nematode Diagnostic Laboratory process samples to help diagnose pest problems for a variety of stakeholders, ranging from commercial producers to gardeners and homeowners. Research, conducted on invasive pests such as the spotted wing drosophila and established pests such as palmer amaranth, is used to develop recommendations which are disseminated through print and multimedia materials and hands-on field demonstrations.

Educational programming and on-farm demonstration has been used to promote the adoption of irrigation water management practices (IWM) in Arkansas and the region. Specifically the target audience has been trained to use the following IWM practices: 1) measurement of irrigation water flow and proper use of flow meters, 2) computerized hole selection for lay flat poly pipe which is a conservation practice that improves distribution uniformity in furrow irrigation, 3) surge irrigation a practices that improves irrigation efficiency and uniformity, 4) soil moisture monitoring, a practice that improves irrigation management and irrigation timing, 5) ET-based scheduling techniques which improve irrigation timing, and 6) pumping plant performance which improves water management and improves energy efficiency. The programs provide education through one-on-one work with the target audiences, on-farm demonstration, meetings and conferences. Primary efforts in Computerized Hole Selection for lay flat poly pipe which has the potential to reduce water use by 19% as demonstrated by side-by-side field comparisons (113 demonstrations). These demonstrations have been an effective tool in promoting irrigation water management on their farms. About 33% of irrigators in Arkansas have now adopted this irrigation water management practice since 2012 according to a recent survey. Eighty-three percent of this adoption has occurred since 2012. This represents over a million acres, 2,619 contacts made with 1,549 clients trained on IWM practices through educational programming (54), visits (948), field days (13) and dissemination of materials (1,545).

Commercial horticulture encompasses the areas of fruits, vegetables, turf, and ornamentals. According to 2015 NASS data, eight horticulture crops rank in the top 25 states including: sweet potatoes (6th), pecans (8th), watermelons (14th) and tomatoes (14th), blueberries (12th), grapes (13th), sod (16th), and peaches (23rd). The collective efforts of the Division of Agriculture and UAPB assists the various commercial horticulture stakeholders with objective research and extension programming to assure improved efficiency, profitability, sustainability and environmental stewardship.

Challenges for growers include climate change, rapidly evolving technologies, invasive pests, global trade, and complex business practices. These same challenges represent opportunities for commercial horticulture in Arkansas. To address these challenges requires that the Division of Agriculture and UAPB be on the cutting edge of scientific research and outreach innovations.

Arkansas is rated 14th in tomato production in the United States, which has a long colorful history. Bradley County became famous for production of pink tomatoes in the 1920's. Production practices have evolved

greatly since that time period to include plasticulture, fertigation, and new integrated pest management practices. Many Arkansas tomato farms have not been utilizing these modern production practices and are experiencing issues with pest management, fruit quality, and decreased yield. These issues including a late blight disease outbreak in Arkansas tomatoes caused a flurry of inquiries to local county agents for help with tomato production. A demonstration research trial was conducted by the Division of Agriculture at the Ouachita River UnitArkansas Department of Corrections (ADC) in Malvern, AR. This trial consisted of 6 different varieties of tomato and demonstrated different methods for weed control including the use of plastic mulch, hay mulch, and preemergent herbicides. A scouting program was utilized for insect control whereas disease control was maintained by calendar sprays every 710 days. These methods were compared to 2 rows that had no treatments applied, for weeds, insects, or disease. The goal was to highlight best management practices. There were 25 county extension agents and 5 Arkansas Department of Corrections staff that attended as well as their private agriculture consultants. The training was very well received. Sharon Reynolds, the Ozark District Director, sent an email expressing the following about the program: "The program was well received and I have been conducting staff chair evaluations with all 25 staff chairs in the Ozark District this week. I have been hearing rave reviews about the quality of the growing tomatoes inservice you conducted in Malvern several weeks ago. The agents have commented that the training was very well done and very helpful." Besides success with county agents, great feedback was received from the ADC staff. The farm manager from Malvern worked very closely with the team on the demonstration trial and was eager to learn as much as he could. His comment after the trial and training was very positive, he said "It is amazing such a small change can make such a big difference! I did the exact techniques you showed me in the tomato trial in the squash I planted and my yields are quadrupled from last year."
Resarches in cooperations with the(Department of Food Science at Iowa State University evaluated various biological agents that can be used to control E. coli on greenhouse-grown hydroponic lettuce. Research currently in progress is focused on the efficacy of using saponin compounds extracted from agave (using the commercial product Penetrate) which is OMRI labeled as an antimicrobial that can be included in the recirculating fertilizer solution to kill and exclude E. coli. Various concentrations of Penetrate are being tested in the fertilizer tanks that have remained uninoculated or inoculated with E. coli. Samples of the fertilizer solutions and lettuce plants growing in the systems are being taken weekly (over 5 weeks) to determine if E. coli survives and if it spreads to the lettuce plants

The research and Extension programs at UAPB are committed to serving the small (less than $250,000 gross income) and socially disadvantaged producers (SSDPs) in eastern Arkansas, southwestern Arkansas and beyond. The programs provide research based information that is used for training and technical assistance to row crop, vegetable crop, and livestock producers. UAPB used the foundation sweet potato seed program to provide virus indexed sweet potatoes to the sweet potato industry in Arkansas. Also, UAPB conducted research trials that evaluated the potential for industrial hemp and other bio-fibers to be used in the commercial textile industry.

Training was provided through field days (16), meetings (59) and demonstrations (8) that show BMP's for specific commodities. Farm visits (414) were made on a regular basis to encourage the farmers to follow the recommendations that were made, to make further suggestions for improvement, and to assess the value of the recommendations that were made. Division of Agriculture Extension recommendations were used where appropriate and 151 samples (soil, nematode, and disease) were sent in to various U of A labs for diagnostic analysis. Assistance was provided in farm financial planning/business planning; vegetable and row crop production and marketing; livestock production and marketing; access to USDA assistance programs; food safety education; and housing.

The UAPB aquaculture and fisheries program conducted research in a variety of important areas including systems development, economics and marketing, nutrition and feeds, water quality, stress and reproductive physiology, and fish health. Most of the research was targeted at catfish, baitfish and sportfish - Arkansas is a major producer of all 3 categories of fish. The overarching goal was to develop

more cost-effective methods of production that will increase profitability for farmers, and create superior products for end-users.

The UAPB Fish Health Inspection lab in Lonoke, Arkansas, conducted routine health inspections; issued health certificates for fish being shipped to other states and countries, conducted inspections for the baitfish certification program in Arkansas, analyzed water quality, and identified aquatic weeds. The Lonoke Fish Health Inspection Lab is one of 11 APHIS approved laboratories in the US for aquatic organisms. UAPB has also used aquaculture as a teaching tool by helping teachers and students in K-12 install and operate recirculating aquaculture systems and conduct aquaponics studies in the classroom.

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/poultry producers
- Commercial poultry producers
- Commercial poultry company personnel
- Aquaculture/Fisheries and aquaponics producers
- 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
- Hmong families and farmers
- Hispanic/Latino families
- African-American families
- Single women
- 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
- Feed ingredient producers
- Feed mills
- Human fish consumers
- Aquaculture supply companies

Energy and commodity market analysts.

3. How was eXtension used?

UAPB developed a user-friendly iterative algorithm to forecast farm-level catfish prices using the index of leading economic variables. Users can get access to online updates of key indicators in the forecast model.

The Division of Agriculture used eXtension as readily accessed database. It was instrumental in information needed by agriculture economists and animals scientists. These databases prevent having to create or recreate the information that is shared.

Division agriculture faculty have assisted in the UAS in Agriculture Learning Network extensively in 2016, educating others on the use of unmanned aircraft systems in agriculture. Dr. Jim Robbins and Dr. Dharmendra Saraswat both served as members of the UAS leadership team.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	734956	2334432	39029	58604

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

Patent Applications Submitted

Year:	2016
Actual:	11

Patents listed
Stalk Cutting Device and Method of Use, US 14/987,969, 1/5/2016. Inventor(s): Roberts, Trenton / Greub, Chester

Method of improving tolerance of plants to herbicides using seed insecticide treatments. US 15/090,218. 4/4/2016. Inventor(s)Lorenz, Gus / Scott, Bob / Norsworthy, Jason / Hardke, Jarrod T.
Composition, Probiotic Formulation and
Method to Reduce Bacterial Infection in
Birds.US 62/286,701 1/25/2016.Inventor(s): Hargis, Billy M. / Wolfenden, Ross / Vincente-Salvador, Jose Luis / Bielke, Lisa / Wolfenden, Amanda.

Method to Reduce Microbial Bloom in Poultry Hatchery. US 62/286,759 1/25/2016. Inventor(s): Wolfenden, Amanda / Wolfenden, Ross / Hargis, Billy M. / Graham, Lucas / Lum, Jacob.

Trailer, Labeling System, Control System, and Program for Field Implementation of Computerized Hole Selection for Layflat Irrigation Pipe US 62/352,418 6/20/2016. Inventor(s):Henry, Christopher G. / Kline, Earl.

Method, Vectors, Cells, Seeds and Kits for Stacking Genes into a Single Genomic Site. US 15/114,724 7/27/2016.Inventor(s): Srivastava, Vibha.

Antibody Guided Vaccines and Methods of Use For Generation of Rapid Mature Immune Responses. US 15/316,421 12/5/2016. man, Luc / Abi-Ghanem, Daad / Chen, Chang-Hsin / Chou, Wen-Ko / Vuong, Christine / Waghela, Suryakant / Mwangi, Waithaka / Hargis, Billy M. / Bielke, Lisa

Novel Mucosal Adjuvants and Delivery Systems
C2012-21 US 15/363,281 11/29/2016. Pumford, Neil / Morgan, Marion J. / Shivaramaiah, Srichaitanya / Tellez, Guillermo / Wolfenden, Amanda / Hargis, Billy M.

Poultry Probiotic Vaccine Compositions and Methods of Use Therof. US 62/360,569 7/11/2016. Inventor(s):Hargis, Billy M. / Bielke, Lisa / Tellez, Guillermo / Teague, Kyle D.

Variable-Flow Solar-Powered Tail-Water Recovery Pump System
US 62/438,545 12/23/2016. Inventor(s): Henry, Christopher G. / Kohler, Brian / Nichols, Jim Page.

Compositions, Probiotic Formulations and Methods to Promote Digestion and Improve Nutrition in Poultry. US2016/41977 7/13/2016. Inventor(s): Hargis, Billy M. / Wolfenden, Ross / Tellez, Guillermo / Latorre, Juan D.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	40	243	283

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of agricultural production education meetings related to food, fiber and bioenergy production

Year	Actual
2016	2223

Output #2

Output Measure

- # of demonstrations/on-farm research related to food, fiber and bioenergy production

Year	Actual
2016	952

Output #3

Output Measure

- # of farm visits related to food, fiber and bioenergy production

Year	Actual
2016	16466

Output #4

Output Measure

- # of field days related to food, fiber and bioenergy production

Year	Actual
2016	289

Output #5

Output Measure

- # of educational materials distributed related to food, fiber and bioenergy production

Year	Actual
2016	13194

Output #6

Output Measure

- # of website visitors and downloads related to food, fiber and bioenergy production

Year	Actual
2016	29088

Output #7

Output Measure

- # of diagnostic samples related to food, fiber and bioenergy production

Year	Actual
2016	232155

Output #8

Output Measure

- Number of research-based scientific presentations at meetings related to Agricultural Production and Processing

Year	Actual
2016	4519

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 producers adopting GAP or other food safety related certification practices.
6	# of crop varieties or germplasm lines released.
7	# of producers using improved biosecurity practices
8	# of diagnostic plant health and nematode samples submitted.
9	# of fish samples submitted for disease testing.
10	# of fish samples submitted for disease-free certification.
11	# of samples submitted for exotic animal or poultry disease testing.
12	# of small and socially disadvantaged farmers reporting increased profitability
13	# of clientele who initiated specialty food-related enterprises
14	# of producers adopting herbicide resistance best management practices.
15	# of pesticide applicator training participants certified or re-certified
16	# of small or socially disadvantaged farmers adopting crop best management practices
17	# of Master Gardener participants trained, certified and re-certified.

18	# of small or socially disadvantaged farmers adopting more diverse crops
19	# of small or socially disadvantaged farmers adopting livestock best management practices
20	# of new ideas/concepts for textile structures/end products from bio-fibers
21	# of acres using improved crop best management practices.
22	# of catfish price algorithms developed
23	$ fuel savings per year of irrigation
24	lbs/acre increase in rice due to University of Arkansas breeding program.
25	% reduction of erosion due to cover crops and tillage.
26	# of producers adopting herbicide resistance best management practices in wheat
27	# of acres using irrigation best water conservation pratices

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
2016	9057

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

With the ever changing issues facing Arkansas soybean producers, the needed for current, unbiased, research based production information is vital for the success of our producers. During 2016, Arkansas ranked 11th nationally with 3,130,000 acres of soybean planted, and a state average yield of 47 bushels per acre. Over the past three 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 fields exhibiting elevated chloride concentrations, proper irrigation, and new herbicide technologies.

What has been done

. The intention of the Soybean College was to expose soybean producers, crop consultants, industry personnel and any other interested parties to current research for soybean production. When the August 18, 2016 date for the Soybean College was selected early in the spring, no one would have predicted that Arkansas would experience the wettest August in recent history.

Results

A total of 133 soybean producers, crop consultants, and industry personnel participated in the Soybean College. Participants were asked to complete a survey rating the quality of each presentation. Ratings for each of the seven stops during the Soybean College ranged from 4.45 for the chloride toxicity stop to 4.83 for the herbicide symptomology stop. The scale for the ratings were from 1 - 5, with 1 being not useful information to 5 being very useful information. A majority of the comments from the participants were positive, with many learning something new and suggesting conducting the Soybean College again in the future.

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
2016	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Throughout the year, when water temperatures are between 70 and 75 degrees F, golden shiner Notemigonus crysoleucas stocks seem to disappear from ponds that have been in production for two or more years. Fish losses from these ponds can range from 40% -80%. As a result, baitfish producers must have several additional acres devoted to golden shiner production in order to meet their customers demand for this baitfish.

What has been done
Investigations indicate that hydrogen sulfide may play a role. Studies in 2012 revealed that potassium permanganate would reduce hydrogen sulfide levels but proved to be too expensive to be a viable option. Studies have been conducted from 2013 to the present in which a bacterial species that reduces hydrogen sulfide was used to control hydrogen sulfide levels in baitfish ponds. In 2016 these trials were conducted on eight commercial farms in Lonoke County. Studies conducted in commercial ponds under commercial production management demonstrated that Paraccocus pantotrophus was capable of reducing hydrogen sulfide levels in pond muds and water. Survival in treated ponds is 54% higher in treated versus control ponds and water quality improved dramatically.

Results
The 2016 baitfish pond studies demonstrated that the bacteria successfully decreased hydrogen sulfide concentrations in ponds and also increased survival of golden shiners. As a side benefit, plankton blooms in ponds that were treated with the bacteria were improved. Analysis of the blooms indicated that populations of blue green algae, which in high numbers can cause high mortalities in small baitfish and off-flavor in catfish, were greatly reduced. These reductions resulted in fewer bloom die-offs, reduced labor and chemicals to control the blue green algae, and fewer aeration days in baitfish ponds. Additional studies were conducted in 2015 to determine the life span of Paraccocus pantotrophus in aquaria containing muds from commercial golden shiner production ponds. Data on these studies is still being analyzed. Producers are also using less aeration and fewer chemicals. This technique is currently estimated to save producers $100,000 annually.

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
2016	2503

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cover crops are proposed to benefit agronomic cropping systems by improving soil water retention, soil organic carbon, and crop yields while reducing soil erosion, weed and nematode pressure, and plant disease. But cropland for wheat production is generally left fallow following harvest in the early summer and tilled during the summer, leaving soil open to erosion by wind and water, and allowing runoff of nutrients into streams and waterways

What has been done
Each pasture was assigned to one of three tillage systems with 6 pastures per system. The tillage systems included: 1) conventional tillage - with tillage operations including chiseling, offset disking and disk harrowing to create a prepared seedbed with minimal surface residue; 2) no-till - with direct seeding via a no-till drill into the residue of the previous crop maintained by chemical fallow (2 burn-down applications of glyphosate each summer); and 3) no-till with forage soybean (cv. Large Lad) cover crop planted during early to mid-May. Steers were stocked to pastures at 1 steer per acre and performance of grazing cattle, forage yield, and forage quality were monitored.

Results

Forage production in conventionally tilled pastures was more affected by hoof action during the wet months of the year allowing steers to sink into the soil and plow up stands as well as increase compaction compared with no-tilled fields whether they had summer cover crops or not. Summer legume cover crops do not affect animal performance, even though fall forage production may be impacted and, along with benefits to enterprise sustainability, can provide high quality grazable fodder during the summer months.

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
2016	2594

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
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 producers adopting GAP or other food safety related certification 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
2016	83

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The number of farmers seeking opportunities to participate in local and regional food systems across the U.S. is increasing rapidly. At the same time, consumers, institutions, food distribution firms are exploring ways to identify and support these emerging niche markets. There are a number of public and private entities (USDA, Farm Credit, several Land-Grant Universities and

non-profit organizations) are seeking to develop resources and tools that enhance understanding and the performance of local food systems.

What has been done

The University of Arkansas Division of Agriculture Cooperative Extension Service leads a partnership with MarketMaker founders and technology team to develop interactive mapping tools and collaborate with the Phase I partners. Project seeks to enhance projects and collaborations focused on improving the understanding, operation and use of local/regional food systems. MarketMaker is a web-based resource developed and operated by its network of state partners working across twenty-one (21) states to connect food supply chain participants. http://foodmarketmaker.com/

Results

The goal for this project is to improve local leaders and food entrepreneurs understanding of the structure of their local/regional food systems with a focus on transparently highlighting the market participants, infrastructure and market channels. This project is a multi-state collaboration that includes MarketMaker, USDA, and a Local Foods Resource Mapping (LFRM) team being led by Stephan Goetz, Director of the Northeastern Rural Development Center.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management
603	Market Economics

Outcome #6

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

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Enhancement of host plant resistance traits provides the opportunity to improve profitability and lessen environmental impact of cotton production by reducing the damage caused by pests and by reducing the costs of pest control. Two major insect pests of Arkansas cotton are the tarnished plant bug and boll worm complex. Boll worm complex is mostly controlled with Bt cottons, but insecticidal treatment for worms in Bt cotton has become more common. Improved resistance to the worm complex would help to lengthen the use of current Bt technology.

What has been done

Incorporation of resistance genes and the evaluation of host plant resistance to these pests is routinely accomplished in the University of Arkansas Cotton Breeding Program. Boll worm resistance is enhanced by the nectariless trait. Nectaries associated with cotton leaves and bolls normally secrete nectar which attracts insects. Without nectaries, plants are less attractive to insects, particularly tarnished plant bug. The presence of gossypol glands (black dots) on most plant parts imparts resistance to most foliage feeding insects. However, gossypol glands do not normally occur in the calyx crown (tips of sepals that surround the square and flower).

Results

In 2016, we released four cotton germplasm lines that were derived from crosses made in 2005. Three lines display the nectariless trait and another displays the high gossypol trait - both traits improve host plant resistance. All four lines possess the bacterial blight resistance genes and are tolerant to Verticillium wilt and Fusarium wilt. Lint yields, yield components, maturity, and fiber quality traits expressed by all four lines are similar to a standard conventional check cultivar (DP393). Small quantities of seed of these lines will be made available for breeding purposes.

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 #7

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
2016	2615

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
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.
Poultry is the leading industry of Arkansas animal agriculture providing over 40,000 jobs and 44% of the total cash receipts.

What has been done
Dr. Clark serves as an educational resource and provides information and trainings on disease recognition, poultry diseases, and Biosecurity practices to the commercial poultry industry, hobbyists, poultry producers, animal owners, veterinarians, etc.
This was accomplished by the following:
-farm/premise visits (80+)
-disease diagnosis (400+) by phone, e-mail, or visits
-distribution of Extension Fact Sheets, information on AI, and copies of DVDs (600+)
-staffed displays (4) at major events such as the state fair
-information on the Extension website and in all 75 Arkansas counties
-information packets to the 4H pullet chain participants (1400 packets)
-Presentations (100+) at 55 meetings
-Biosecurity information/presence at the Arkansas state fair, AR-OK state fair, district fairs, and each of the 75 Arkansas county fairs
-3 day short course for the USDA/APHIS/VS temp employees

Results
Continued educational outreach to growers in the poultry industry and hobby and small flock owners are a vital link in Biosecurity efforts to prevent an outbreak of AI or any disease.The continued dialogue with numerous backyard, hobby, and exhibition flock owners in Arkansas assists greatly with Biosecurity efforts in small flocks, an increased awareness of diseases, and preventative measures to prevent introduction and/or spread of disease to commercial poultry. Commercial poultry growers continue to be vigilant with Biosecurity efforts to prevent disease in

their flocks. The hobby of keeping poultry continues to increase and the seminars conducted with small flock owners have been successful and shown them that they have a source of information available to them that can help them, the Arkansas Cooperative Extension Service.

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 #8

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
2016	4861

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Science-based diagnostic service and education continue to be fundamental to successful IPM of crop production in the US and Arkansas. While the internet is filled with do-it-yourself identification guides for pests, many novices come to incorrect conclusions leading to expensive and sometimes disastrous results. The correct diagnostic and research-based best management practice recommendations remain critical and are not that easy to do, in spite of the information age. The University of Arkansas System Division of Agriculture Plant Health Clinic and Nematode Diagnostic Lab represent science-based approach to regional diagnostics, serving Arkansas stakeholders, but also providing information to scientists interested in detection, invasive species, and epidemiology.

What has been done

The Plant Health Clinic program focuses on diagnoses, in addition to written information, presentations, and workshops. Outreach efforts through newsletters, displays, and presentations focus on education of Extension personnel, homeowners, growers, and professional nurserymen and Master Gardeners. This program is designed to educate, support, and assist Extension personnel, the citizens of Arkansas, and agriculture through diagnostic services and education on those topics relating to plant diseases. Program goals are achieved through county and state educational programs such as demonstrations, applied research, education booths, presentations, publications, newsletters, web pages, in-service training of county faculty, and news releases. Twenty-nine Plant Health Clinic Newsletters were distributed to over 6,000 individuals. Three hundred-eighty-six Master gardeners were trained in 26 counties.

Results

The Plant Health Clinic and Nematode Diagnostic Lab significantly impacted both Arkansas growers and Extension personnel through their diagnostic services, training sessions, and public outreach. The Clinic serves as a valuable aid to county agents in solving problems connected with Extension clients and shareholders. The Clinic partners with the Southern Plant Diagnostic Network, the National Plant Diagnostic Network, and the Arkansas State Plant Board to alert and train shareholders about developing threats to the agricultural and horticultural industries. Additionally, thousands of homeowners were benefited through our diagnostic services, and one-to-one personal attention to their problems. During 2016, the Plant Health Clinic and Nematode Diagnostic Lab processed 4,861 samples.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

Outcome #9

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
2016	439

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 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 2016, personnel at the lab conducted 439 disease diagnostic cases, 121 water quality/aquatic weed cases, and 94 health certifications for interstate or international transport of live fish. I also provided technical assistance to clientele through more than 67 farm visits, 715 phone consultations, and 500 office visits. The Arkansas Baitfish Certification Program provides APHIS certifications for fish to be exported interstate and to other countries. In 2016, 20,000 fish were sampled and certified for the certification program. These certifications obtained by farmers, enables the shipment of more than $700,000 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
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases

Outcome #10

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
2016	94

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

# of samples submitted for exotic animal or poultry disease testing.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	280

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #12

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
2016	63

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Small and Socially Disadvantage Producers (SSDPs) are attending fewer and fewer Cooperative Extension educational meetings. The failure of SSDPs to attend these meetings and obtain the latest recommendations may have helped caused many to have lower yields. On the other hand, those who have larger farms (1000 acres and over) have consultants who attend the Extension educational meetings and advise the farmers on production techniques.

What has been done
The UAPB Extension Associates (EAs) worked with SSDPs to inform them about the Cooperative Extension Service (CES) Best Management Practices (BMPs). SSDPs were contacted and informed about soil testing, nematodes testing, plant sampling for diseases, using herbicide resistant management practices, variety selections, etc. Over 1000 educational fact sheets and pesticides manuals (weed, insect and disease), were distributed to SSDPs.

Results

After taking samples from watermelons seedlings a producer was able to determine that he needed to spray cooper fungicide applications to control the Bacteria Fruit Blotch that infected his 500 acre watermelon and cantaloupe crop. The spray applications prevented the producer from losing approximately 90% of his yield. The estimated value of the crop was $1500/acre. Approximately 50 SSDPs were counseled on specific herbicide resistant weed control practices for the soybeans on their operations. In addition, fact sheets, with specific resistant weed control practices were provided. An estimated 10,000 acres of soybeans were grown by SSDP's with an estimated value of $185/acre being realized as a result of controlling pigweed.

4. Associated Knowledge Areas

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

Outcome #13

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
2016	160

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Commercial Horticulture encompasses the areas of fruits, vegetables, turf, and ornamentals. According to a 2013 report (Economic Contribution of Arkansas Agriculture), eight Horticulture crops rank in the top 25 states including: sweet potatoes (5th), pecans, watermelons and tomatoes (12th), blueberries and grapes (13th), sod (16th), and peaches (19th). The collective efforts of the Division of Agriculture assists the various Commercial Horticulture stakeholders with objective research and extension programming to assure improved efficiency, profitability, sustainability and environmental stewardship.

What has been done
Challenges for growers include climate change, rapidly evolving technologies, invasive pests, global trade, and complex business practices. These same challenges represent opportunities for Commercial Horticulture in Arkansas. To address these challenges requires that the Division of Agriculture be on the cutting edge of scientific research and outreach innovations.

Results
Changes in knowledge- 97% of participants
Changes in Learning (skills based): 75%
Changes in farming practices or actions: 88%
Changes in perception: 100%

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 #14

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
2016	6162

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Glyphosate-resistant Palmer amaranth has been the main focus of weed control programs in cotton and soybean for the last 10 years. Recently, populations of Palmer amaranth (pigweed) were found to be resistant to herbicides in the PPO (protoporphyrinogen oxidase) class of chemistry. PPO-resistant pigweed has now spread from a couple of counties in 2015 to over 15

counties in Arkansas and across 7 other states in 2016. This is a serious issue, especially for soybean growers because the key herbicides that were used to manage glyphosate-resistant pigweed from a residual standpoint at planting in addition to postemergence in crop are in the PPO class of chemistry.

What has been done

Three on-farm locations were identified that contained PPO-resistant pigweed at Gregory, Crawfordsville and Marion, AR. Over 30 trials in Roundup Ready, Liberty Link, Xtend and Enlist technologies were conducted to develop best management recommendations in each system. In addition pigweed samples were taken across the state to determine the spread of PPO-resistant pigweed. Preliminary samples indicate that 50% of pigweed populations in Northeast Arkansas contain the PPO-resistant gene. Field tours and agent trainings were conducted multiple times throughout the season to educate clientele on recommendations for PPO-resistant pigweed moving forward.

Results

Over 500 clientele including county agents, consultants, growers and agriculture industry groups toured the PPO-resistant weed control research trials in Crawfordsville, Gregory and Marion, AR. In addition major manufactures utilized these plots for internal training of their field force. This research revealed the importance of utilizing a comprehensive preemerge or at planting herbicide program. No single herbicide at planting provided adequate control, however herbicide programs containing full rates of metribuzin plus either Zidua or Dual Magnum outperformed the others. These trials also demonstrated the benefit of a timely postemergence herbicide. When evaluated across technology, the Liberty Link system provided the best overall control of PPO-resistant pigweed, followed by Enlist and Roundup Xtend technologies. These recommendations were added to the MP-44 publication and numerous growers and consultants have requested these data to build herbicide programs in 2017.

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 #15

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
2016	3568

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. The pesticide safety education program (PSEP) in Arkansas is the primary way that pesticide applicators are trained and certified on the proper and safe use of pesticides.

What has been done
The University of Arkansas Division of Agriculture personnel work closely with the Arkansas State Plant Board to coordinate the development of the required exams for commercial applicators. Division personnel are also responsible for developing the exam study kits that are sold to individuals wanting to obtain their commercial/non-commercial pesticide licenses.The PSEP has developed a Pesticide Training, Licensing, Education, and Recommendations webpage (http://www.uaex.edu/farm-ranch/pest-management/education-licensing.aspx). The site contains information and links to certification and recertification training schedules, study kits, licensing & testing, the Worker Protection Standard, pesticide recordkeeping, pesticide resources in Spanish, Arkansas crop profiles and pest management strategic plans, "Ask the Pest Crew," Extension recommendations for disease, insect, and weed control, crop management newsletters, and other pertinent resources.

Results
Successful implementation of the PSEP depends in large part on obtaining the funding needed to support the efforts towards meeting the objectives listed above. In order to keep the program viable, as Federal funding has steadily declined, the program has pursued grants, cost recovery measures, and funding agreements with the Arkansas State Plant Board.
The Division of Agriculture Extension initiated registration fees in the early 1990's for all applicators that attend Extension conducted pesticide applicator training. These fees have become a substantial source of funding with over $60,000 collected per year. One-half of the registration fees collected at the county level stay in the county for pesticide safety education related purchases.

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 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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	152

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pollinators such as honey bees and native bees are required to pollinate fruits and vegetables in small, medium, and large high tunnel operations. Most farmers recognize the importance of pollinators but they need to be educated on how to maintain pollinators in their high tunnels and how to use insecticides and other chemicals in a safe and non-toxic manner.

What has been done
Workshops, presentations, and farm visits were conducted to educate and train farmers on current issues and new regulations to apply in farmland. Discussions included the role of honey bees in pollination and how to manage pollinators. Pests and diseases that occur in pollinator populations were covered also.

Results
Many beginner beekeepers and small or limited resource farmers learned better practices to keep

pollinators in their farm environment. Farmers and beekeepers were continually communicated with and updated on new issues to improve their 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 #17

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
2016	3458

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Master Gardener program is offered by the University of Arkansas Division of Agriculture and is designed to increase the availability of horticultural information and improve quality of life with horticultural projects. People all over the state of Arkansas with horticultural skills, a willingness to learn and a desire to help others become Master Gardeners.

What has been done
The University of Arkansas Master Gardeners conduct events in a wide range of activities including educational seminars and workshops, youth gardening programs, plant therapy work with hospitals and nursing homes, community beautification projects all helping to disseminate horticulture information. Master Gardeners also have continuing education opportunities, in

addition to the initial 40-hour Master Gardener training each individual must complete when they first join the program.

Results
Started in 1988 in 4 counties (Garland, Jefferson, Pulaski, and Saline) and 40 members, in 2016, the Arkansas Master Gardener Program now:
-has over 3400 volunteers
-reported 89,810 education hours and 163,876 service hours in 2016
-operated in 67 Arkansas counties
-coordinated over 20 county and regional horticulture event each year

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 #18

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
2016	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sweet potatoes are highly susceptible to viruses and natural mutations that accumulate with successive generations. In the variety mostly grown by Arkansas producers, Beauregard, viruses alone account for 25 percent to 40 percent yield reduction. Availability and cost of high quality, disease-free planting material proved to be a major constraint affecting Arkansas producers, who depended on sources outside of Arkansas for this material. This led to an increased cost of production due to associated shipping cost and ultimately, a decreased return on investments.

Other shipping challenges led to delayed time of planting and compromised the quality of planting material.

What has been done

The University of Arkansas at Pine Bluff initiated a Sweet potato Foundation Seed Program which provides high quality, virus-indexed seed stock to Arkansas producers. This material is produced and provided to producers at a reasonable cost. In addition, the university has stepped up its outreach efforts to inform producers about the benefits of using clean planting material. Technology transfer activities have also been increased and farmers have been targeted through field visits, workshops and demonstration activities. Technical assistance has been provided in specific areas of sweet potato production, for example, weed management, slip production and curing.

Results

The timely availability of affordable high quality planting material has eliminated the problem of delayed planting faced by Arkansas producers. Farmers can now get their crop in on time and benefit from optimum prices during peak periods of the season. Since this material is now accessible within the state, there has been a substantial decrease in the acquisition cost of planting material, mainly transportation cost, thus leading to an increased return on investment. Additionally, the use of high quality planting material has translated into increased yields and an improved quality of Arkansas sweet potatoes. This has contributed to higher profits for producers and has allowed small and limited resource farmers to maintain some form of economic stability, since they can better compete in their local marketplaces with sweet potatoes entering from outside of the region. Farmers have also considerably decreased the potential for disease and insect pest transmissions by not having to transport seed potatoes across state lines.

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 #19

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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	28

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Small and socially disadvantaged farmers often rely on small ruminant production to supplement or completely provide farm income, especially on marginal lands. Many of these small ruminant producers are experienced farmers, but their experience is usually not with livestock or small ruminants. Therefore, they need training and education on the basics of small ruminant production because Small Ruminants in the southern US face high exposure to Haemonchus contortus, a blood-sucking gastrointestinal parasite that frequently kills its host. Chemical dewormers are becoming less effective in controlling Haemonchus infections and producers need more effective methods of controlling Haemonchus on their farms to reduce economic losses.

What has been done
Four workshops for new and beginning small ruminant producers were conducted in south Arkansas to educate and train new farmers and people interested in starting a small ruminant operation. One gastrointestinal parasite management workshop was conducted in the state. The workshop was designed to educate producers about the use of FAMACHA scoring and proper use of chemical dewormers to reduce the development of resistance, reduce the cost of medicine and reduce death losses to gastrointestinal parasites.

Results
As a result of the program, Small and Socially Disadvantaged Farmers gained knowledge of the basic equipment and facility needs of small ruminant production. They learned the basics of marketing small ruminants, basic herd health needs and basic reproductive management. Producers who attended the FAMACHA trainings became certified in FAMACHA scoring and received their FAMACHA cards. Producers reduced the frequency with which they deworm their goats, reducing their costs by an estimated $230 per farm and slowing the rate of development of parasite resistance to anthelminthics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
311	Animal Diseases

Outcome #20

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Industry professionals (product designers, textile experts, manufacturing, and marketing experts) and consumers are concerned about getting accurate information about environmental sustainability in relation to eco-fibers/textiles. Natural bio-fibers such as hemp, kenaf, alpaca, etc. are being re-evaluated as to the role they can play in reducing the environmental impact on textile production, use, and care.

What has been done
Woven textiles have been evaluated for wrinkle recovery and shrinkage. Three presentations were made including two on sustainability of fibers at UAPB events; one book chapter was published and one presentation on sustainability of textile communities. Four proprietary concepts for yarn, textile structures, and/or end products using hemp fibers were conceptualized during this period.

Results
Physical Performance of hemp textiles indicates that shrinkage is a problem for woven textiles of 100% hemp fibers as is resiliency which is less of a problem in knitted textiles. The evaluation of knitted textiles continues in regards to shrinkage. Four Proprietary fiber/textile/product concepts were developed.

Sustainability of communities using traditional bio-fibers in traditional textile production can help sustain communities; the results were published as an abstract from International Textile & Apparel Association (ITAA) and Springer book chapter.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

Outcome #21

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
2016	5965150

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Corn acreage has increased dramatically in Arkansas over the last 15 years. In 2016 Arkansas corn producers planted the second greatest amount of corn since 1951. Much of the increased corn acreage has come from fields that were previously planted to cotton, soybean, or rice and many producers, crop consultants, and county agents are still learning how to properly grow corn. As a result, producers may not fully understand how management decisions impact yield and quality of corn grown in Arkansas. New producers, crop consultants, and county extension agents need production information on how to grow economical high yielding and high quality irrigated corn.

What has been done
Educational efforts were made throughout the year to educate corn producers, county extension agents, and crop consultants 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. Educational efforts focused on proper production methods to grow corn and included; hybrid selection, planting dates and rates, fertility, weed control, insect management, irrigation, harvest, and storage.

Results
Despite a tough growing season, Arkansas corn producers averaged 178 bu/acre from the second highest corn acreage in recent history (750,000 acres). This yield represents the 4th highest all time state average yield. Corn has become an economically important crop that producers want to grow. In 2016, Arkansas produced approximately 133 million bushels of corn worth an estimated $500 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 2016.

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 #22

1. Outcome Measures

# of catfish price algorithms developed

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This study aims to assist catfish stakeholders to forecast farm-level catfish prices. It is developed by revealing the influences of critical long-run factors to short-run adjustments in catfish prices.

Technically, this project transforms catfish price fluctuations as a function of critical leading input prices (e.g. feeds and energy), seasonality and general economic conditions. In addition, our forecast toolkit in this study can be used in quantitative analysis for commodity markets and risk management. The optimal selection of critical economic index can be performed to risk control, uncertainty assessments and performance improvement in agricultural marketing and agricultural finance.

What has been done

In this study, our leading indicators approach had a subtle link with the approach of using time series based historical simulations. First, we used in-sample data for extracting information from the selected indicators. Secondly, we applied the estimated coefficients for out-sample predictions. Historical simulations provide a simple approach to represent hypothetical movements of the dependent variable using actual historical data. Thirdly, to assist catfish producers in forecasting prices, we developed a Microsoft Excel based algorithm-LIM 1.0 and provided online updates.

Results

This study developed a two-step algorithm to forecast catfish prices using an optimal combination of leading economic variables. We chose an appropriate combination of leading indicators. To avoid over-fitting and to obtain a parsimonious model, we used the leaps-and-bounds methods to select an optimal subset of predictors from the full model. Secondly, we applied a quantitative time-series model to estimate long-run equilibrium and short-run relationships between farm level fish prices and leading indicators. Using in-sample data, we will generate ADL coefficients, which will then be used for out-sample predictions. Our results indicate predicted values approximate actual in-sample price movements well. When the model is applied for out-sample, outcomes are still desirable. In addition, real price changes and two predicted series were similar in their distributions. Overall, our model can be used for predicting long-run catfish price movement in practice.

4. Associated Knowledge Areas

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

Outcome #23

1. Outcome Measures

$ fuel savings per year of irrigation

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	303

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Irrigation and fertilization represent a significant part of the costs of producing a crop in a sustainable way. Field productivity and nitrogen use efficiency as well, can be significantly impacted with improper irrigation scheduling and inefficient use of irrigation equipment. Proper operation of irrigation equipment not only reduces the risk of nitrogen loss, but could potentially decrease irrigation costs.

What has been done
During the 2016 season, as part of an irrigation project lead by Dr. Chris Henry, we conducted 23 pump evaluation tests in 11 counties in Arkansas, with 15 of such tests being done on diesel units and the remaining 8 on electrical units. Fuel consumption time, engine speed, and pump productivity were recorded. Similarly, electric power consumption, motor speed, and pump productivity were recorded in the wells equipped with electrical power units. Irrigation water costs were calculated based on test results and defined effective engine speed (lowest rpm that achieves maximum water flow). Water pumping costs were heavily influenced by the underground water level, pump-engine type and condition of the unit.

Results
Results from the pump test evaluations showed that significant improvements in fuel efficiency could be achieved by using the correct engine speed. Such improvement could be as high as 10%. This increase in efficiency translated into fuel savings ranging between $103 and $525 (average of $303) per unit tested for a given season. When our findings are extrapolated to the whole Delta region, where nearly 5 million acres of cropland are irrigated and groundwater being the main source, it is easy to conclude that Arkansas farmers could potentially save millions of dollars on fuel costs.

4. Associated Knowledge Areas

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

Outcome #24

1. Outcome Measures

lbs/acre increase in rice due to University of Arkansas breeding program.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3040

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas farmers produce more than 45 percent of the rice grown in the United States under dynamic production conditions that differ from those in other rice growing areas. Because of their prominence in this crop, Arkansas rice farmers depend on an Arkansas variety development program that provides a progression of improved varieties to meet the challenges of changing conditions in their fields and in the marketplace for rice.

What has been done
Arkansas rice producers provide check off funds administered by the Arkansas Rice Research and Promotion Board to help support a dynamic rice breeding program by Arkansas scientists in cooperation with researchers in other states and the USDA. Check off funding for the breeding program was started in 1980 and has increased substantially over the years. Twenty-nine varieties have been released from the Arkansas breeding program since 1980. The most recent notable releases are Diamond and Titan. Each variety comes with management recommendations developed through research on plant nutrients, diseases, insect pests, weeds and other areas.

Results
Thirty percent of the rice grown in Arkansas in 2016 was comprised of varieties developed in the Arkansas rice variety improvement program. When the program was started in 1980, the average rough rice yield in Arkansas was only 4,110 lbs/acre compared to an estimated 7150 lbs/acre in 2016. Assigning a conservative value of 60 percent of this 3040 lbs/acre yield increase to Arkansas varieties, the average monetary gain in 2016 over 1980, at a rough rice price of $10.50/cwt, would be $192/acre or $291 million for the 1.521 million acres harvested in Arkansas in 2016, of which $87 million is due to the improvement of Arkansas 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

Outcome #25

1. Outcome Measures

% reduction of erosion due to cover crops and tillage.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	68

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Producers are continuously focusing on adjustments that can be made to increase efficiency in an effort to improve profitability. As producers improve efficiency, a positive impact is often observed with regards to sustainability. The supply chain is very interested in becoming more sustainable all through their process and desire to source responsibly produced commodities for their products. The Fieldprint Calculator, an online tool developed by Field to Market is available for use by producers to measure their environmental footprint, is one of the tools the supply chain has invested in and is using to document improvements in sustainability.

What has been done
The University of Arkansas, Division of Agriculture has conducted the Cotton Research Verification Program since 1980 with the objective of demonstrating the profitability of university production recommendations. The University of Arkansas Cotton Research Verification/Sustainability Program was able to partner with the Discovery Farms in Southeast Arkansas in 2015 and 2016. Discovery Farms primary focus is monitoring edge of field water quality. Gauges, meters, and samplers are employed to measure all water entering and leaving the field and measuring nutrient and sediment losses in the runoff. Each field is composed of two irrigation sets allowing for evaluation of farmer standard practices to that of a modified production system and compares how each impacted edge of field water quality and ultimately profitability of each system.

Results
Soil compaction was consistently lower in no-till with cover, soil moisture was consistently higher in no-till with cover, and irrigation water flow rates down the row was slower in no-till with cover. After large rain events we observed that no-till with cover infiltrates water quicker which allows for decreased runoff when compared to that of a stale seedbed re-hipped with a cover crop. The

fields in this two-year study had an increased yield primarily as a result of increased water infiltration and soil health. Improvements were also observed in regards to sustainability measures with an established no-till cover crop production system when compared to farmer standard tillage practice. Changes in production practices to almost no-till with a cover crop has the greatest impact on improving soil conservation by reducing total soil erosion losses by 68%, improving irrigation water use by over 18%, and reducing greenhouse gas emissions and improving land use or yield by over 11%. This practice also resulted in decreasing operating costs by $0.06 per pound of lint produced.

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

Outcome #26

1. Outcome Measures

# of producers adopting herbicide resistance best management practices in wheat

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1196

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Herbicide-resistant ryegrass in wheat is becoming a more significant issue each year in Arkansas wheat production. Sometime in the late 2000's the standard ryegrass control herbicide used in wheat in Arkansas, Hoelon, essentially stopped being effective as over 90% of the populations tested came back at high levels of resistance.

What has been done
Extensive efforts have been made through the county agent system, publication of Delta Farm Press articles and presentations at County, trade and scientific meetings to promote the use of multiple modes of action for ryegrass control in wheat. The presentation of data from a

comprehensive resistance survey followed by recommendations for herbicide programs has been effective.

Results

According to informal evaluations taken at county meetings and other production meetings, there has been about a 60% adoption rate of herbicide resistant management programs for ryegrass in Arkansas. In addition, a new mode of action for wheat was labeled this past fall under the trade names Zidua and Anthem Flex. The development of large populations of ryegrass resistant to Axial XL herbicide appears to have been slowed compared to what happened with the ALS chemistry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #27

1. Outcome Measures

# of acres using irrigation best water conservation pratices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1028200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Arkansas's groundwater withdraws from the alluvial aquifers are only about 42 percent sustainable and 54.6 percent sustainable from the Sparta/Memphis aquifer. Implementation of best management practices on a large scale will improve water sustainability in Arkansas. Without sustainable irrigation practices, yields could be 30-50% less in the future if water becomes limited. Aquifer overdrafts pose a real concern about the future of row crop production and food security. The 2014 Arkansas Water plan projects that by 2050 that irrigation water for row crop agriculture will be scarce, not available or limited on 3.8 Million acres. This equates to about half of all wells

being decommissioned by 2050 to reach a sustainable withdraw for Arkansas aquifers.

What has been done

Educational programming and on-farm demonstration has been used to promote the adoption of irrigation water management practices (IWM) in Arkansas and the region. Specifically the target audience has been trained to use the following IWM practices, measurement of irrigation water flow and proper use of flow meters, computerized hole selection for lay flat poly pipe a conservation practice that improves distribution uniformity in furrow irrigation. Surge irrigation a practices that improves irrigation efficiency and uniformity. Soil moisture monitoring a practice that improves irrigation management and irrigation timing. ET-based scheduling techniques which improve irrigation timing.

Results

Primary efforts in Computerized Hole Selection for lay flat poly pipe which has the potential to reduce water use by 19% as demonstrated by side-by-side field comparisons (113 demonstrations). These demonstrations have been an effective tool in promoting irrigation water management on their farms. About 33% of irrigators in Arkansas have now adopted this irrigation water management practice since 2012 from a recent survey. 83% of this adoption has occurred since 2012. This represents over a million acres, 2,619 contacts made with 1,549 clients trained on IWM practices through educational programming (54), visits (948), field days (13) and dissemination of materials (1,545).

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Other (Animal or plant disease outbreak)

Brief Explanation

Drought, floods, heat, and disease resulted in difficulties for Arkansas's farmers but none of these could hold the impact as falling commodity prices. Spring 2016 started wet with floods and wet conditions lasting until sometime in June. Several plant diseases were exasperated due to cooler temperatures and humid conditions. Summer and fall turned hot and dry and lead to drought conditions by August without relief until late October. Record night time high temperatures during flowering of rice reduced yields significantly. Those high temperatures during seed formation resulted in less quality and more chalking. Because of the unusual combination of conditions, target spot became a problem with soybeans this year.

Falling prices of row crops and cattle have put strain on farm budgets. Investment in cattle operations were made during good cattle prices. Low prices have created tight budgets and investments in cattle operations have lessened. Cotton and grain sorghum have been

at record low acres. Rice, bean, and corn all have increased acres in Arkansas with very little movement upward in price.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Economics/marketing studies with catfish can be evaluated by the performance of catfish stakeholders participating in transactions. Our data can correct the asymmetric information between catfish producers and the real economic environment. Potential benefits include fully informed farmers that could adjust their input purchase decisions and benefit from lower input costs and enhance price-negotiations between farmers and traders. With classroom aquaponics projects, participants were asked to grade each workshop presentation on a scale of 1-10. Workshop average was 9.

Producers attending the Four States (AR, LA, TX, and OK) Cattle Conference were cow-calf (77%) or predominantly cow-calf with some stocker cattle (19%), manage an average of 151 head of cattle (range of 25 to 750 per operation), and 50% were from Arkansas. From this conference 49% of those in attendance improved their understanding of factors affecting the cattle markets in 2017, 85% believed it will be easier to evaluate cattle production and marketing alternatives in the upcoming year, 94% improved their understanding of nutrient requirements of cows and how nutritive quality of stored forages relates to these requirements, 40% planned to adopt recommendations to test hay quality for development of a winter feeding program, 85% increased the level of understanding related to keeping good production records, 19% plan to adopt recommendations to conduct annual mineral balance review and 96% increased their level of understanding related to the importance of selection traits. Producers indicated that they anticipate an average total economic benefit of $1,940 for their operation. It is anticipated from these results that the producers polled would gain economic benefits of approximately $97,017 and if this is extrapolated to the entire population of producers in attendance the total economic benefit would equal over $197,880; with an economic benefit to Arkansas alone of $97,000.

Key Items of Evaluation

Catfish economics/marketing studies included the following key items for evaluation: 1) A user-friendly interface developed in Excel in an easy-access format (No programming and macros). Users can make improved forecasts via simplified models; 2) An innovative time-series model for estimating parameters of leading indicators. It generates robust out-sample forecasts using in-sample parameters; 3) Improved quantitative analysis technology and economic value added toolkits for stakeholders and market participants in response to an inefficient market.

For aquaponics projects, evaluations graded what the participant felt the level of usefulness was for each of 5 presentations given during the beginner workshop.

The Four States Cattle Conference was designed to pool the efforts of Beef Extension Specialists and County Extension Agents from Louisiana, Texas, Oklahoma, and Arkansas so that top quality education events could be offered to the producers of the region. Topics included: Cattle Market Outlook; Winter Cow Nutrition; Mineral Supplementation; and a Producer Panel Highlighting Genetic Evaluation of Cowherds. Producers in attendance were asked about the size and scope of their operations, the knowledge improvement of the subjects covered, and their intention to adopt technologies. The expected economic benefits of this program was determined on a subset of 50 of the 102 in attendance.

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%	2%	0%
102	Soil, Plant, Water, Nutrient Relationships	12%	0%	15%	0%
111	Conservation and Efficient Use of Water	8%	25%	7%	15%
112	Watershed Protection and Management	8%	25%	8%	15%
123	Management and Sustainability of Forest Resources	15%	0%	5%	0%
132	Weather and Climate	0%	0%	1%	0%
133	Pollution Prevention and Mitigation	6%	20%	4%	0%
134	Outdoor Recreation	0%	20%	0%	20%
136	Conservation of Biological Diversity	2%	0%	2%	10%
141	Air Resource Protection and Management	2%	0%	2%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	9%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	21%	0%
204	Plant Product Quality and Utility (Preharvest)	5%	0%	4%	10%
306	Environmental Stress in Animals	0%	0%	2%	10%
402	Engineering Systems and Equipment	5%	0%	3%	0%
403	Waste Disposal, Recycling, and Reuse	3%	10%	0%	20%
511	New and Improved Non-Food Products and Processes	5%	0%	5%	0%
601	Economics of Agricultural Production and Farm Management	9%	0%	4%	0%
605	Natural Resource and Environmental Economics	5%	0%	5%	0%
610	Domestic Policy Analysis	5%	0%	1%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	18.3	1.1	129.3	2.0
Actual Paid	16.2	1.1	118.1	2.0
Actual Volunteer	0.9	0.0	1.2	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**
227437	139666	999341	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
333443	129617	12787788	83177
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2589117	0	2154479	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Arkansas has tremendous soil, water and air resources that provide a multitude of beneficial uses. These resources support a highly productive, efficient agricultural system that annually accounts for $20 billion of value-added to the Arkansas economy. Yet, Arkansas still remains the "Natural State," as its scenic beauty attracts many outdoor enthusiasts and generates over $5.9 billion in tourism expenditures annually.

Managing Arkansas's natural resources to protect and sustain these multiple beneficial uses for future generations is not without its challenges. Air and water quality concerns have evoked lawsuits, new state and federal regulations, as well as voluntary natural resource conservation programs, such as USDA-NRCS' and Mississippi Healthy River Basin Initiative (MRBI). Large-scale modeling studies of the Mississippi River basin point to agriculture as the leading source of excessive nutrients that cause hypoxia in the Gulf of Mexico. The State Assembly commissioned ANRC to update the State Water Plan while the Gulf of Mexico Hypoxia Task Force, consisting of 5 federal agencies and 13 states, held their Annual Spring Meeting in Little Rock in May 2015. The Division also jointly produces a regional newsletter entitled "Confluence" to provide information to the agricultural public on nutrient reduction and water quality protection efforts within the 13 states participating in the Gulf of Mexico Hypoxia Task Force. Other sectors of society, such as municipalities and urban areas also face nonpoint source water issues. Municipalities and urban areas are also required to address storm water management issues and provide education on reducing the impact of storm water on runoff water quality. Municipalities in three Arkansas counties have contracted with Extension to provide storm water education, providing research-based and unbiased information to Arkansans to assist with voluntary efforts to address nonpoint source water quality issues. In 2014, the State of Arkansas developed a process to update the State Water Plan, a comprehensive plan for addressing both water quantity and quality concerns.

The UAPB Aquaculture and Fisheries Department (AQFI) provided management training and assistance to private impoundment owners of Arkansas. Privately-owned impoundments can be used for numerous purposes and the management of those impoundments is affected by, and can have an impact on, the environment immediately surrounding the impoundment and its watershed. Proper management

helps to ensure a healthy and productive environment within the impoundment and the surrounding area. In addition, research is underway to assist the Arkansas Game and Fish Commission in determining the success of their supplemental stocking programs with crappie and other important sportfish.

Monitoring water quality and nutrient levels on a tributary to the Buffalo National River was assigned to an environmental task force in late 2013 by the Arkansas Governor's office and a subcommittee of the Arkansas General Assembly. This action was in response to public interest in a state-permitted swine farm in the Big Creek Watershed. The Big Creek Research & Extension Team was formed in fall 2013 and received $340,000 from the governor's office to initiate the environmental study and monitor potential environmental impacts of the swine operation. Monitoring efforts have continued through FY2016. Members of this team, including the team leadership, include Division of Agriculture research and Extension faculty and staff. After three years of extensive monitoring, no impacts or consistent trends of farm operation on area water quality are evident.

Efforts to reconcile competing agricultural and environmental interests are often hampered by a lack of definitive best practices. The Division of Agriculture has created a multidisciplinary team approach to discovery, demonstration and promotion of agricultural/environmental best practices. The Center for Agricultural and Rural Sustainability (CARS), the Arkansas Water Resources Center and the Environmental Task Force represent team efforts that range from basic discovery to economic consequences of implementing best practices.

Agricultural production and processing sustainability has been a focus of the Division of Agriculture and UAPB for many years. Evidence of this is the Division's hosting of the Center for Agricultural and Rural Sustainability (CARS), a nationally known center of excellence. Faculty associated with the Center have pioneered life cycle analysis of cropping practices, studied alternative production and marketing systems, organic agriculture, phytoremediation, alternative residue and water management, and trace gas emissions. The projects carried out by CARS faculty are diverse covering all major areas of agricultural production including animal and livestock, rice, forestry and timber, soybeans, specialty crops, local foods, etc. Their work provides the unparalleled support to the agricultural industries and rural communities to build sustainable, "green" agriculture in the State. In 2013, CARS was awarded a $3 million grant by the Walmart Foundation to improve fresh strawberry production in the U.S. Since then, CARS faculty have conducted research on the processing of various strawberry products to ensure retention of anthocyanins, which are attributed to the vivid red color of strawberries. In 2014, the Walmart Foundation donated an additional $3 million to fund the creation of the "Success in the Field" e-book, which outlines the accomplishments of the National Strawberry Sustainability Initiative. This e-book was completed and published in FY2016.

The Division of Agriculture has research and extension faculty making contributions in the focus area of sustainability. Specific efforts related to sustainability are being made in alternative residue and water management, trace gas emissions to the atmosphere, and poultry production and poultry waste management. 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. Furthermore, the effects of nutrient source, cultivar, soil texture, crop rotation, and water management scheme on methane and nitrous oxide emissions from rice are also being investigated.

The Big Creek Research and Extension Team (BCRET) project determining the impact of the C&H Farm operation on Big Creek. After three years, no impacts or consistent trends of farm operation on area water quality are evident. Continued CRIS research program on the fate, transport, and legacies of phosphorus in agricultural production systems. Led five Discovery Farms in northwest AR, which assess rotational grazing management on soil health and water quality, poultry production facility conservation practices to minimize nutrient runoff, use of cover crops to limit nutrient and sediment loss, and nutrient management of rotational grazing dairy. This is an ongoing collaboration among Division Faculty, state and federal employees, and farmers.

UAPB's Department of Agriculture is involved in reducing lignin in rice for biofuel. Rice straw, one of the largest biomasses in the world, is considered a potential biomass feedstocks for lignocellulosic ethanol production. However, the association of lignin with cellulose and hemicellulose has hindered the

efficient utilization of rice straw and big bluestem for cellulosic bio-fuel. UAPB researchers were able to successfully reduce lignin by 10% in rice through research.

The Division of Agriculture conducted research to develop rapid and accurate tests for assessing bird health and pathogen defense in poultry. 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.

The Division of Agriculture's Nitrogen Soil Test for Rice (N-STaR) was merely a research tool just a few years ago. The N-STaR program for determining optimum site-specific Nitrogen fertilization rates on rice has been adopted quickly by Arkansas rice producers. In 2016, 2,510 N-STaR samples were analyzed and new producers are entering the program every year which increases the scope of N-STaR's impact on Arkansas rice production. For many fields, N applications were reduced without sacrificing yield, thus reducing potential greenhouse gas (GHG) emissions and reducing potential N losses to watersheds.

UAPB's agricultural production efforts continue to be focused upon aquaculture and serving small and socially disadvantaged producers in eastern and southwestern Arkansas. The programs provide research based information that is used for training and technical assistance to row crop, vegetable crop, and livestock producers. Assistance was provided in farm financial planning/business planning; vegetable and row crop production and marketing; livestock production and marketing; access to USDA assistance programs; food safety education; and housing. UAPB used the foundation sweet potato seed program to provide virus indexed sweet potatoes to the sweet potato industry in Arkansas. Also, UAPB conducted research trials that evaluated the potential for industrial hemp and other bio-fibers to be used in the commercial textile industry.

The UAPB Aquaculture and Fisheries Department (AQFI) provided management training and assistance to private impoundment owners of Arkansas. Privately-owned impoundments can be used for numerous purposes and the management of those impoundments is affected by, and can have an impact on, the environment immediately surrounding the impoundment and its watershed. Proper management helps to ensure a healthy and productive environment within the impoundment and the surrounding area. The Aquaculture-Fisheries club participates in the Youth Fishing Outreach Program: The Arkansas Collegiate Series, to ensure that young anglers are provided with engaging and affordable options to encourage them to pursue this sport throughout life.

AQFI also is assessing the contribution of stocked fish to the 2015-year class of Black Crappie and White Crappie in fall 2015. We marked 96,000 Black Crappie and 86,000 White Crappie with both oxytetracycline and calcein and stocked them into 8 lakes. Marking efficacy for calcein was 100% at the time of marking, and mark longevity is under study. AQFI is also investigating the effects of aquaculture-related pollutants (especially ammonia) and other environmental stressors (such as starvation, exhaustive swimming and hypoxia) on the physiological and the ecological fitness of fish, and studying their compensatory responses at physiological, biochemical and molecular levels.

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

Wildlife education program areas for the Division of Agriculture are (1) addressing nuisance wildlife problems, including Feral Hog Education Program and pesky wildlife around the yard and garden, (2) wildlife habitat management, (3) Developing A Wildlife Enterprise - Is It For You?, in partnership with Mississippi State University's Natural Resource Enterprise Program and Winthrop Rockefeller Institute, and (4) 4-H Wildlife Program.

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
Professional Foresters
Master Gardeners
Women Landowners
Rice producers
Apple producers
Ecologists
Remediation/phytoremediation researchers/specialists/practitioners
Hunters/Sportsmen
Private impoundment owners living in Arkansas

U.S. Fish and Wildlife Service

Dale Bumpers White River National Wildlife Refuge

Aquaculture producers

Environmental groups

3. How was eXtension used?

eXtension was used in a NIFA swine GHG model development and education project eXtension was used present information regarding the project as well as general information regarding the interaction of swine production decisions and carbon foot. (see http://articles.extension.org/pages/65666/extension-and-education-on-swine-greenhouse-gas-emissions)

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	45120	169485	33127	2366

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

Patent Applications Submitted

Year: 2016

Actual: 1

Patents listed

Trailer, Labeling System, Control System, and Program for Field Implementation of Computerized Hole Selection for Layflat Irrigation Pipe. Henry and Kline. US 62/352,418 6/20/2016.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	12	90	102

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
2016	131

Output #2

Output Measure

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

Year	Actual
2016	64

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
2016	122

Output #4

Output Measure

- Number of locations for bioenergy crop demonstrations.

Year	Actual
2016	4

Output #5

Output Measure

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

Year	Actual
2016	45

Output #6

Output Measure

- Number of research-based scientific presentations at scientific or professional meetings related to Environment, Energy & Climate.

Year	Actual
2016	125

Output #7

Output Measure

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

Year	Actual
2016	3

Output #8

Output Measure

- Number of research projects on biofuels performance and emissions conducted in Arkansas. Not reporting on this Output for this Annual Report

Output #9

Output Measure

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

Year	Actual

2016	1504213

Output #10

Output Measure

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

Year	Actual
2016	31

Output #11

Output Measure

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

Year	Actual
2016	67

Output #12

Output Measure

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

Year	Actual
2016	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of graduate students working on bioenergy projects or biofuels labs.
2	Life cycle inventory methodology and data for row crops for greenhouse gases.
3	Number of N-StaR samples processed.
4	Number of new assessment and management tools developed, including models and measurements of greenhouse gas emmisions
5	Number of current year citations of climate related publications.
6	Number of program participants who indicate a change in behavior, based on lessons learned during Environment, Energy & Climate programs.
7	Number of participants (both youth and adult) indicating new knowledge gained as a result of Environment, Energy & Climate programs.
8	Number of program participants indicating new knowledge of water quality and conservation best management practices
9	Number of producers who changed or adopted new production and/or conservation management practices or technologies
10	Number of program participants indicating the adoption or implementation of new water quality and conservation best management practices.
11	Number of farm pond owners who indicate new knowledge of pond management
12	Number of fisheries biologists indicating new knowledge of populations of important Arkansas fisheries
13	Number of Wildlife habitat assessments achieved
14	Number of Wildlife Relevant Research Programs
15	Number of Wildlife Genetic research Projects
16	Number of Wildlife Policy Assessments
17	Number of nutrient assays developed for soybeans

18	# of Registered foresters who maintained their state certification as a result of programs
19	# of acres on which forest management was improved as self-reported
20	Number of Forest by-products assessments completed
21	Number of Wildlife Management Education Programs
22	Number of Watershed Protection Teams
23	Number of students participating in the 2016 Youth Fishing Outreach Program: The Arkansas Collegiate Series

Outcome #1

1. **Outcome Measures**

   Number of graduate students working on bioenergy projects or biofuels labs.

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

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

   Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

   Number of N-StaR samples processed.

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
2016	2510

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Arkansas rice producers have relied on soil test recommendations for applying Nitrogen to the crop which are based on response curves from limited test sites. Scientists have been seeking a site specific-test for making N recommendations in rice. N-STaR is a unique, field specific test which identifies the available N from soil samples submitted to the University of Arkansas N-STaR Soil Testing Lab. Recommendations from N-STaR may reduce N rate recommendations significantly without sacrificing yield, thus saving money and potentially reducing N losses to the environment.

What has been done

The 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 in deep soil sample (in contrast with a typical 4 in 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 has been available for rice produced on silt loam soils in Arkansas for the 2012-2015 rice crops. 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. 500 producers entered the program this year
which increases the scope of N-STaRs impact on Arkansas rice production. More than half of the N-STaR recommendations have called for reduced N rates, making the program an economic and
environmentally sustainable practice. 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 #4

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #5

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
2016	31

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 #6

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
2016	314

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 has been monitoring water quality in almost 20 stream in Northwest Arkansas for the last several years 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, collected water samples from 20 streams in the Upper Illinois River Watershed and the Upper White River Basin. 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 appropriate statistical techniques.

Results

The Arkansas Water Resources Center noticed three 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. Finally, there is an increasing trend in chloride and sulfate concentrations in these streams ? why is an important question, but it might be related to salt use during winter. 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
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #7

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
2016	3731

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Invasive plants and animals such as fire ants, kudzu, Paulownia, Japanese honeysuckle, and privet already have become entrenched in Arkansass forests. Additionally, several potential invasive pests could reach Arkansas at any time, with the potential to cause tens of millions of dollars in damage to Arkansas forests. One such potential pest was the Emerald Ash Borer, an exotic, invasive pest responsible for the death of millions of ash trees across the United State. In July 2014, the Emerald Ash Borer (EAB) was found in SW Arkansas. UA Division of Agriculture faculty worked closely with the Arkansas Forestry Commission and the Arkansas State Plant Board to develop and implement an outreach and educational protocol. In 2016, the EAB was found in NE Arkansas. Another new invasive pest was also found in Southern Arkansas in FY16: laurel wilt disease which is fatal to the native Sassafras tree.

According to the U.S. Fish and Wildlife Service, approximately 555 thousand people, 16 years old and up, fished in Arkansas in 2011 with expenditures totaling $496 million. One of the keys to maintaining this healthy industry is the recruitment and retention of youth anglers.

What has been done

The Invasive Species Program, initiated in 2012 with support from the Arkansas State Plant Board, is delivered via several methods including the arinvasives.org website, the UA website, fact sheets, social media, and presentations to: 1) professional forester educational meetings; 2) County level Master Gardener trainings; 3) Arborists and landscape professionals; 4) gardening clubs and organizations; 5) Project Learning Tree Teacher Conservation workshops; and 6) loggers. In FY2016, UA Division of Agriculture faculty and staff delivered 8 presentations about invasive species including the EAB, kudzu, privet, and other invasive plants, resulting in over 550 direct contacts, most of them women involved with Arkansas Federation of Garden Clubs or the Master Gardening program. In 2016, the EAB was found in NE Arkansas: previously, confirmed locations were in SW Arkansas, UA Division of Agriculture Faculty developed and led a ZOOM training on the latest EAB confirmations and firewood quarantines for 20 county agents from across the State. In cooperative with the AFC Forest Health Specialist, a fact sheet about Laurel wilt, an exotic disease that kills sassafras trees discovered in Arkansas in the summer of 2016, was written and distributed to all UA Cooperative Extension offices in Arkansas.

Since its creation in 2011, the UAPB Fishing Team has hosted many youth fishing activities to encourage the continued growth and stability of fishing in Arkansas and to promote and recruit for UAPB.

Results

As a direct result of training provided through the invasive species program, UA Cooperative Extension Service county agents in Arkansas reported two new emerald ash borer infestations in Hempstead and Lafayette Counties in southwest Arkansas in 2016. These reports helped us gain a better understanding of the range of emerald ash borer in Arkansas. Over 500 participants gained new knowledge and awareness of the Emerald Ash Borer and other invasive species as a result of the program. Although difficult measure the total indirect impact of our educational efforts via media including social media, the invasive species information on the UAEX website received 1,016 unique pageviews in 2016 and a social media post about the EAB reached over 2,000 people.

The 2016 Youth Fishing Outreach Program: The Arkansas Collegiate Series attracted a total of 92 students (16% increase from 2015) from 13 institutions (86% increase from 2015) in Arkansas, Missouri and Texas. The series hosted three qualifier tournaments and a two-day championship,

averaging 30 two-person teams and 59 students per tournament. The net economic benefit produced by the ACS in the 2016 season was between $22,891.48 and $34,406.48. The ratio of return on the AQFI?s investment into the program to the state of Arkansas was between $37.62 and $56.54 for every $1 invested. One-hundred percent of the 31 survey takers agreed with the statement ?I enjoy ACS tournaments? on a scaled-response question asking how they felt about the ACS. Forty-two percent of survey takers indicated that without bass tournaments, like those provided by the ACS, they would fish less often. Fewer fishing trips means less money going into the fishing industry and businesses near fishing locations, and could even result in fewer fishing license sales in Arkansas due to reduced participation in the sport. Keeping younger anglers interested and engaged through entertaining and affordable tournament options should help retain more anglers in the sport.

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 #8

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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1557

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is currently a lack of information examining a multitude of soil characteristics that contribute to high-yielding soybean growth. With careful characterization of soil properties and crop responses in high-yielding areas within fields compared with average-yielding areas in the same or adjacent fields, key differences may be identified that may explain the larger yields in certain areas and offer opportunities to better manage average-yielding areas for larger yields. Since a recent world record for soybean yield (10817 kg ha-1 or 161 bu ac-1) occurred in Southwest Missouri in 2010, and Missouri and Arkansas are bordering states, Arkansas soybean growers have the potential to approach or match the current world record. By understanding soil properties that contribute to larger yields in certain fields or areas within fields, producers may be able to determine those fields with the potential for increased productivity given appropriate crop management. In addition, this information may also be valuable in helping producers understand what fields are unlikely to respond to increased management attention and/or resources.

What has been done

A field study was conducted in 2014 and 2015 in producer fields, who had a field entered into Arkansas' "Grow from the Green" soybean yield contest, to i) evaluate the effects of region and soil depth on soil property differences between high- and average-soybean-yielding areas, ii) determine which soil properties are most related to ultra-exceptionally high soybean yields, and iii) identify correlations among aboveground biomass and seed nutrient concentrations from various growth stages and soil properties for high- and average-yielding fields. In each of seven regions of the ?Grow for the Green? yield contest in Arkansas, one contest-entered, high-yield area in close proximity to one average-yield area were plant-sampled at three growth stages in 2015 and soil sampled from two depth intervals (0- to 10- and 10- to 20-cm) in each yield area immediately prior to or just after harvest in 2014 and 2015.

Results

To meet the needs of an increasing global population and ensuing rise in food production efforts, continuous increases in yields are necessary to alleviate crop production expansion onto poorer quality soils, which may decrease land quality and threaten sustainability. Nevertheless, for a more complete comprehension of properties contributing to high yield, additional factors (i.e., genetic, agronomic and/or environmental) that may be more correlated and associated with yield, beyond those evaluated in this research, may need to be further studied, while mimicking the approach of investigations on producer's fields. Since this study encompassed a wide variety of landscapes and soybean management systems across Arkansas, results of this study have the potential to help growers better understand soil and plant properties in their own fields that contribute to or hinder achieving ultra-high soybean yields, which may contribute to minimizing the soybean yield gap.

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 #9

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
2016	287

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

More than half of the State (55%) is forested and more than half of this is owned by private non-industrial forest landowners. Most of them also hold their forest lands for reasons other than timber management. The future supply of timber therefore, might not be secure unless harvesting forest products fulfills the landowner's objectives and needs. Forest management is a long term endeavor often spanning generations. Sadly, most forest landowners do not have a written management plan for their forest resulting in an often haphazard approach to management. Nationally, the USFS provides funds to State Forestry Agencies like the Arkansas Forestry Commission, to provide technical assistance to forest landowners. The Forest Stewardship Plan program is designed to provide technical assistance to forest landowners resulting in the development of a comprehensive forest management plan. The American Tree Farm system is a certification program in which forest landowners can enroll. They must have their forest land inspected and re-certified periodically. The UA Division of Agriculture, Arkansas Forest Resources Center provides training to forest management consultants and AFC foresters to assist them in developing management plans and to become certified Tree Farm Inspectors. Forest landowners are also educated about the importance of forest management plans and are strongly encouraged to seek professional assistance from the State technical service providers.

What has been done

In FY16, 2 forestry field days, one 2-day women owning woodlands workshop, and 2 Tree Farm inspector trainings were conducted that reached over 254 landowners, professional foresters, and other natural resource managers. News articles, newsletters, webpages, social media, one-on-one consultations, and fact sheets were are also developed and utilized to educate landowners about the importance of forest management, forest plan development, benefits of using consulting foresters, and how to access the online Timber Market Report. The importance of planning, mapping, and managing for climate variability was stressed in two of the educational events. Women forest landowners received hands-on instruction about a computer based decision support system that uses climate models to project potential changes in AR forests. Twenty-three registered foresters were trained to become certified Tree Farm inspectors.

Results

Over 400 clientele adopted or changed a forest/and/or wildlife management practice as a result of attending Forest Resource related programs in FY16. Over 250 landowners, foresters, and other natural resource managers were trained on how to develop a forest stewardship plan and 23 Forest Stewardship plans were developed with the support of the UA Division of Agriculture faculty. Thirty landowners stated that they implemented a least one new forest stewardship practice as a result of our educational efforts.

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 #10

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
2016	89

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Water resource concerns (both quality and quantity) from agricultural operations have prompted a combination of voluntary, regulatory and judiciary actions in Arkansas. Livestock agriculture continues to face scrutiny amid concerns of nutrient losses to waterbodies from land application of manures while row crop agriculture in Arkansas is under increasing pressure to reduce any nutrient and sediment inputs to help minimize the hypoxia in the Gulf of Mexico. In Eastern Arkansas, there is increasing concern about the sustainability of groundwater to meet future irrigation demand for row crops and the expansion of poultry production in Northeastern Arkansas.

In the farming community, this may create severe constraints to remaining economically viable and competitive in today?s global market place. With this activity in addressing nonpoint source pollution and water quantity, it has left landowners and others confused and concerned about what may be required of them.

What has been done

In response, the U of A Division of Agriculture Cooperative Extension Service has conducted the Arkansas Discovery Farm Program, an innovative on-farm research and education program. These farms serve as the cornerstone for field days and tours to educate the public on environmental issues related to agricultural production.

The Arkansas Discovery Farm Program utilizes edge-of-field monitoring of both the quantity and quality of inflow (precipitation and irrigation) and outflow (runoff) from fields on real, working farms. Data is being collected to quantify nutrient and sediment losses to determine off-farm environmental impacts and to address long-term sustainability and profitability. There are currently twelve Discovery Farms strategically placed across the State to represent the predominant livestock and row crop enterprises. Discovery Farms are utilized to promote stewardship through our website, at field days and tours and through oral presentations throughout the State at various events. Our Discovery Farmers are using the data to make management changes and to educate fellow farmers by making presentations at agricultural practices at both the State, regional and national levels.

Results

The Arkansas Discovery Farm is in its fifth year of on-farm data collection and is financially supported at nearly $2 million by 15 different sources. One important aspect is the ownership being taken by the stakeholders and farmers who guide and direct this program. The Arkansas Discovery Farm Program has helped Arkansas become the leader of 13 states in the NRCS MRBI program area in terms of approved project areas and dollars that go directly to Arkansas farmers as financial assistance to install soil and water conservation practices.

After 4 to five years of monitoring several row crop fields across the State, so results include:

-Nutrient Losses, both N and P, in runoff at the edge-of field average less than 5% of that applied as fertilizer, indicating much lower losses than modeled results performed to study water quality-nutrient trading scenarios
-Conservation practices such as irrigation water management and cover crops coupled with adaptive management can show a trend of continuous improvement with differences in effectiveness among years as hydrology can and does vary from year to year.
-Computerized-hole selection and other irrigation water management strategies such as the use of surge valves can increase irrigation efficiency by 20% by reducing tail water losses. On the Stevens Discovery farm in Desha County after four years of cover crops, tail water losses have been reduced to only 10%
-Reducing tail water losses reduces nutrient losses as well
-Nutrient losses tend to be higher after rainfall events as compared to furrow irrigation events.
-Rice acts as a constructed wetland and reduces nutrient losses
-Cover crops are effective means of reducing sediment losses.

The Discovery Farm program is a model voluntary approach for engaging farmers in addressing natural resource concerns as well as improving profitability by reducing nutrient losses and conserving irrigation water which reduce energy costs. For example, we hosted 14 field tours this year for groups such as Arkansas U.S. Representatives Crawford and Womack, the Agricultural Nutrient Policy Committee, an organization consisting of over 45 agricultural industries and agencies such as Tysons, the Fertilizer Institute, Land Of Lakes, American Farm Bureau, and others. Other tours included a delegation of Cuban farmers, The National Association of County Agricultural Agents, the Executive Committee of the National Association of Conservation Districts, Mississippi Farm Bureau, and others.
It is a difficult task to quantify the impacts of our educational programs on either the natural resources we are trying to protect or the economic value to landowners who are having to make changes to accommodate new regulations or court-issued decrees. As we move forward and create more awareness and transfer more soil and water conservation technology, we do know that we are aiding in prevention of degrading water quality, which collectively is much less costly than having to make remediation and restoration efforts.

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
133	Pollution Prevention and Mitigation

402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management

Outcome #11

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
2016	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas has approximately 128,000 small impoundments. The Extension service is tasked with helping private land owners manage their impoundments to their highest potential, or at least to the satisfaction of the owner.

What has been done
The UAPB Aqua/Fish Department employs Extension specialists to teach and assist county Extension agents in pond management. I train agents to handle basic to intermediate pond management issues that arise in their counties. The Farm Pond Management in-service, offered by UAPB Extension Specialists, is the primary method for directly training Extension agents to handle pond issues. Extension agents can also receive assistance over the phone, by email, or by visit on cases that cannot be easily solved. Private pond owners are also able to contact me directly.

Results

In 2016, there were 206 Extension agent contacts, mostly involving pond cases and the Weed and Irrigation Ditch Management in-services. Due to various factors, the Farm Pond Management and Weed and Irrigation Ditch Management in-services were combined. Future plans are to alternate between aquatic plant management and general pond management every other year, and the location will move to different parts of the state each year. Owners of ponds visited received summaries of the visit, recommendations, and reading material tailored to their pond and management goals. In most cases, these reports were completed and delivered back to the pond owner within one week of the landowner visit. Cases were from all parts of the state and the most frequent issues were vegetation, muddy water and poor fishing.

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 #12

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
2016	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Arkansas Game and Fish Commission stocks crappies annually with little verifiable return on investment. We will follow the fate of hatchery crappies on short time scales via calcein marks. Calcein marks are a non-lethal, quick method of assessing hatchery contribution to a year class in the field. UV light degrades calcein marks, but a brief saltwater bath improves the quality of the mark. Calcein cost requires using the lowest effective dose for marking, but fish preference for low densities requires the determination of an optimal dunking density.

What has been done
Crappies were confined to jars with salt solution at salinities of 0.005 to 50 ppt. After 3.5 min, Crappies were removed, tempered into separate aquaria, and held for 24 h while mortality was recorded. The LC50 determined from this test was used to set the maximum dose for salinity tolerance tests. To determine best fish density to use for static immersion during calcein marking, densities of 0.025 to 0.250 kg/L were tested. Crappie were subjected to a 20.5-min treatment time at graded densities, then mortality was recorded for 24 h post-treatment.

Results
During osmotic induction trials, immediate and 24-h mortalities were 0% and 0% - 13%, respectively, for Black Crappie. Similarly, immediate and 24-h mortalities were 0% and 0% - 27%, respectively, for White Crappie. During dunking density (kg of fish/L) trials, immediate and 24-h mortalities were 0% and 0% - 3%, respectively, for Black Crappie and 4% - 23% and 8% - 23%, respectively, for White Crappie. The results of our salinity and density experiments can be scaled up to typical hatchery production operations, allowing tests of the marking efficacy and longevity of calcein marking in Black Crappie and White Crappie.

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 #13

1. Outcome Measures

Number of Wildlife habitat assessments achieved

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In portions of elk range in Arkansas, some cattle producers claim that elk remove large amounts of forage from their pastures, especially in late summer and winter. This has resulted in numerous

management challenges, including the management of elk distribution and population abundance, and forage distribution, availability, quality, and utilization by elk and cattle. Understanding the extent and intensity of competition between elk and cattle includes more than simply quantifying dietary or spatial overlap. Competition for food between large herbivores involves several interactive factors: diet similarity, consumption equivalence, range overlap, timing of forage use, forage height, and density of competing species. Moreover, demonstrating dietary overlap between elk and cattle does not necessarily "prove" competition is occurring. Manipulative experiments utilizing elk and cattle exclosures are required to quantify the extent and intensity of competition.

Potential limiting resources for large mammals are cover, space, water, and food. Cover and space are resources seldom limiting in a competitive sense and there have been no reported instances of competition between elk and cattle for water resources. This would suggest that if elk and cattle are competing for limited resources on private pasturelands within elk range in Arkansas, competition would most likely focus on forage. Therefore, the objectives of this study were to 1) determine forage utilization by elk in areas where cattle do not occur, and 2) determine forage utilization by elk and cattle on pasturelands where both species occur, and 3) identify key monthly forage species for both species. Thus, this project quantified the potential for interspecific competition only.

What has been done

Microhistological analysis (i.e., microscopically examining plant epidermal fragments in fecal material to identify plant species eaten), was utilized to quantify plant composition of elk and cattle diets. Elk diets consisted of approximately 80 vascular plant species (including 28 tree, 12 vine, 9 shrub, and 31 herbaceous species) representing 44 families, and 10 grass and 1 fern species. Grasses (native and non-native combined) comprised at least 30% of elk diets in all seasons. Shrubs were utilized most heavily in spring and were at least 10% of elk diets in all seasons. Forbs were utilized heavily in summer and fall. Interestingly, conifer comprised 14% of elk diets in winter. Preliminary data indicate that cattle diets consisted mostly of non-native grasses in all seasons, indicating potential forage competition with elk on pasturelands during all seasons.

Results

The main objective of this project was to improve our understanding of seasonal forage availability and diet of elk and cattle and to assess the potential for forage competition. This study produced a list of plants elk and cattle consumed monthly from August 2013 through August 2015. These data will be utilized in planning and evaluating elk habitat suitability and improvement programs, especially in areas of their range that contain private pasturelands. These data will also be useful in planning habitat improvement projects in the Ozark National Forest, which forms a large part of the southern border of elk range in Arkansas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
306	Environmental Stress in Animals
605	Natural Resource and Environmental Economics

Outcome #14

1. Outcome Measures

Number of Wildlife Relevant Research Programs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Midcontinent population of greater white-fronted geese has gained considerable attention given an increase in abundance and a winter range expansion into non-traditional wintering area. The wintering range of the species shifted from freshwater marsh and agricultural landscape of coastal Texas and Louisiana into the agricultural-dominated region of the Grand Prairie and Alluvial Valley in eastern Arkansas during the late-1980s. This abundant resource has provided Arkansians both economic gains from increased opportunities for waterfowl hunting and economic losses from reduced yields of winter wheat crops and spread of pest weed seeds.

Accurate estimates of population abundance are vital for effective harvest management decisions, particularly under an adaptive harvest management framework. Currently, white-front population counts occur in the Canadian Prairies during late-October, however the counts neglect to account for detectability and there is no way to know what proportion of the population is being accounted for during the 2-week survey period. Thus we used GPS-equipped satellite transmitters to 1) determine the timing in fall migration, and 2) evaluate the proportion of transmitter-marked white-fronts in the survey area during the survey period.

With range expansion of the species comes new challenges for wildlife managers to provide enough food on the landscape to support the target number of wintering ducks and geese for the duration of wintering period. Waterfowl managers utilize a metric called duck-energy-days (DEDs) which refers to the number of ducks that can obtain daily energetic needs on a particular land parcel for the duration of the winter period. Concerns for management of waterfowl exist because of the increased level of competition for food resources from increasing and shifting species distribution.

What has been done

We live-trapped white-fronted geese in the Arctic tundra along the North Slope of Alaska and in the Central Canadian Arctic during 2014 and 2015. White-fronts were fitted with backpack style, solar-powered satellite transmitters. Through use of novel modeling approaches, we found that white-fronts from Central Canada departed the Arctic 9 days earlier, arrived at the fall staging area in Prairie Canada 11 days earlier, and stayed 17.6 days longer than white-fronts from the Alaska. Our data suggest that population counts are underestimating abundance as we found 33-50% of the white-fronts from Alaska are not in the survey area during the survey period. This information is critical for those using population estimates to make harvest management decisions and future refinement of the survey to improve population estimates is warranted.

Results

White-fronts are selecting for flooded rice field during winter and consuming a large proportion of the waste grain that remains after harvest. Selection pressure for flooded rice is greatest in November and decreases as winter progress. The expansion of white-fronts into Arkansas has resulted in increased levels of completion for winter food resources and likely deplete waste rice grain rapidly, making it difficult for many duck species to obtain adequate food resources to survive winter.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
136	Conservation of Biological Diversity
306	Environmental Stress in Animals
605	Natural Resource and Environmental Economics

Outcome #15

1. Outcome Measures

Number of Wildlife Genetic research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In October 2015, chronic wasting disease (CWD), a neurodegenerative disease found in members of the deer family, Cervidae, was detected for the first time in Arkansas in a 2.5-year-old female elk legally harvested near Pruitt in Newton County. Four months later, in February 2016, a CWD-positive 2.5-year female white-tailed deer was found dead in Ponca in Newton County. Given the potential negative effects of CWD on white-tailed deer populations, it is essential that wildlife biologists and managers, and wildlife veterinarians understand of the nature of CWD, its management, and implications for the future.

What has been done

During 14-24 March 2016, wildlife biologists from the Arkansas Game and Fish Commission (AGFC) and the University of Arkansas Agricultural Experiment Station (UAAES) randomly collected 266 white-tailed deer from a 125,000-acre CWD focus area in Newton County, Arkansas. CWD was detected in 62 (23%) of these animals. CWD prevalence rate in female and male deer was 20% and 32%, respectively. Concurrent with the collection of the obex and retropharyngeal lymph nodes used for CWD testing, a 1-inch2 section of ear tissue was obtained from each deer and frozen.

Beginning in March 2016, additional deer sampling, including the collection of road-killed deer, occurred state-wide. Interestingly, a 2.5-year male, road-killed in Pope County, was found to be CWD-positive. Of course, the presence of a CWD-positive deer found 45 miles south of the CWD focus area raises an important question: does the CWD-positive male road-killed in Pope County, genetically assign to the deer herd in Pope County or did the deer disperse into the area from another location? If the deer genetically assigns to the deer herd in Pope County, CWD may already be established in the area. If the deer does not genetically assign to the herd, perhaps the deer dispersed to Pope County or the deer was translocated by humans. Thus, the source (i.e. family group) of the CWD-positive male found dead in Pope County is open to speculation.

Results

Preliminary results demonstrate that the CWD-positive deer found dead in Pope County can be genetically assigned to the deer subherd in Newton County. In addition to assigning family group to the CWD-positive deer, the DNA extracted in this study will contribute to an important genetic database that can eventually be used to address a multitude of important questions related to the biology of CWD and the impact of CWD on deer populations in Arkansas. For example, the deer DNA samples collected in this study could be used to 1) increase our understanding of the origin of CWD in Arkansas, 2) monitor the movement of CWD across the landscape, 3) increase our understanding of how different forms (alleles) of the PRNP gene (the gene that codes for the protein, or prion, that causes CWD) can lead to different prion forms that moderate individual susceptibility to and progression of CWD infection, 4) determine how different forms in the PRNP gene influence the natural selection of the PRNP gene. In summary, the large amount of genetics data this project has produced forms the beginning of what I hope will eventually become a region-wide deer genetics database that can be used to address important genetics and disease-related research questions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity

Outcome #16

1. Outcome Measures

Number of Wildlife Policy Assessments

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Ten-year trends in population abundance estimates and hunter success rates for wild turkey in Arkansas indicate declining populations state-wide. In response, the Arkansas Game and Fish Commission (AGFC) modified hunting regulations during 2011 by implementing a no-jake harvest policy aimed to reduce juvenile male turkey harvest mortality and increase recruitment into the 2-year old age class. Recruitment of juvenile male turkeys into the 2-year age-class is vital to maintain sustainable population dynamics, sex ratios, and to improve hunter success rates during the spring hunting season.

What has been done
Survival rates are vital pieces of information for management agencies, particular for game species in which harvest management policy can be adapted in times of demographic distress. Therefore this research intends to provide the science-based information needed to facilitate future harvest management decisions. The objectives of this study were to 1) determine annual and seasonal survival and recruitment rates of juvenile male turkeys, 2) estimate annual and seasonal survival rates of adult male turkeys, and 3) estimate harvest rates of adult male turkeys.

We live-trapped male turkeys using rocket nets at camera-monitored bait stations during January?March 2016. Turkeys were fitted with a uniquely numbered aluminum rivet leg band and a backpack style, battery-powered PTT satellite transmitter. We generated parameter estimates for survival by age-class using a Kaplan-Meier staggered entry approach.

Results
Preliminary analysis of these data suggest annual survival rate of juvenile male turkeys was greater than that of adult males, and that the rate of survival and recruitment of juveniles into the adult age class is comparable to other states within the southern US.
The main objective of this project was to assess the effectiveness of the no-jake harvest policy to

achieve the desired goal of AGFC to increase the number of 2-year old male turkeys in the population.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis

Outcome #17

1. Outcome Measures

Number of nutrient assays developed for soybeans

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Most agronomic crops have published critical tissue nutrient concentrations but only a few are based on replicated field research validating crop yield response to fertilization and the published diagnostic tissue concentrations are usually for a single growth stage. Soybean tissue nutrient concentrations are dynamic and change as the plant progresses through reproductive growth as nutrient sinks change from vegetative to reproductive structures. The changing plant tissue nutrient concentrations and the ability to interpret tissue nutrient analysis at only a single growth stage limit the use of tissue analysis for monitoring crop nutrient needs. Development of critical nutrient concentrations based on field research can help increase the efficiency of fertilizer and increase crop yields through continuous monitoring of plant tissue nutrient concentrations.

What has been done

Research was initiated in short- and long-term potassium research trials representing a range of irrigated soybean growing environments, varieties and maturity groups, potassium availabilities, and yield potentials. Soybean trifoliolate leaf and petiole potassium concentrations from multiple soybean growth stages were regressed against the percentage of maximum yield produced by soybean receiving no potassium fertilizer to identify the critical potassium concentrations from the R2 to R6 stages. The rate of tissue potassium decline during reproductive growth was also

documented to generate theoretical critical tissue potassium concentrations compared to the defined critical potassium concentrations across growth stages. The preliminary and theoretical critical tissue potassium concentrations were closely associated and showed promise for developing guidelines that could be used for monitoring soybean tissue K concentrations.

Results

Curves that defined the preliminary upper and lower critical tissue potassium thresholds for soybean were developed for the period that corresponds to soybean reproductive growth stages R2 thru R5. Leaf or petiole potassium concentration accounted for 62 to 85% of the variability in relative soybean yield between the R2 and R5 stages. Tissue potassium concentrations after completion of the R5 stage were not good predictors of the relative soybean yield as tissue potassium explained only 41-48% of relative yield response to potassium fertilization. The ability to accurately assess soybean potassium nutrition from tissue analysis after the R5 stage is not likely important since plant potassium uptake has peaked, seed number has mostly been set, and an economic yield increase from late season potassium fertilization is unlikely following the R5 stage. The preliminary tissue potassium thresholds need to be validated with additional research but in the short-term will aid interpretation of soybean tissue samples collected for troubleshooting purposes and shows that development of multi-growth stage interpretation of nutrient concentrations is possible and can be developed relatively quickly.

4. Associated Knowledge Areas

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

Outcome #18

1. Outcome Measures

# of Registered foresters who maintained their state certification as a result of programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	457

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Under legislation passed in 1999, all individuals referring to themselves as foresters and providing assistance to private forest landowners must be registered with the Board of Registered Foresters and complete 8 hours of Continuing Education a year to remain registered. The majority of these foresters are consultants who provide direct, expert management advice to non-industrial private forest landowners including developing management plans, administering timber sales, and protecting forested watersheds. The UA, Division of Agriculture is the lead agency in providing continuing education credits and professional training for registered foresters and other natural resource professionals.

What has been done

UA Division of Agriculture faculty and staff, working with the Arkansas Board for Registered Foresters, and the Society of American Foresters hosted 4 workshops and meetings specifically targeting registered foresters in need of continuing education credit. The largest annual workshop is attended by 200 to 250 registered foresters from Arkansas, Louisiana, and Texas each year. Over 400 registered foresters in Arkansas and an additional 300 from other states received education on a variety of topics. This represents at least 90% of all professional foresters registered (457) in the State of Arkansas. Topics included: Invasive Species, apps for foresters, herbicide use, water quality issues, workforce reinvestment, ethics in forestry, pine varietal testing, prescribed fire as a management tool, and other topics. Each topic and workshop was approved by the Society of American Foresters for Continuing Forestry Education credit. These credits hours can also be applied for foresters participating in the National SAF Certified Forester program.

Results

UA Division of Agriculture faculty and staff, working with the Arkansas Board for Registered Foresters, and the Society of American Foresters hosted 4 workshops and meetings specifically targeting registered foresters in need of continuing education credit. The largest annual workshop is attended by 200 to 250 registered foresters from Arkansas, Louisiana, and Texas each year. Over 400 registered foresters in Arkansas and an additional 300 from other states received education on a variety of topics. This represents at least 90% of all professional foresters registered (457) in the State of Arkansas. Topics included: Invasive Species, apps for foresters, herbicide use, water quality issues, workforce reinvestment, ethics in forestry, pine varietal testing, prescribed fire as a management tool, and other topics. Each topic and workshop was approved by the Society of American Foresters for Continuing Forestry Education credit. These credits hours can also be applied for foresters participating in the National SAF Certified Forester program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
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
141	Air Resource Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics

Outcome #19

1. Outcome Measures

# of acres on which forest management was improved as self-reported

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	14204461

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Ecosystem restoration goals such as improved biodiversity, resilience to climate change, elimination of exotic/invasive species, and maintenance of ecosystem services are often poorly understood by the public and concerns are raised about investments in activities that benefit forest ecosystems but are not perceived by the public to be cost efficient or have real benefits to local, regional and national economies.

What has been done
In FY16, research work was completed on two landscape-scale forest restoration projects on the Ouachita and Ozark National Forests in Arkansas. All restoration expenditures and timber product outputs for FY2014 were used in a regional input-output analysis to determine regional and national benefits from restoration activities. FY2014 was chosen as the research work started in 2015 as soon as the accounting records for FY2014 activities were closed.

Results
In FY16, research work was completed on two landscape-scale forest restoration projects on the

Ouachita and Ozark National Forests in Arkansas. All restoration expenditures and timber product outputs for FY2014 were used in a regional input-output analysis to determine regional and national benefits from restoration activities. FY2014 was chosen as the research work started in 2015 as soon as the accounting records for FY2014 activities were closed.

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

Outcome #20

1. Outcome Measures

Number of Forest by-products assessments completed

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Concerns regarding climate change are driving many organizations to seek to lower their carbon footprint through the use of bio-energy. Concurrently, because of low natural gas and other fossil fuel prices, paper mills that typically use woody biomass residues from sawmills are no longer buying those residues in bulk. Thus, wood residues are building up at sawmills and disposal costs are typically $15 per ton.

What has been done
In FY2016, research work was started on estimating woody biomass in northwest Arkansas for the development of a wood pellet mill that could heat multi-floor residential buildings such as apartments or college dormitories. Mills in 14 northwest Arkansas counties are being surveyed

for mill residue availability and cost to develop supply curves for a residential wood pellet facility in the region.

Results

Initial survey indicates 49 wood residue producing facilities in the region that produce 2 million oven dry tons of woody residue annually. Potential cost savings to the sawmill industry from disposal alone are $30 million annually, however, it is likely that there are market uses internally for this wood waste, and so not all of it needs to be landfilled or would be available at a low cost to a pellet mill.

4. Associated Knowledge Areas

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

Outcome #21

1. Outcome Measures

Number of Wildlife Management Education Programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The presence and damage caused by feral hogs is growing in Arkansas. The purpose of this educational effort is to inform and demonstrate best management practices for controlling feral hogs to private landowners to increase awareness, reduce damage through localized trapping, and improve the conservation of natural resources.

What has been done

The University of Arkansas System Division of Agriculture has taken leadership in educating producers and private landowners about feral hogs and their control, in collaboration with partners: Arkansas Game and Fish Commission, who served as speakers and provided demonstrations at workshops, and funded for a couple meals associated with workshops; the Natural Resource Conservation Service ? Arkansas, which provided a two-year grant ($50,000) ending December 2016 which funded publications, exhibits, and workshop facilities; the Arkansas Forestry Association, which provided funding for meals and promotion of events through their membership; and USDA APHIS Wildlife Service who served as speakers and provided trapping demonstrations at workshops. Initially county agents attended an in-service training in 2011 in which Dr. Bronson Strickland and Bill Hamrick from Mississippi State University demonstrated gate options and trapping practices. Feral hog control updates were incorporated into two additional in-service trainings for county agriculture agents in 2013 and 2014. Since January 2015, UA has hosted 11 regional (multi-county) workshops attended by 458 landowners, educational displays staffed at 18+ events resulting in an estimated 5,616 viewers, published 4 fact sheets/miscellaneous publications and printed 1,500+ feral hog publications distributed at workshops and exhibits, conducted 11 field demonstrations of trail camera surveillance techniques, and 13+ field demonstrations of corral trapping.

Results

The feral hog webpage (www.uaex.edu/feralhogs) received 6,382 unique page views since January 1, 2015 with an average of 7:26 minutes per visit. Ten-plus newspaper/radio interviews have been conducted. The educational reach in past 5 years includes 29 counties. A professional poster presentation was given at The Wildlife Society?s Annual Conference in Raleigh, North Carolina in October 2016. Future plans include continuing educational outreach with exhibits, workshops, and field demonstrations. A pilot effort is proposed for educating high school industrial art or vocational agriculture teachers about building feral hog traps using off-the-shelf technology and partnering county agent to provide educational outreach about best management practices.

4. Associated Knowledge Areas

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

Outcome #22

1. Outcome Measures

Number of Watershed Protection Teams

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2013, a new swine operation was permitted by the State of Arkansas to initiate production and spread effluent as fertilizer on hay fields within the Big Creek Watershed, a direct tributary to the Buffalo River managed by the National Park Service. The operation and its associated hay fields are located in karst geographical region, which further prompts concerns. The allowed operation and placement of this farm has created tremendous controversy prompting lawsuits and strong emotional opposition among environmental groups. To ensure that his operation was doing everything possible to minimize impact, the operator contacted our local County Extension Service. Amid the controversy and strong emotion and because the operation had adequately met all legal requirements, the Governor of Arkansas commissioned the Division of Agriculture to conduct a watershed study to determine the impact of the operation on surrounding water quality.

What has been done
The U of A Division of Agriculture formed the Big Creek Research and Extension Team to monitor on the impact of the Swine operation on the Big Creek watershed, with respect to nutrients and bacteria. This multidisciplinary team formed a comprehensive plan to collect weekly water samples upstream and downstream of the farm. Three fields were selected for edge-of-field monitoring on runoff quality to determine if excessive nutrients are leaving hay fields receiving effluent. We have intensively mapped soil nutrient levels on a quarter-acre sample block to determine changes in soil test parameters especially for phosphorus. We also sampling water quality feeder streams, springs and wells on and near the farms as well as the two manure holding ponds. Additionally, we have used electrical resistivity methodology to remotely map the underlying karst in the three fields as well as under the holding ponds to determine if the ponds are leaking due to bedrock fractures.
Collected data is summarized and a quarterly report is sent to the Governor's office as well as the Arkansas Department of Environmental Quality.
We feel that the Big Creek is one of the most instrumented and heavily monitored watersheds in the country. We have collected data for three years now and are now comparing results to nearby "reference" watersheds with similar characteristics.

Results
The Big Creek Team believes a minimum of five years of data is needed to determine trends and impacts. However, we provide all data to the public when requested. Some environmental groups challenged our findings about whether the holding ponds are leaking through fractured

bedrock. Our direct measurements including installation of inceptor trenches downslope of the holding ponds have not indicated any evidence of leaks. But due to strong sentiment from the environmental groups, the State decided to employ an independent consulting firm to drill below the holding ponds and sample any groundwater encountered. The independent firm found no evidence of leakage.

We continue monitoring and believe we are developing a "blue print" to how to interject science-based information into emotional, environmental issues facing agriculture that may assist other States.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation

Outcome #23

1. Outcome Measures

Number of students participating in the 2016 Youth Fishing Outreach Program: The Arkansas Collegiate Series

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	92

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the U.S. Fish and Wildlife Service, approximately 555 thousand people, 16 years old and up, fished in Arkansas in 2011 with expenditures totaling $496 million. One of the keys to maintaining this healthy industry is the recruitment and retention of youth anglers.

What has been done
Since its creation in 2011, the UAPB Fishing Team has hosted many youth fishing activities to encourage the continued growth and stability of fishing in Arkansas and to promote and recruit for UAPB.

Results

The 2016 Youth Fishing Outreach Program: The Arkansas Collegiate Series attracted 92 students (up 16% from 2015) from 13 institutions (up 86% from 2015) in Arkansas, Missouri and Texas. The series hosted 3 qualifier tournaments and a 2-day championship, averaging 30 2-person teams and 59 students per tournament. The net economic benefit was $22,892 - $34,407. The ratio of return on the AQFI's investment in the ACS to Arkansas was $37.62 - $56.54 for every $1 invested. 100% of the 31 survey takers agreed that "I enjoy ACS tournaments", and 42% said they would fish less often without the tournaments. Fewer fishing trips means less money for the fishing industry, nearby businesses, and possibly reduced fishing license sales. Keeping younger anglers engaged through affordable tournament options should help retain more anglers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
134	Outdoor Recreation

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 outlook for forestry and forest products, at least in the short term, does not provide incentive for Arkansas forest landowners to make substantial investments in improvements of forest land. In Arkansas, where very little infrastructure related to biofuels has evolved, there is little incentive for producers of biofuels feedstocks to invest in alternative biofuels crops and related equipment. Interest in growing alternative biofuel crops in the state today is low, where traditional row crops enjoy reasonable profitability and the short term outlook for oil prices does not favor investment in biofuel alternatives. With oil currently at very low prices, there is little interest in renewable biofuels in Arkansas.

The emergence of a viable and dynamic Carbon Market could have a big impact among Arkansas forestland and cropland managers.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Comprehensive program and departmental evaluation reviews for Research, Extension and Teaching Programs are conducted on a five to seven year cycle by various research based evaluation methods. In 2016, the Department of Agricultural Education, Communication and Technology was reviewed by an elite team of peer reviewers. Review Boards are composed of a Chairman, focused reviewers for the teaching program, the research program and the Extension program in each department. Each team has a local, knowledgeable stakeholder reviewer. A comprehensive report of findings and recommendations is submitted by the Review Board and each department is asked to write a detailed response to the report, which is submitted to the Division administration.

The first of two Aquatic Weeds and Nuisance Algae Management Extension Agent in-service trainings was held in Hot Springs, AR and resulted in average scaled responses of 3.0 out of 4.0 on questions about how the in-service was delivered and how much the attendee's learned during the in-service. The second in-service held in Huntsville, AR resulted in average scaled responses of 3.25 out of 4.0. While most comments were positive in nature, a common request in the evaluations was for us to provide hard copies of the materials and handbooks presented at the in-services for the agents to take with them.

Key Items of Evaluation

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 indicates enrollees 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.

The Aquatic Weeds and Nuisance Algae Management Extension Agent in-service trainings were well-received by those who participated. It appears that agents left knowing more about the management of aquatic plants than they did upon arrival. We must work to improve our hands-on demonstrations, include more case-study based instruction, and provide physical copies of critical materials for the agents to take with them after the in-service is complete.

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%	20%	15%
502	New and Improved Food Products	0%	0%	10%	15%
503	Quality Maintenance in Storing and Marketing Food Products	0%	0%	10%	15%
504	Home and Commercial Food Service	10%	0%	0%	0%
701	Nutrient Composition of Food	0%	0%	10%	0%
702	Requirements and Function of Nutrients and Other Food Components	10%	40%	20%	5%
703	Nutrition Education and Behavior	25%	10%	10%	25%
704	Nutrition and Hunger in the Population	15%	0%	0%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%	50%	20%	25%
724	Healthy Lifestyle	15%	0%	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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	51.1	0.5	80.0	4.1
Actual Paid	79.6	1.5	51.5	5.6
Actual Volunteer	5.7	0.0	2.0	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**
606243	89234	470824	400225
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
888806	6794	4858101	409639
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
6901387	0	808800	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Food Security
Arkansas has a high rate of food insecurity with 19.2% of households and 26.3% of children lacking access to enough food for an active, healthy life. To address food security, the University of Arkansas System Division of Agriculture's Supplemental Nutrition Assistance Program - Education (SNAP-Ed) and Expanded Food and Nutrition Education Program (EFNEP) are delivered in many Arkansas counties. EFNEP addressed food insecurity by teaching low-income households with children how to better manage their food resources, handle their food safely, make healthier food choices and be more physically active. In FY16, trained program assistants in 18 counties taught more than 13,700 lessons to nearly 3,000 adults. We also reached more than 13,800 unduplicated adults through the SNAP-Ed program.

Childhood Obesity
The Division of Agriculture and UAPB addresses childhood obesity through the SNAP-Ed, EFNEP and 4H and youth development programs. SNAP-Ed and 4-H programs are conducted in all 75 counties by the Division of Agriculture and EFNEP is conducted in 18 counties by the Division of Agriculture and UAPB. The goal of the SNAP-Ed is to help individuals receiving SNAP benefits or eligible to receive SNAP benefits make healthy food choices on a limited budget and choose physically active lifestyles consistent with the Dietary Guidelines for Americans. SNAP-Ed partners with schools in which 50% or more of students receive free and reduced price lunch. Nutrition education is delivered in classrooms, school gardens, cafeterias, after school programs, and summer programs. Lessons emphasize MyPlate guidelines, Arkansas grown foods, physical activity, and food preparation. Information and recipes are sent home to parents to reinforce what the children are learning. In FY16, SNAP-Ed nutrition educators worked with 234 schools to deliver 9,688 lessons.
Research within the Division of Agriculture has focused on several aspects of adult and children health with a focus on obesity and diabetes.
Joint research between the Division of Agriculture, Arkansas Children's Hospital Research Institute, University of Arkansas for Medical Sciences, and University of Arkansas at Fayetteville is examining the link between childhood obesity outcomes and features of the food, social, and built environment. This work is being done to ensure that interventions are targeted to those children most at-risk for obesity and provides a better understanding of the effect of food retail access, the proximity of fast foods around schools and residences, the impact of school food programs such as the Fresh Fruit and Vegetable Program (FFVP) and the educational component of SNAP-Ed and the role of peers on childhood obesity outcomes.
Nutrition
Five of the ten leading causes of death in the U.S. have been linked to diet and lifestyle as contributing factors. Poor diet and obesity remain common problems especially among under-served populations. The

Extension Food and Nutrition programs focus on: adoption and maintenance of healthy lifestyles for chronic disease prevention including regular physical activity and healthy eating. The food and nutrition program identifies and promotes evidence-based policies and practices that will reduce the incidence of chronic disease.
Multiple educational approaches were used by the Division of Agriculture to respond to issues related to chronic illness and obesity. Healthy weight classes were evaluated in 3 counties. Participants learned to plan healthy meals, balance calorie intake with calorie expenditure, read food labels, reduce portion sizes and decrease fat and sodium intake. Cooking classes offered in 14 counties helped people learn skills that enable them to plan and prepare healthier meals at home. Participants learned to cook using healthier techniques, eat more locally grown foods and save money by eating at home more often. Nine counties offered programs to help people with diabetes better manage their disease. General nutrition programs were reported by 22 counties. Programs focusing on healthy weight, diabetes self-management and choosing and preparing healthy foods resulted in 48,710 contacts through 2,441 direct education methods. Division of Agriculture and UAPB programs provided to adults through the EFNEP resulted in 22,263 direct education contacts through 12,967 educational sessions and SNAP-Ed had 22,263 contacts via 878 programs.
Nutrition scientists in the Division of Agriculture are studying obesity and diabetes prevention in order to reduce the incidence of these diseases within the state and nationally. For example, studies conducted by the University of Arkansas System Division of Agriculture show that diets higher in protein can spare muscle mass and increase fat loss as well as lower plasma triglycerides in both men and women. High protein diets have also been found to improve glycemic regulation and post meal glucose and insulin response in type 2 diabetics. Our research has identified whey protein as the most ideal protein source, compared to pea and beef protein, for increases postprandial energy expenditure (calories burned after the meal). Based on this finding, we believe that whey protein-based beverages are ideal for breakfast, especially for children.

Food Safety
The Division of Agriculture Extension & Research offers a comprehensive approach to address food safety from industry to individuals. Taught in many Arkansas counties, the ServSafe® Food Safety Program for Managers course provides the necessary tools for industry managers to effectively teach food service employees best practices in food safety. SNAP-Ed, EFNEP and 4-H Positive Youth Development programs teach basic principles of food safety to families, adults and youth. In addition, the Better Process Control School (BPCS) continues to be an essential program as Arkansas has a large food industry with a need for food safety education of its workforce. BPCS in Arkansas has certified over 3,000 food processing employees since its inception in 1973. To serve as an educational resource for the food industry in Arkansas, Division of Agriculture along with the HACCP Consulting Group are currently the only organizations offering public courses of the Food Safety Preventive Controls for Human Foods developed by the Food Safety Preventive Controls Alliance.
Research efforts within the Division of Agriculture have focused on food pathogens, gaining a better understanding of their ecology, improving food processing systems to minimize their survival, and improving their detection. Some key research findings over the past year include: (1) Development of a rapid method (less than one day) to quantify Salmonella Typhimurium on poultry meat using a combination of MPN with qPCR and a shortened time incubation, (2) Establishing the efficacy of the natural compound, &beta-resorcylic acid, against Campylobacter colonization in broiler chickens, and (3) quantification of antimicrobial effects of lauric arginate, peroxyacetic acid, active bromine and buffered sulfuric acid against pathogenic bacteria populations in beef trimmings destined for ground beef.

Aquaculture
UAPB Researchers and others have studied how declines in marine fish supply will affect human health. Results were reported in a paper entitled "Fall in Fish Catches Threatens Human Nutrition" published in Nature (Vol 534, 16 June, 2016). Researchers coupled two databases (Global Expanded Nutrient Supply database and Sea Around Us database) from 2010 (most recent data from both). The

new Global Expanded Nutrient Supply database combines food balance sheets (total quantity of food production and imports minus livestock feed, post-harvest losses, and exports) and production or trade data from the Food and Agriculture Organization of the United Nations with estimates of food group intake by age and sex. The Sea Around Us database, released in 2016, provides a portrait of marine fisheries catch between 1950 and 2010 for every coastal nation. This database measures the contribution of subsistence, artisanal and industrial marine fisheries to food supply at the country level more accurately than previous estimates.
Nearly 11 % of the current global population could become deficient in iron, zinc or vitamin-A by 2050 if current trajectories in fish catch declines continue. The negative health impact of fisheries decline will be felt more severely in some countries than others. Low-latitude developing nations are at high risk because human nutrition in these areas depends mostly on wild capture fisheries.
The study investigated whether global aquaculture and the production of farmed fish can meet production shortfalls predicted for poor equatorial populations. Aquaculture is growing globally, but has not developed enough in many low-income countries where food and technology are in short supply, particularly in the Pacific islands and sub-Saharan Africa. However, aquaculture can serve as a crucial contribution to local diets and economies when correctly planned. Some communities have grown nutrient-rich, indigenous fish for household consumption in ponds together with fish such as carp, catfish or tilapia that can be sold for cash. Aquaculture therefore provides families both nutrition and income gains. Next-generation analytical models that integrate data on human health and fisheries should play an increasingly important role when assessing the human health burdens of environmental change and natural resources management. It will require interdisciplinary partnerships between fisheries scientists, aquaculture technologists, ecosystem managers, nutrition and public health specialists, development economists and policymakers.
Innovation in Food Technology
The Division of Agriculture faculty conduct world class food research. Research topics included improving the quality of rice and improving rice processes, expanding the use of Arkansas soybeans and its co-products, assessing the health benefits associated with processed specialty crops, developing novel food ingredients and processes to better the nutritional quality of food, and improving the sensory quality of processed foods. Key research in 2016 included: (1) the further developments on the production of CLA rich soybean oils, (2) the development of novel grain treatments (infrared and microwaves) to prevent the formation of mycotoxins in grains during storage, (3) the improvement of blueberry juice anthocyanins stability by acidification and refrigeration, and (4) the development of novel phenolic extracts derived from seed coats of selected soybean cultivars as antimicrobial and antihypertensive agents.

The Division of Agriculture contributes to the state's economic development by providing assistance to food entrepreneurs through the Arkansas Food Innovation Center. The AFIC assists small food processing companies, farmers and entrepreneurs by providing educational programs and services and allowing food manufacture in its facilities until entrepreneurs are large enough to graduate from AFIC. The Center has assisted 26 entrepreneurs in 2016, contributed to manufacturing 72 retailed food products and conducted a series of workshops on food entrepreneurship. Since 2013, AFIC has helped launch over 100 products in the marketplace in retail establishments such as farmers markets, specialty and grocery stores.

2. Brief description of the target audience

Youth
School personnel
Parents
Adults
Limited resource families with children at home
Limited resource adults
Limited resource youth
Adults and youth receiving or eligible to receive SNAP
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?

Through the USDA Food Safety Program, a grant to enhance farmers' market food safety was awarded to The University of Arkansas Division of Agriculture beginning in 2013 through 2017. As an integrated project, the researchers proposed both research and extension components and by doing so established a unique collaboration with the USDA eXtension Community of Practice (eCoP) known as "Community, Local, and Regional Food Systems" (CLRFS). To show commitment to this eCoP, the grant hired a Project Specialist with 50% of their time committed to administrative and creative aspects of CLRFS in order to help build membership, national recognition, and delivery of content through eXtension.
Listed below are specific activities we completed with the CLRFS eCoP during our last reporting period (9/1/15 to 8/31/16).
Specifically, the Project Specialist:

- Welcomes new members to the eCoP and fields questions from the listserv and Ask an Expert.
- Sets up webinars
  - "Undoing Inequality" CLRFS working group webinar
- Tags webinars of other eXtension groups that might be of interest to CLRFS, and seeks outside webinars, trainings, and conferences to forward to CLRFS members
- Participates in the CLRFS Steering Committee and National Leadership Meetings and uploads meeting minutes to CLRFS eXtension site
- Creates and maintains the eCoP web presence through social media including profiles on Twitter, Instagram, Pinterest, and Facebook. Through these social media outlets, the Project Specialist shares the work of CLRFS members as well as other NGO and government organizations involved in food systems
- Assisted with some planning of the Food Distribution Research Society meeting in 2016 at which CLRFS and the farmers' market food safety researchers had plenary sessions.
- The original grant specifically designated funds to support the membership of CLRFS to meet during one of the project years.
- Acquired a professional Zoom account through eXtension in order to conduct conference web calls for CLRFS.
- Took online courses offered by eXtension in order to enhance the work done for CLRFS:
  - Impact statement reporting
  - Virtual Communications Camp

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	157094	533721	268851	18037

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

Patent Applications Submitted

Year:	2016
Actual:	8

Patents listed

Composition, Probiotic Formulation and Method to Reduce Bacterial Infection in Birds

Composition, Probiotic Formulation and Method to Reduce Bacterial Infection in Poultry

Method to Reduce Microbial Bloom in Poultry Hatchery

Yeast Vaccine Vector Including Immunostimulatory and Antigenic Polypetides and Methods of Using the Same

Antibody Guided Vaccines and Methods of Use For Generation of Rapid Mature Immune Responses

Novel Mucosal Adjuvants and Delivery Systems Poultry Probiotic Vaccine Compositions and Methods of Use Therof Compositions, Probiotic Formulations and Methods to Promote Digestion and Improve Nutrition in Poultry

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	4	98	102

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 and being active

Year	Actual
2016	12571

Output #2

Output Measure

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

Year	Actual
2016	284618

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 and being active

Year	Actual
2016	84149

Output #4

Output Measure

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

Year	Actual
2016	39

Output #5

Output Measure

- Number of research projects focused on increased understanding of the ecology of fecal indicators and pathogens

Year	Actual
2016	5

Output #6

Output Measure

- Number of research projects focused on increased understanding of preharvest and postharvest processes impacts on microbial and chemical threats

Year	Actual
2016	7

Output #7

Output Measure

- Number of research projects focused on novel food processing technologies

Year	Actual
2016	4

Output #8

Output Measure

- Number of research projects focused on improving the quality of food

Year	Actual
2016	12

Output #9

Output Measure

- Number of research projects focused on the impact of food on nutrition and health

Year	Actual
2016	11

Output #10

Output Measure

- Total competitive federal Grant $ for program area

Year	Actual
2016	3769896

Output #11

Output Measure

- Total non-federal competitive grant $ for program area

Year	Actual
2016	1816054

Output #12

Output Measure

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

Year	Actual
2016	45

Output #13

Output Measure

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

Year	Actual
2016	390

Output #14

Output Measure

- Number of participants in quarterly HACCP roundtables
  Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of culinary workshops for food technologists

Year	Actual
2016	3

Output #16

Output Measure

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

Year	Actual
2016	23

Output #17

Output Measure

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

Year	Actual
2016	5

Output #18

Output Measure

- Number of food processing laboratory services provided

Year	Actual
2016	10

Output #19

Output Measure

- Number of nutritional labels developed

Year	Actual

2016	272

Output #20

Output Measure

- Number of food processing approvals developed (2541a)

Year	Actual
2016	4

Output #21

Output Measure

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

Year	Actual
2016	19474

Output #22

Output Measure

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

Output #23

Output Measure

- Number of presentations to catfish farmers and processors

Year	Actual
2016	6

Output #24

Output Measure

- Number of emails, phone calls, and conference calls to catfish farmers and processors

Year	Actual
2016	14

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
5	Number of youth demonstrating improved knowledge of food safety or hand washing
6	Number of Online Master of Agriculture (Food Safety Emphasis) 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	Increased understanding of food safety issues in imported catfish and catfish-like products as compared to U.S. farm-raised catfish by public agencies, the aquaculture industry, and the general public
20	Number of adults who report improved food security after participating in a nutrition education class
21	Increased understanding of the impact of aquaculture and fisheries on human nutrition

Outcome #1

1. Outcome Measures

Number of participants receiving certification in Better Process Control

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	38

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

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
2016	295

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	70

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Food Safety Modernization Act is a reality for the food industry separate from Meat and Poultry plants that have been under HACCP for almost 20 years. The first round of regulatory implementation began in 2016 for large plants. Since then, FDA has been backing off of implementation to allow more time for assimilation of a large piece of work.

What has been done
To serve as an educational resource for the food industry in Arkansas, the U of A System Division of Agriculture Cooperative Extension Service along with the HACCP Consulting Group are currently the only organizations offering public courses of the Food Safety Preventive Controls for Human Foods developed by the Food Safety Preventive Controls Alliance. Several large corporations have their own trainers doing private, internal programs.

Results
The training that we are offering is the only curriculum that is approved by the Food and Drug Administration and persons completing the curriculum are considered to be a "Preventive Control Qualified Individual" (PCQI) by the FDA unless the company that they work for fails an FDA inspection / investigation. Every company producing human food (or animal food) must develop a Food Safety Plan and that development must be supervised by a PCQI. The education is not mandatory if the person has many years of experience and the necessary knowledge.
Because this training is targeted to the food industry separate from the meat and poultry companies under USDA regulation, the outreach to this audience is not as easy. Therefore, Cooperative Extension will be working in cooperation with Arkansas Manufacturing Solutions, an educational group within the Arkansas Economic Development Commission that is also an educator for manufacturing with similar goals to Extension. In 2016, CES had 4 courses in Fayetteville and one in Little Rock at the Little Rock State Office, the last one in cooperation with AMS. Going forward in 2017, CES is offering 4 workshops in Fayetteville and AMS will work to identify locations outside of Fayetteville and they will conduct the course with CES and HCG as the instruction team.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

Number of Online Master of Agriculture (Food Safety Emphasis) 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
2016	9

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

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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Foodborne diseases such as salmonellosis are of concern the public, food regulatory agencies and the commercial food industries. Salmonellosis is one of the most common foodborne diseases with a range anywhere from 1 to 4 million human infections reported each year in the United States Furthermore, it is one of the more costly foodborne diseases in the U.S. Given that foodborne Salmonella spp. can originate from a wide variety of food production environments, reduction of this organism at all stages of food production is critical.

What has been done
Our Salmonella research program reflects an integrated approach for controlling Salmonella spp. and other foodborne pathogens by examining virulence expression of Salmonella under typical food production and processing conditions. We are doing the following: 1) Determining the environmental factors that must be modified to prevent the early establishment of Salmonella in food production environments and virulence expression under these conditions; 2) Studying the metabolism of Salmonella spp. under anaerobic conditions to better understand what factors are required for successful Salmonella spp. establishment in food production animals; 3) Screening potential prebiotic compounds that would promote beneficial bacteria in the gastrointestinal tract for humans and animals.

Results
1) Developed a rapid method (less than one day) to quantify Salmonella Typhimurium on poultry meat using a combination of MPN with qPCR and a shortened time incubation. Demonstrated

that the amount of time required to detect and quantify Salmonella could be greatly reduced using non selective enrichment media in an MPN approach that was combined with quantitative PCR.

2) Characterized heat survival and phenotype microarray profiling of Salmonella Typhimurium mutants. Demonstrated that certain mutants could elicit relevant phenotype characteristics indicative of Salmonella?s ability to survive heat stress.

3) Reduction of Salmonella Typhimurium by prebiotic-like compounds using in an in vitro anaerobic mixed culture. Demonstrated that an in vitro system using chicken cecal inocula could be used to screen prebiotic candidates for Salmonella inhibition properties generated by the cecal microbiota.

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 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The intrinsic characteristics of organic poultry production, one of the fastest growing segments oforganic agriculture, create unique challenges for producers. Despite the fact that most management practices in organic production are designed to promote animal health and prevent disease, the lack of consistently effective organic treatments for enteric diseases can adversely influence the bird's health and the wholesomeness of poultry products. Enteric diseases such as necrotic enteritis and food safety hazards caused by the pathogens Salmonella and

Campylobacter, are high priorityissues for organic poultry producers. Therefore, there is a real need to develop strategies to promote gut health and limitdisease/pathogens in these birds. Unfortunately, organic poultry producers have a

limited number of safe, effective and approved organic treatments to prevent and treat health problems in their flocks. Using combinations of natural plant compounds and management approaches customized for organic production; our objective is to develop comprehensive strategies to eliminate enteric diseases (necrotic enteritis) and foodborne bacterial contamination(Salmonella and Campylobacter) in organically raised poultry.

What has been done

1. We conducted studies to evaluate the effectiveness of management strategies to prevent and control enteric pathogens in organic poultry.

2. Studies were conducted to investigate the efficacy of the natural compound, β-resorcylic acid, against Campylobacter colonization in broiler chickens.

3. Studies were conducted to evaluate the ability of select probiotics to reduce enteric Campylobacter colonization in broiler chickens.

4. We also conducted on-farm studies at Across the Creek Farm, a local pasture poultry farm and evaluated the growth rate and meat characteristics of slow versus fast growing strains of chickens recommended for organic poultry production.

Results

1. Evaluate the effectiveness of management strategies to prevent and control enteric pathogens in organic poultry.

Previously we evaluated the effect of pasture access, housing and feeding systems on the health of poultry and incidence of enteric pathogens and the research findings were published in the Journal of Applied Poultry Research. Subsequently we also evaluated the meat quality characteristics of broiler chickens raised in portable versus fixed housing, with or without access to pasture. These studies were completed and the manuscript was submitted to the Journal of Applied Poultry Research.

2. Investigating the efficacy of the natural compound, β-resorcylic acid, against Campylobacter colonization in broiler chickens. The objective of this study was to evaluate if the phytophenolic compound β-resorcylic acid (BR) would reduce enteric Campylobacter colonization in birds. Results suggest BR has the potential to reduce enteric colonization of Campylobacter but further explorations are warranted to ensure consistent efficacy. As a follow up study, we investigated the potential of BR for reducing Campylobacter in post-harvest organically raised poultry (chicken skin and meat). In addition, the effect of the compound on the expression of genes critical for the survival of Campylobacter in the environment and virulence were also investigated. These studies have been completed and two manuscripts were prepared and submitted to peer reviewed scientific journals for publication.

3. The ability of select probiotics to reduce enteric Campylobacter colonization in broiler chickens. Bacterial isolates demonstrating increased growth rates in the presence of mucin in broth were tested in bird trials. Results demonstrated 2 individual isolates grown in mucin before inoculation consistently reduced cecal Campylobacter counts. These results support the potential use of

preselection and growth of isolates in mucin in evaluating bacterial isolates with the ability to reduce enteric Campylobacter colonization. These studies were published in International Journal of Poultry Science.

4. On-farm testing of effectiveness of treatments and strategies against enteric pathogens in organic poultry production systems We selected two fast growing strains of chickens, Naked neck and Cornish cross, and a slow growing strain (Freedom rangers) for this study. Birds are wing banded and individual body weights are recorded every 2 weeks until processing. Birds were processed to evaluate the carcass weight and meat quality characteristics. Data is being evaluated and manuscript is under preparation.

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
2016	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Blueberries have received much attention as a functional food due to their abundance of polyphenols, especially anthocyanins and procyanidins. Unfortunately, due to their perishable nature and limited seasonal availability, blueberries are commonly consumed in processed forms including juices. It is well established that blueberry anthocyanins are susceptible to degradation during juice processing and long-term storage at ambient temperature. These losses may in part be due to polymerization of anthocyanins with procyanidins resulting in the formation of polymeric pigments, or decolorization as a result of water nucleophilic attack at the 2 position of the anthocyanin nucleus. Anthocyanins are reported to be more stable at low pH due to the cationic form of the flavylium ring. Hence, acidification of blueberry juice is a potential treatment that may prevent anthocyanin losses through inhibition of hydration and polymerization reactions. The goal of this work was to evaluate the effect of acidification of blueberry juice on changes in anthocyanins and percent polymeric color in response to juice processing and during eight months of storage at ambient and refrigerated temperatures.

What has been done
Three subsamples of non-pasteurized blueberry juice were adjusted to three pH levels: 2.9 (control, no pH adjustment), 2.5, and 2.1. After pH adjustment, juices were pasteurized and placed in storage at 4 and 25oC. Samples were analyzed before (non- pasteurized) and after pasteurization, and after 2, 4, 6, and 8 months of storage at each temperature (4 and 25oC) for anthocyanin composition by HPLC and percent polymeric color. Blueberry juice acidified to pH 2.1 retained higher levels of total anthocyanins and had lower percent polymeric color values than juice acidified to pH 2.5 and control juice (pH 2.9) following pasteurization. Anthocyanin

arabinosides were more susceptible to thermal degradation than glucosides, galactosides and acetylated derivatives. Levels of total anthocyanins declined markedly over 8 months of storage, but juices stored at 4oC had on average 56% higher levels of total anthocyanins than juices stored at 25oC. Juice acidified to pH 2.1 had on average 12% and 26% higher levels of total anthocyanins than pH 2.5 and control juices, respectively. After 8 months of storage, juice acidified to pH 2.1 had 11 and 22% higher levels of total anthocyanins than pH 2.5 and control juices stored at 4oC, and 26% and 59% higher levels of total anthocyanins than pH 2.5 and control juices stored at 25oC. Acetylated derivatives were more prone to losses during storage than glycosides, especially in acidified juices.

Results

Acidification of blueberry juice to pH 2.1 ameliorated losses of anthocyanins and maintained lower polymeric color values in blueberry juice following pasteurization and over eight months of storage. Refrigerated storage resulted in much higher retention of anthocyanins and lower polymeric color values compared with juices stored at ambient temperature. Results from this study indicate that blueberry juice should be refrigerated to retain higher levels of health-promoting anthocyanins. Acidification of blueberry juice appears to be a viable treatment to prevent anthocyanin losses, especially when used in conjunction with refrigerated storage, but additional sensory analysis is needed to confirm that acidification of juice does not adversely affect organoleptic properties.

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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the state of Arkansas, soybeans stand as one of the top three cash crops of Arkansas farmers generating an income of about $1.7 billion annually. Soybean hulls or seed coats, a by-product of soybean processing industry, consist of complex carbohydrates, proteins, lipids, and polyphenols such as anthocyanidins, proanthocyanidins, and isoflavones, and constitute about 8% of the whole seed. The polyphenolic compounds in the seed coats, which give them various colors such as black, brown, green, yellow or even a mottled appearance, can be used as alternatives for synthetic antimicrobials and preservatives to assist in preventing the growth of foodborne pathogens.

What has been done

"Green solvent" of 70% ethanol was used to prepare phenolic extracts from seed coats of soybean seeds from 4 cultivars: yellow (R08- 4004), dark brown (R09- 349), brown (R07-589), and black (R07-1927).ACE-I inhibition activity was also determined by an in vitro method using hippuryl-L-histidyl-L-leucine (HHL) as a substrate to evaluate the potency of the extract as an anti-hypertensive agent.

Results

The significance of this study is in the utilization of by-product seed coats from colored soybean as a source of nutraceutical phenolic compounds. The phenolic extracts has the potency as a novel antihypertensive agent. The highest total phenolic content was observed in the seed coat extract of the darkest soybean cultivar (R07-1927) and was significantly different from the conventional soybean cultivar. The extract from the seed coat of soybean var. This study demonstrated that phenolic extracts from soybean hulls can inhibit angiotensin 1 converting enzyme (ACE); the highest ACE-I inhibitory activities were shown by the extract from the darkest soybean cultivar (R07-1927). This phenolic extract has the potential to be used as an alternative choice in the inhibition of hypertension with lower cost and without / minimal side effects.

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

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The vast majority of jobs in the United States and in Arkansas are created by small, privately held companies. It is therefore vital to create an environment and conditions to assist small businesses to develop and hire people. Assisting small food companies and entrepreneurs in technical and business issues of the food processing industry can result in job creation and provide additional tax revenue for Arkansas.

What has been done
The Institute of Food Science & Engineering (IFSE) of the University of Arkansas System Division of Agriculture assists small food processing companies and entrepreneurs by providing technical assistance and making its FDA registered processing plant accessible for product manufacturing. The use of the Arkansas Food Innovation Center (AFIC) has provided the platform which to help entrepreneurs in the state of Arkansas. This past year the center has continued its outreach in the state through entrepreneurship workshops.

Results
AFIC currently has twenty five active entrepreneurs using the facility routinely. This past year alone, 12 new companies joined forces with AFIC to launch new food products in the marketplace. A total of 72 different products were manufactured in the plant for a total of 469 production runs. We estimate that this past year AFIC was chiefly responsible for the creation of 5 fulltime processing jobs and 15-20 fulltime jobs within the startup companies associated with AFIC.

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
2016	15089

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over 38% of school-aged children in Arkansas are overweight or obese. Arkansas children and teens are falling short of nutrition and physical activity recommendations. Approximately sixty-one percent (289,596) of Arkansas students receive free and reduced price lunches.

What has been done
SNAP-Ed partners with schools in which 50% or more of students receive free and reduced price lunch. Nutrition education is delivered in classrooms, school gardens, cafeterias, after school programs, and summer programs. Lessons emphasize MyPlate guidelines, Arkansas grown foods, physical activity, and food preparation. Information and recipes are sent home to parents to reinforce what the children are learning. In FY16, SNAP-Ed nutrition educators worked with 234 schools to deliver 9,688 lessons.

Results
As a result of participating in nutrition education programs:

83% of youth reported they intend to follow MyPlate guidelines.
74% of youth reported increased knowledge about Arkansas foods.
71% of youth reported improved food preparation skills.
66% of youth reported increased knowledge of MyPlate.
52% of youth reported eating closer to the recommended amount of fruit.
50% of youth reported eating closer to the recommended amount of vegetables.
50% of youth reported decreased consumption of sugar-sweetened beverages.
48% of youth reported eating closer to the recommended amount of whole grains.
45% of youth reported increasing physical activity or reducing sedentary behavior.
42% of youth reported eating closer to the recommended amount of low-fat or fat-free dairy.
39% of youth reported understanding the importance of balancing food intake and physical activity.

What participants are saying...

"The Kids in the Kitchen recipes are yummy! I loved the pizza, best! Eating healthy is delicious!" - 4th grade student, Jackson County

"I like trying new foods at school. I go home and tell my mom what I liked and we go buy it at the grocery store." - 4th grade student, Ouachita County

"I did not know what zucchini was at first, but now it is in my garden." -Youth Participant, Sevier County

"I can't wait to get home and try out this Yoga for Kids DVD. It will be a lot of fun for me and my sister!" - Youth Participant, Washington County

"My child picks out healthier foods at the grocery store since attending your programs. Our favorite thing is shopping for fruits and vegetables and trying new ones." - Parent, Fulton County

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
2016	10044

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over 38% of school-aged children in Arkansas are overweight or obese. Arkansas children and teens are falling short of nutrition and physical activity recommendations. Approximately sixty-one percent (289,596) of Arkansas students receive free and reduced price lunches.

What has been done

The University of Arkansas Division of Agriculture addresses youth health and nutrition education through SNAP-Ed, EFNEP and 4H and youth development programs. SNAP-Ed and 4-H programs are conducted in all 75 counties and EFNEP was conducted in 18 counties in FY16. The goal of the SNAP-Ed is to help individuals receiving SNAP benefits or eligible to receive SNAP benefits make healthy food choices on a limited budget and choose physically active lifestyles consistent with the Dietary Guidelines for Americans. EFNEP is taught by peer educators to deliver up to 12 lessons to eligible youth. 4-H uses healthy living projects and other curricula (4-H Yoga for Kids, Healthy Lifestyle Choices, Choose Health: Food, Fun and Fitness) to reach Arkansas youth. Youth engagement approaches, such as Teens as Teachers, and a youth healthy living ambassador track are used to connect state and county level program efforts.

Results

For SNAP-Ed. Youth, evaluations collect information on knowledge gain and diet and physical activity practices.
45% reported increasing physical activity or reducing sedentary time
39% reported understanding the importance of balancing food intake and physical activity
For EFNEP youth outcomes:
54% (2471 of 4562) Children and youth improve their physical activity practices or gain knowledge
4-H Healthy Living Common Measures
76% indicated healthy physical activity habits.
86% had positive attitudes toward physical activity.
Yoga for Kids Participant Survey Data
59% reported doing yoga at home
69% said they showed yoga poses to family or friends
27% do yoga with family
84% think yoga helps them relax
79% think it is fun to exercise

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
2016	12473

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
2016	772

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
2016	4674

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In Arkansas, 69.5% of adults are overweight or obese, 11.5% have diabetes, 41% have high blood cholesterol and 39% have high blood pressure. Research shows that even small changes in diet and small decreases in weight can lower the risks for diabetes, heart disease and hypertension.

What has been done

Multiple educational approaches were used to respond to issues related to chronic illness and obesity. Healthy weight classes were evaluated in 3 counties. Participants learned to plan healthy meals, balance calorie intake with calorie expenditure, read food labels, reduce portion sizes and decrease fat and sodium intake. Cooking classes offered in 14 counties helped people learn skills

that enable them to plan and prepare healthier meals at home. Participants learned to cook using healthier techniques, eat more locally grown foods and save money by eating at home more often. Nine counties offered programs to help people with diabetes better manage their disease. General nutrition programs were reported by 22 counties. Programs focusing on healthy weight, diabetes self-management and choosing and preparing healthy foods resulted in 48,710 contacts through 2,441 direct education methods. Programs provided to adults through the Expanded Food and Nutrition Education Program resulted in 22,263 direct education contacts through 12,967 educational sessions and SNAP-Ed had 22,263 contacts via 878 programs.

Results

Of adult participants in general nutrition programs who were asked:
o 81% reported improvements in one or more nutrition practice
o 79% reported increased fruit and/or vegetable intake
o 73% reported increased lowfat or fat-free dairy intake
o 59% reported increased whole grain intake

Of participants in healthy weight programs who were asked:
o 54% reported decreasing weight
o 67% reported decreased blood pressure
o 67% reported decreased blood glucose
o 22% reported lower blood cholesterol

What participants are saying?

"I was shocked at the amount of salt that is in processed foods. I always knew it was high, but when Ms. Hadley showed us the amount of sodium, I was shocked. I am going to limit my processed foods and use herbs to flavor my foods." Miller Co. Participant

"I love making freezer meals, they save me and my family time and money!" Independence Co. Participant

"I needed an educator not a salesman. The information I received from Mississippi County Extension was useful and applicable. I recommend it. I found it informative, understandable, and the agent was only a phone call away." Mississippi Co. Participant

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
2016	3044

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas now has the sixth highest obesity rate in the nation, according to the State of Obesity: Better Policies for a Healthier America released September 2016. The Arkansas adult obesity rate is currently 34.5%.

What has been done
Two nutrition education programs are offered through the University of Arkansas at Pine Bluff. These programs conduct classes on increasing fruit and vegetable consumption, choosing low-fat and non-fat foods, reading Nutrition Facts Labels, increasing whole grains in the diet as well as increasing physical activity. Participants also participated in food preparation classes in two counties.

Results
EFNEP participants were surveyed through pre/posttests:

90% showed improvements in one or more nutrition practices

85% showed improvements in one or more food resource management practices

71% showed improvements in one or more food safety practices

68% increased physical activity

What participants are saying:

"I learned to take the skin off chicken before I cook it. I enjoy the lessons and food demonstrations. I now use spices and herbs instead of salt." Jefferson County

"I enjoy this class. My eating habits have changed a lot. I eat less salt and I bake most of my meat. I think this class is good for everybody." Jefferson County

"The classes improved the quality of life for me and my family by using what I learned in the program. I increased my physical activity level by adding gardening to my daily activities. I saved money by using the strategies taught in the lesson Plan, Shop, Save." Phillips County

"I will cut back on salt, little by little."

4. Associated Knowledge Areas

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

Outcome #19

1. Outcome Measures

Increased understanding of food safety issues in imported catfish and catfish-like products as compared to U.S. farm-raised catfish by public agencies, the aquaculture industry, and the general public

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

2016 5286

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Arkansas has a high rate of food insecurity with 19.2% 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-income households with children how to better manage their food resources, handle their food safely, make healthier food choices and be more physically active. In FY16, trained program assistants in 18 counties taught more than 13,700 lessons to nearly 3,000 adults. We also reached more than 13,800 unduplicated adults through the SNAP-Ed program.

Results

As a result of participating in UA nutrition education programs:

85% of adult EFNEP program graduates adopted one or more food resource management practice
70% of adult SNAP-Ed program participants adopted one or more food resource management practice
50% of adult EFNEP program graduates ran out of food less often
51% of adult SNAP-Ed program participants ran out of food less often
48% of adult EFNEP program graduates increased food security
44% of SNAP-Ed participants reported saving money on groceries
361 EFNEP participants enrolled in public programs to assist them in feeding their families better

What participants are saying:

"I never knew how other people just knew how to take care of their money. Now I feel like I am able to save and budget like I never have before." Pulaski Co. EFNEP Participant

"The EFNEP classes have helped me plan better and that has saved me both time and money." Craighead Co. EFNEP Participant

"I now use sale ads and compare prices to find good deals." Crittenden Co. EFNEP Participant

As a result of participating in EFNEP through the University of Arkansas at Pine Bluff:

85% of participants adopted one or more resource management practices(plan meals, compare prices).
90% of participants adopted one or more nutrition practices (plan meals,prepared food without adding salt)
71% of participants adopted one or more food safety practices thawing and storing food correctly)

4. Associated Knowledge Areas

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

Outcome #21

1. Outcome Measures

Increased understanding of the impact of aquaculture and fisheries on human nutrition

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Presently, 17% of the global population is zinc deficient, while nearly one-fifth of pregnant women worldwide have iron-deficiency anemia and one-third are vitamin-A deficient. In addition to supplying protein, fish are excellent sources of micronutrients such as iron, zinc, omega-3 long-chain polyunsaturated fatty acids and vitamins. But fish stocks have faced major declines. Developing countries are at greater risk, as micronutrient deficiencies can increase perinatal and maternal mortality, and numerous health problems in children.

What has been done
Researchers studied how declines in marine fish supply will affect human health. Results were reported in ?Fall in Fish Catches Threatens Human Nutrition? published in Nature (Vol 534, 16 June, 2016). Researchers coupled two databases from 2010. The new Global Expanded Nutrient Supply database combines food balance sheets and production or trade data from the FAO with estimates of food group intake by age and sex. The Sea Around Us database uses marine fisheries catch data to measure the contribution of wild fish to the food supply at the country level.

Results
Nearly 11 % of the current global population could become deficient in iron, zinc or vitamin-A by 2050 if current trajectories in fish catch declines continue. We investigated whether global aquaculture could meet production shortfalls of wild fish predicted for poor populations. We found that aquaculture can be a crucial contribution to local diets and economies when correctly planned. Next-generation analytical models that integrate data on human health and fisheries should play an increasingly important role when assessing the human health burdens of

environmental change and natural resources management. This will require interdisciplinary partnerships between fisheries scientists, aquaculture technologists, ecosystem managers, nutrition and public health specialists, development economists and policymakers.

4. Associated Knowledge Areas

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

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

Availability of participants, language barriers, not enough staff and lack of agency cooperation are some of the barriers that affected the EFNEP program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UA Extension Nutrition programs use pre- and post- program surveys or retrospective pre-post surveys with similar evaluation questions to assess impact of multi-session educational programs. Data for the food security outcome indicators are compiled across SNAP-Ed and EFNEP programs and totals are reported below. Not all participants complete evaluation surveys.
For youth, EFNEP uses age appropriate evaluation tools with K-2nd using the same tool, 3rd-5th using a different tool, 6-8th using a different tool, and finally 9th-12th is using a different tool. Every state uses the same evaluation tool as required by our Federal partners. Food resource management and food security are only assessed in the 6-8th grades and 9-12th grades, respectively.
For EFNEP youth outcomes:
41% (1853 of 4562) Children and youth improve their abilities to choose foods according to the Federal Dietary Recommendations or gain knowledge
54% (2471 of 4562) Children and youth improve their physical activity practices or gain knowledge
For SNAP-Ed, process evaluation is critical because it allows ongoing monitoring of the program and enables timely refinements which help achieve success. Process evaluation activities include tracking the number of SNAP-eligible and potential eligibles reached, the number of materials distributed at educational displays and the number of events and

methods used to reach the target audience. SNAP-Ed reports planned events in the UACES Arkansas Information Management System (AIMS) online electronic reporting system.

Formative evaluation assures the best possible program by identifying appropriate target audiences and ensuring program messages and activities are relevant and meaningful to them. Methods used to evaluate the program include observing participant behavior, informal talks with the participant about the educational activity, giving short surveys, holding group discussions with participants to gain feedback to assess a project as it progresses or to determine improvements and adjustments needed to attain the program objectives.

Outcome/impact evaluation is conducted with direct contact programs. Pre-and post-tests or post-then pre-tests are used to assess knowledge, attitude, and behavior change among youth and adults. A series of evaluation questions are in place for county agents to use to develop appropriate questionnaires that fit their programs and are aligned with UACES outcome/impact indicators.

For SNAP-Ed. Youth, evaluations collect information on knowledge gain and diet and physical activity practices.

Youth outcome evaluation measures changes as a result of participating in a SNAP-Ed program. The number of youth surveyed is not necessarily the same for every outcome indicator. Of youth surveyed:

83% reported they intend to follow MyPlate guidelines

52% reported eating closer to the recommended number of cup equivalents from the fruit group most days

51% reported eating closer to the recommended number of cup equivalents from the vegetable group most days

48% reported eating closer to the recommended number of ounce equivalents of whole grains most days

42% reported eating closer to the recommended number of cup equivalents of low fat or fat free foods from the dairy group most days

45% reported increasing physical activity or reducing sedentary time

39% reported understanding the importance of balancing food intake and physical activity

50% reported decreasing consumption of sugar sweetened beverages

74% reported increased knowledge about Arkansas foods

71% reported improved food preparation skills

4-H Healthy Living

Overall in FY16, 73,337 contacts were reported to youth Healthy Living programs, representing 23% of total youth development contacts reported in AIMS. Extension faculty and staff devoted 33,109 hours to programs in this area; 11,407 hours were dedicated to healthy living programs by volunteers ($268,749 value @ $23.56/hour).

Healthy Living Common Measures

* Survey of 3,835 participants showed that, as a result of the program:

89% (n=3,411) reported little to no difficulty in making healthy food choices.

89% (n=3,418) increased knowledge of healthy food choices.

81% (n=3,099) improved eating habits.

76% (n=2,920) indicated healthy physical activity habits.

86% (n=3,307) had positive attitudes toward physical activity.

Yoga for Kids Participant Survey Data

Survey of 690 students showed that:

59% (n=406) reported doing yoga at home

69% (n=474) said they showed yoga poses to family or friends

27% (n=189) do yoga with family

84% (n=579) think yoga helps them relax

79% (n=542) think it is fun to exercise

Key Items of Evaluation

50% (2577/5110) unduplicated adults who reported less often running out of food before the end of the month after participating in an Extension program
44% (706/1606) of unduplicated adults who reported saving money on groceries after participation in an Extension program

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%	17%	0%
724	Healthy Lifestyle	20%	0%	0%	0%
801	Individual and Family Resource Management	10%	0%	0%	0%
802	Human Development and Family Well-Being	18%	0%	15%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	2%	0%	3%	0%
806	Youth Development	40%	100%	2%	0%
902	Administration of Projects and Programs	0%	0%	4%	0%
903	Communication, Education, and Information Delivery	0%	0%	59%	0%
	Total	100%	100%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	132.2	3.3	1.8	0.0
Actual Paid	141.3	3.5	14.6	0.0
Actual Volunteer	0.0	0.0	0.0	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**
1348677	325642	31986	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1977279	383846	1057969	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
15353147	0	1253977	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The University of Arkansas System Division of Agriculture (1862) and the University of Arkansas at Pine Bluff (1890) are uniquely positioned to extend research-based information to the 2,966,369 residents of Arkansas. We have a poverty rate of 19.7%. Arkansans face many challenges, such as low child well-being rate, sedentary lifestyles, financially vulnerable consumers, a continually growing population of residents age 65+, and a need to prepare students for the future. The University of Arkansas Cooperative Extension (1862) and the University of Arkansas at Pine Bluff (1890) are a part of the land grant system that focuses on the human dimensions of food and agriculture through programs in the areas of Health and Aging, Strengthening Families, Family Resource Management, and 4-H Youth Development.
Health and Aging. Extension's Health and Aging programs aim 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 help you and old Arkansans increase physical activity, improve health, and improve quality of life. The Extension Wellness Ambassador Program trains and engages community volunteers to address local health issues by implementing projects and conducting health improvement activities. Extension Health and Aging programs work 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.
Strengthening Families: Our marriage, parenting, and family life programs offer invaluable resources to parents, couples, and individuals who seek to improve their psychological and relationship health and their overall quality of life. We offer free, researched-based professional development training to childcare providers and afterschool care workers to help them meet their annual state required training hours, improve their job performance, and quality of care given to our youngest citizens. Our parenting programs offer parents tools to improve relationships with their children and partners.
Family Resource Management: Research shows that Arkansans have the 48th worst financial behavior and the 49th worst financial literacy among all states (Employee Benefit Research Institute). Much of our population is economically vulnerable. Arkansas had the 7th highest poverty rate (18.7%) in the country. Pockets of extreme poverty remain throughout the state, and 16 counties had a poverty rate 25% or greater. Additionally, many counties are primarily rural, with limited access to education resources. Only 19 % of the population was identified as rural compared with 44 of Arkansans. Our programs to address this issues include debtor education, estate planning, consumer education and fraud prevention.
Empowering Youth: Arkansas youth face many challenges. The teaching of life skills, like effective communication, leadership training and decision making, helps youth become productive adults. The need for science, technology, engineering and math education is at an all-time high. Both 1862 and 1890 institutions are uniquely positioned to teach and demonstrate scientific exploration. The Arkansas AG Awareness Adventures program (1890) and Collegiate 4-H will aid youth in having a better understanding

of agriculture, its industry and communities.

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 by UAPB in Empowering Youth to research programs, collaboration and grants.
eXtension was also used by Extension staff for professional development.
Division of Agriculture (1862) used eXtension for links in the Marriage, Parenting, Family Life parenting webpage.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	337953	1003768	215175	271299

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	19	0	0

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
2016	791

Output #2

Output Measure

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

Year	Actual
2016	10078

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
2016	417

Output #4

Output Measure

- Number of volunteers working with organized adult and other groups

Year	Actual
2016	6417

Output #5

Output Measure

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

Year	Actual
2016	1488190

Output #6

Output Measure

- Number of unique visitors to Health and Living webpage

Year	Actual
2016	1258

Output #7

Output Measure

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

Year	Actual
2016	2720

Output #8

Output Measure

- Number of Health & Aging programs delivered

Year	Actual
2016	6310

Output #9

Output Measure

- Number of participants in Health & Aging programs

Year	Actual
2016	70057

Output #10

Output Measure

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

Year	Actual
2016	10411

Output #11

Output Measure

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

Year	Actual
2016	39380

Output #12

Output Measure

- Number of youth participating in Citizenship/Leadership programs

Year	Actual
2016	4072

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
2016	34

Output #14

Output Measure

- Number of youth participating in 4-H mentoring programs

Year	Actual
2016	180

Output #15

Output Measure

- Number of volunteers participating in 4-H mentoring programs

Year	Actual
2016	45

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
2016	92

Output #18

Output Measure

- Number of Extension Wellness Ambassadors graduates

Year	Actual
2016	35

Output #19

Output Measure

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

Year	Actual
2016	4889

Output #20

Output Measure

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

Year	Actual
2016	1156

Output #21

Output Measure

- Number of child care providers trained

Year	Actual
2016	5187

Output #22

Output Measure

- Number of participants in a Family Resource Management program

Year	Actual

2016 9068

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 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	Individuals, families and employees who participate in Family Resource Management programming will report they have used the knowledge/materials gained from the program to change behaviors related to targeted financial management goals.
19	Number of mentoring program participants who increase their knowledge about agriscience and STEM related topics (1862)

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
2016	24056786

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
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
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4072

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 processes. 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 project. In 2016, 4072 youth were engaged in citizenship and leadership opportunities, including officer roles, teaching roles, and volunteer service. The Division of Agriculture also coordinated at 4-H Day at the Capitol which was attended by over 400 4-H members from across Arkansas. The Division of Agriculture also offered a number of leadership roles within the 4-H program, such as state 4-H officers, 4-H Ambassador Program, and the Teen Start recognition program.

Results

In the Leadership/Citizenship initiative area, 484 participants were surveyed using 4-H Common Measures 4th - 12th Grade Citizenship measurement tools and:
90% indicated that they were more aware of community needs
78% indicated that they were more likely to volunteer in community service projects.
75% indicated they increased their skills and leadership abilities through 4-H programming.

In one FY2016 4-H Youth Development Impact statement, Clay County 4H recognized the need to prepare youth for stepping into leadership roles. They developed a youth leadership program based on researched criteria to support and engage young leaders, adults, organizations and communities. We help young people develop leadership competencies making them better able to solve community problems and enhance their civic participation. As a result, 37 high school juniors completed leadership skills training through 17 different workshops involving community leaders. They received over $8,000 in grants to support their program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Number of 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
2016	2561

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The U.S. Consumer Product Safety Commission (CPCC) reports Arkansas ranks 15th in the nation for deaths associated with All Terrain Vehicles (ATVs), In 2014, there were an estimated 93,700 ATV-related emergency department treated injuries in the United Sttes. An estimated 26% involved children younger than 16 years of age. According to the Health Research Funding organization, there were over 107,500 emergency room visits by people who were involved with a four wheeler accident in 2011. Of the 2,865 ATV-related fatalities of children younger than 16 years of age, 43% 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 an adult-sized ATV. Recent 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 a non-fatal head injury by 64%

What has been done

The Division of Agriculture has the capacity to reach youth and adults in every Arkansas County with ATV Safety education. The Division's 4-H Youth Development program offers the ATV Safety Institute's (ASI) RiderCourse program to help youth and adults learn to safely and properly ride ATV's. Twenty-seven Division faculty and staff are trained to teach the four-hour ASI ATV RiderCourse. This program is made possible through partnerships with many businesses, state agencies, and other organizations. In addition, school and community-based ATV safety educational programs re provided to clients.

Results

4-H ATV Safety educational programs have reached over 40,000 individuals in the last five years. This extraordinary effort has resulted in 1,898 participants completing the ASI RiderCourse which certifies riders through a four hour hands-on course. Partnerships have evolved over the years involving Arkansas Children's Hospital, Arkansas Game & Fish Commission, Arkansas Farm Bureau, Arkansas 4-H Foundation, ATV dealerships, and other businesses that have assisted with development of this program. This strong support across the state through positive educational experiences have contributed to reduced death and injury rates in Arkansas since 2007.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Number of youth indicating healthy physical activity habits

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10044

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Arkansas is the least physically active state in the US and has among the highest rates of adult obesity. Twenty percent of youth ages 10 to 17 are obese, the 6th highest rate for this age group in the nation. High school students in the state have the 4th highest obesity rate; 18% are obese. As rates of adult and childhood overweight and obesity continue to rise, risk for potentially life-threatening chronic diseases like diabetes, heart disease and hypertension increase as well, leading to higher healthcare costs and increased burden on the healthcare delivery system.

What has been done

Physically active Arkansans experience better health outcomes and lower healthcare costs than their sedentary counterparts. However, rural Arkansans have limited access to places for physical activity and fewer opportunities to participate in organized exercise classes. Limited access to fitness facilities and programs mean rural citizens, who tend to be less healthy than those in urban areas, are geographically isolated from resources that could help them live healthier lives. The 4-h Yoga for Kids program is increasing access to physical activity and improving health for youth.

Results

Youth healthy living programs, including Yoga for Kids, reached more than 73,000 Arkansas students in 2016. Educators representing sixteen states received training as Yoga for Kids Instructors. In two years, 349 instructors have been trained (114 in Arkansas) and are increasing access to physical activity during the school day and afterschool hours. Youth healthy living participants reported healthy physical activity habits (76%) and positive attitudes toward physical activity (86%). Sixty-nine percent shared what they learned with their families, taking home the message that physical activity is important for health.

Healthy habits established in childhood and adolescence are more likely to endure into adulthood. Engaging youth in physical activity programs that can be continued through the lifespan, and positively influencing attitudes toward a physically active lifestyle, support the change in the culture necessary for Arkansas to rise from among the bottom tier of states for health outcomes. The Yoga for Kids program is increasing access to a non-competitive form of physical activity beneficial for all ages. Beyond the health benefits of yoga as a form of exercise, we anticipate youth involved in these programs will be better able to cope with stress and less prone to anxiety and depression.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
806	Youth Development

Outcome #6

1. Outcome Measures

Number of youth that practiced positive communication skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1162

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1123

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

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
2016	35861

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to 2014 ACT data, 63% of American high school graduates are not prepared for college-level math and science courses. Nearly two-thirds of American teens have never considered a career in engineering. Increased youth engaged in 4-H STEM activities, hopefully leading to Career in STEM areas and increasing the aptitude for science.

What has been done

Division of Agriculture 4-H members participated in coding workshops, Sea Perch competitions, compass & orienteering, and junk drawer robotics. Scientific method and research reporting introduced to 4-H members.

Results
Division of Agriculture 4-H members indicated 87% more interest, engagement and positive attitudes toward science and 83% reported they were able to apply science skills and abilities. Four 4-H members, who had not previously done science projects, developed independent or group projects and entered the UAPB Regional Science Fair.

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
2016	26

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lifestyle factors, such as diet and exercise, lay at the core of Arkansas' heavy chronic disease burden. Such issues are complex and require more than educational messages to make a difference. Arkansans have fewer opportunities to engage in health-promotion services and programs. Limited access to fitness facilities and programs mean rural citizens, who tend to be less healthy than their urban counterparts, are geographically isolated from resources that could help them live healthier lives. A look at Arkansas's health statistics paints a grim picture, but Arkansas has many willing volunteers. More than 21% Arkansans actively volunteered in 2012.

What has been done
The approach is to engage residents to use their knowledge in service of others in their communities. This lay health leadership development program provides training and organizational structure to guide collective efforts to improve health. The program's 124 graduates

from 18 counties demonstrated increased knowledge of personal community health, nutrition, and exercise by passing a final exam following the 40-hr. basic training program. The pilot, which was supported by $345,000 NIFA Rural Health and Safety Education Competitive Grant funds, includes planning and implementation of projects by program graduates. More than 500 educational classes and sessions reached a reported 4,889 Arkansans, approximately 3,761 volunteer hours valued at $88,609 were contributed by Wellness Ambassadors. Dozens of state and local partnerships have been formed to support healthy communities, with a common goal of increasing the number of Arkansans who are healthy at every stage of life.

Results

Ambassador Program graduates are filling program gaps and expanding Extension's capacity to improve health in communities. Ambassadors planned and are implementing projects to help others live healthier lives, including youth healthy living programs delivered in and out-of-school settings; fitness classes in rural areas; intergenerational community gardens; development of a community health resource guide; one-on-one health mentoring; and initiation of caregiver support groups. Extension Wellness Ambassadors improved their own health while serving their communities. Program evaluation data, which were collected at the start of the program, and 3- and 6-months later, showed statistically significant positive changes in self-efficacy to take control of personal health and increases in physical activity levels. Participants improved blood glucose, cholesterol and blood pressure levels. Half of participants with a baseline BMI 25 improved their weight. Ambassador graduates significantly improved functional fitness as demonstrated by tests of upper and lower body strength, aerobic endurance, and lower body flexibility.

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	619

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

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
2016	2221

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The need for quality childcare in Arkansas is greater than ever. Arkansas childcare professionals are required to get a minimum of 15 hours per year to maintain their license. With the Division of Agriculture's three, grant-funded childcare training programs, participants have the option of earning all 15+ hours with Extension.

What has been done

The Best Care and Guiding Children Successfully programs are provided free of charge to childcare professionals in Arkansas to fulfill their educational requirements. They are available in multiple formats: face-to-face, online and self guided. Face to Face Best Care sessions reached 2526 participants. The Best Care Connected online program reach 1070 participants. Guiding Children Successfully, delivered both online and correspondence, reached 1355 participants.

Results

Participants report that their knowledge of childcare has increased and that they will change at least one practice. Of the Best Care participants, 87% reported knowledge gained, and 88% stated that they will change at least one behavior or practice. Of those completing the Best Care Connected program, 97% reported knowledge gain, and 95% stated that they will change at least one behavior or practice.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
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
2016	619

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, 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.

What has been done
The Division of Agriculture delivered programs in three areas including personal well-being, couple relationships, and parenting.
Personal Well-Being- The Division of Agriculture offers several programs to improve Personal Well-Being include Managing Stress: Turning Challenges into Blessings, Your Blueprint for Happiness: Five Principles for Building a Better Life, Navigating Life?s Journey, the Personal Journey, and Getting Our Hearts Right: Three Keys to Better Relationships. These programs are delivered either face-to-face in a formal setting, through our online Guiding Children Successfully Program, or indirectly in pamphlet form.

Couple Relationships- The Marriage Garden is offered as a multi-session, face-to-face program or as a series of handouts available on our website. The goal of the program is to improve marital communication and relationships.
Parenting- The Division of Agriculture offers several programs aimed at improving parents? understanding of their children?s development and engagement in developmentally appropriate parenting practices. These programs include See the World through My Eyes, Family Time Tips, Ages and Stages, and Just In Time Parenting (which is offered through eXtension).

Results

Across all media, FCS agents and specialists made over 250,000 direct contacts with adults in Arkansas, nearly 54,000 youth contacts, and over 1 million indirect adult and youth contacts through social and other media sources. Overall all three programs, 619 participants indicated they intended to change at least one practice as a result of our programs.
Personal Well-Being- In FY16, 88% of reported participants in our Personal Well-Being programs increased knowledge, and 73% stated that they would change at least one behavior.
Couple Relationships- Over 250 Arkansans participated in this program during FY16.
Parenting- See the World is typically presented as a handout to parents, with well over 1000 distributed last year. We are currently working on a multi-state project with Minnesota Extension to adapt and create new parenting programming.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

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
2016	4470

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Childcare providers in Arkansas are required to have educational training to obtain and keep a license.

What has been done
The Division of Agriculture offers 10 hours of Best Care (face-to-face) training, Best Care Connected (5-hrs of online training), and Guiding Children Successfully (online correspondence program offering up to 30 hours of continuing education designed for childcare providers and foster parents).

Results
Four-thousand seventy childcare providers obtain the necessary training for the licensure with little or no costs. Eighty-seven percent of participants report knowledge gained and 88% report they will change at least one behavior or practice.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
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
2016	363

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas is the least physically active state in the US and has among the highest rates of adult obesity. Twenty percent of youth ages 10 to 17 are obese, the 6th highest rate for this age group in the nation. High school students in the state have the 4th highest obesity rate; 18% are obese.

As rates of adult and childhood overweight and obesity continue to rise, risk for potentially life-threatening chronic diseases like diabetes, heart disease and hypertension increase as well, leading to higher healthcare costs and increased burden on the healthcare delivery system.

What has been done

Physically active Arkansans experience better health outcomes and lower healthcare costs than their sedentary counterparts. However, rural Arkansans have limited access to places for physical activity and fewer opportunities to participate in organized exercise classes because of limited access to fitness facilities and program. The Extension Get Fit programs is increasing access to physical activity for adults and improving access.

Results

The Extension Get Fit program uses a volunteer delivery model to expand access to group exercise classes for Arkansans across the state. In 2016, this program reached 62,505 participants with twice-weekly sessions. Evaluations results demonstrated that participants improved upper body strength (79%), lower body strength (77%), aerobic endurance (61%), upper body flexibility (75%), lower body flexibility (74%), and agility and balance (68%). Participants also increased overall physical activity levels (775), increased energy (82%), and decreased pain (65%).

Extension Get Fit programs aim to improve overall fitness through strength training, which is shown to also increase bone density and reduce fall risk. Based on fitness test results, we estimate that Extension Get Fit programs contributed to healthcare cost savings totaling $9.2 million for 2016, including hospitalization, treatment and rehabilitation cost savings from reduced fall risk alone.

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

Not Reporting on this Outcome Measure

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
2016	2920

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Arkansas is the least physically active state in the US and has among the highest rates of adult obesity. Twenty percent of youth ages 10 to 17 are obese, the 6th highest rate for this age group in the nation. High school students in the state have the 4th highest obesity rate; 18% are obese. As rates of adult and childhood overweight and obesity continue to rise, risk for potentially life-threatening chronic diseases like diabetes, heart disease and hypertension increase as well, leading to higher healthcare costs and increased burden on the healthcare delivery system.

What has been done
Physically active Arkansans experience better health outcomes and lower healthcare costs than their sedentary counterparts. However, rural Arkansans have limited access to places for physical activity and fewer opportunities to participate in organized exercise classes. Limited access to fitness facilities and programs means rural citizens, who tend to be less healthy than those in urban areas, are geographically isolated from resources that could help them live healthier lives. The Extension Get Fit and 4-H Yoga for Kids programs are increasing access to physical activity and improving health for youth and adults.

Results
Youth healthy living programs, including Yoga for Kids, reached more than 73,000 Arkansas students in 2016. Educators representing sixteen states received training as Yoga for Kids Instructors. In two years, 349 instructors have been trained (114 in Arkansas) and are increasing access to physical activity during the school

day and afterschool hours. Youth healthy living participants reported healthy physical activity habits (76%) and positive attitudes toward physical activity (86%). Sixty-nine percent shared what they learned with their families, taking home the message that physical activity is important for health.
Healthy habits established in childhood and adolescence are more likely to endure into adulthood. Engaging youth in physical activity programs that can be continued throughout the lifespan, and positively influencing attitudes toward a physically active lifestyle, support the change in culture necessary for Arkansas to rise from among the bottom tier of states for health outcomes. The Yoga for Kids program is increasing access to a non-competitive form of physical activity beneficial for all ages. Beyond the health benefits of yoga as a form of exercise, we anticipate youth involved in these programs will be better able to cope with stress and less prone to anxiety and depression.

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
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	175

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Arkansas 82% of youth in the juvenile justice system come from homes where one or both parents are absent, and more than 63% have parents or guardians with drug or alcohol addiction.

What has been done
Opportunities for leadership were provided at each of the seven sites. These including leading meetings, leading an activity, public speaking, and service learning.

Results
Ninety-one percent increased their decision-making, goal-setting, and confidence levels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #18

1. **Outcome Measures**

Individuals, families and employees who participate in Family Resource Management programming will report they have used the knowledge/materials gained from the program to change behaviors related to targeted financial management goals.

Not Reporting on this Outcome Measure

Outcome #19

1. **Outcome Measures**

Number of mentoring program participants who increase their knowledge about agriscience and STEM related topics (1862)

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	180

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Arkansas Juvenile System reports most kids live in chaotic homes. More than 83% have had contact with the child welfare system. Eight-two percent come from homes where one or both parents are absent, and more than 63% have parents or guardians with drug or alcohol addiction. More than 63% of Arkansas youth in correctional facilities have had a drug abuse problem, and more than 57% have struggled with alcohol abuse.

What has been done
The Arkansas 4-H Mentoring program is supported by the U.S. Office of Juvenile Justice - Delinquency Prevention/National Mentoring Program. The objective of this program is to provide direct one-on-one, group, using the 4-H program structure: establish a 4-H club, elect youth officers, provide monthly educational activities and family night out events. The goals of the program are to improve academic performance, enhance social competencies, strengthen family bonds, increase developmental assets, and increase awareness of cultural commonalities.

Results

The 4-H Mentoring program as impacted 247 young people in the last five years. In the 2015-2016 program year, the program involved the following counties: Craighead, Crawford, Crittenden, Desha, Randolph, Polk, and White. These seven counties targeted 180 mentees and 45 adult mentors. The youth participants were evaluated using the National 4-H Common Measures instrument. Evaluation data collected from young people involved in the program indicate the following: 87% had a positive experience in the mentoring program, 91% increased their decision-making, goal setting and confidence levels, 83% responded positively about stress management and standing up for themselves, and 88% had a positive experience with the adults involved in the program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

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

Plan implementation processes must constantly adapt to the circumstance of time and place: the economic condition within and surrounding Arkansas; the public policy landscape; Program leadership; staffing; clientele interest and capacity; environmental circumstance; natural disaster; and other unforeseen changes in the community of constituents we serve, provides a challenging and fluid basis for the success of everything planned. Fortunately, the University of Arkansas Division of Agriculture's and the University of Arkansas at Pine Bluff faculty and staff are well positioned and have the experience necessary to serve and adapt as the circumstance warrants. The leadership within the two institutions has the proven intent to keep the organizations constituent grounded, agile, appropriately staffed, and adequately financed to meet the needs of each new program situation.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Several strategies will be initiated and utilized 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 programmatic and audience centered. Programs

focusing on physical activity will use skill-based assessments, before-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 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 a result of their program participation, and if so, what they plan or hope to do. Participant contact information is also collected. This contact information allows county agents to contact program participants one month following program completion to see what changes they have actually made. The Youth Development program uses the National 4-H Outcome Indicators to discern outcomes and impacts. The mentoring programs use pre and post data through 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 methods.

Key Items of Evaluation

Fifty-one Extension Get Fit volunteer leaders were trained through 13 multi session workshops. An "agent trainer" structure is used, with 13 county FCS agents selected to serve as trainers. Volunteer Get Fit leaders contributed 22,645 volunteer hours valued at $533,516 instructing 4,383 exercise sessions. Of the 458 participants with pre- post-data from the Senior Fitness Test: 77% increased lower body strength; 79% increased upper body strength; 61% increased aerobic endurance; 74% increased lower body flexibility; 75% increased upper body flexibility; and 68% increased agility and dynamic balance.
The Extension Wellness Ambassador Program has graduated 124 trained health-focused volunteer leaders representing 18 counties since the program started; 29 graduated in 2016. In FY 16 3,761 volunteer hours valued at $88,609 were contributed by Wellness Ambassadors, teaching 533 sessions that reached 4,889 Arkansans.
Extension Get Fit and Yoga For Kids programs has provided an opportunity (access) for rural residents to have a program to assist them in becoming more active. Combined these programs have reached 135,000 (62,000 adults, 73,000 youth) Arkansans. Establishing these healthy habits will more likely provide an outcome of creating positive attitudes about physical activity and support a change in the culture necessary for Arkansas to rise from among the bottom tier of states for health outcomes.

As a result of Extension's Early Care Education Program (Best Care & Guiding Children Successfully) 90% of participants indicated their knowledge of effective child care practices increased and did something new to be a better child care professional. A total of 4,969 child care professionals successfully completed hours of professional training with a budget of $475,000. The RAND Institute calculates that for every dollar invested in such programs, there is an estimated return of $2.50 to $4.50. That means that the return investment in Arkansas is between $1.19 and $1.90 million dollars.
Eighty-eight percent of reported participants in our Personal Well-Being programs increased knowledge, and 73% stated that they would change at least one behavior.
In Family Resource Management 4,156 people participated in face-to-face programs. They reported increasing knowledge (87%), and intentions to make at least one, positive money management behavior change (59%). Additionally 2,526 early childhood educators received training with 2,198 indicating knowledge gained.

The 4-H STEM program (1862) directly engaged 3,300 youth in hand-on activities. Thirty-four county faculty members were trained in the curricula thru two in-service training. Youth were involved in coding, Sea Perch competitions/workshops, orienteering and junk drawer robtotics.

Youth (1862) responding to the 4-H Common Measures instrument indicated 88% reported to more likely to volunteer in community service projects. Of the youth who are in 8th - 12th grades, 84% reported to have increased their skills and leadership abilities. Additionally, 93% reported to be more aware of community needs as a result of the educational programming they participated in and 86% intend to engage in community service in the future.

The 4-H Mentoring program impacted 247 young people in the first five years. Ninety-one percent increased their decision-making, goal-setting, and confidence levels. Eight-three percent responded positively about stress management and standing up for themselves. Eight-eight percent had a positive experience the adults involved in the program.

Arkansas (1862) has a traditional 4-H Community Club model. To increase minority participation in the club program a 12 county pilot in-school 4-H program began in 2016. These clubs are more diverse in membership. We are looking forward to reporting results in the future.

UAPB (1890) created 4-H learning modules for enrichment activities for use with 4-H Clubs and school enrichment. Teachers, volunteers, and 4-H members use them to reinforce what was learned in the club and school setting.

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
112	Watershed Protection and Management	7%	0%	0%	0%
602	Business Management, Finance, and Taxation	44%	0%	0%	0%
605	Natural Resource and Environmental Economics	7%	0%	3%	0%
608	Community Resource Planning and Development	14%	0%	12%	0%
610	Domestic Policy Analysis	8%	0%	44%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	17%	0%	40%	0%
805	Community Institutions, Health, and Social Services	2%	0%	0%	0%
806	Youth Development	1%	0%	1%	0%
	Total	100%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	17.6	0.0	2.0	0.0
Actual Paid	17.3	0.0	13.4	0.0
Actual Volunteer	23.5	0.0	0.0	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**
241784	0	186708	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
354477	0	1473651	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2752435	0	380824	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Economic and Community Development programs focus on five core areas:

- Economic Viability and Sustainability
- Rural Infrastructure
- Leadership and Community Involvement
- Quality of Life
- Population Composition and Change

Program activities in 2016 include:

- Presentations and workshops on leadership development topics such as effective meetings, parliamentary procedure, leadership principles, board governance, facilitation skills, ethics, conflict resolution, consensus building, effective communication and listening, issue prioritization, and team building.
- LeadAR (Lead Arkansas), a statewide leadership program consisting of eleven three day seminars about issues affecting Arkansas, a National Study Tour to Washington, D.C., and an International Study Tour to another country.
- Breakthrough Solutions, a visioning and strategic planning program to help communities and regions understand key drivers of change in the world and leverage their assets to create breakthroughs that can move them forward. Once a plan is developed, program partners provide advice and technical assistance to implement the blueprint and strategies developed in the planning process.
- Educational workshops, webinars, and one-on-one assistance regarding local foods system development.
- Arkansas Procurement Assistance Center (APAC), 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 (Arkansas) and local government contracts.
- Guidance to farmers and others interested in agritourism development.
- Ballot issues education on local and statewide ballot initiatives.
- Work with communities and state agencies to encourage public involvement on public policy issues.
- Work with local organizations on understanding and interpreting new laws and regulations.
- Facilitation of stakeholder engagement and public awareness of water pollution issues in watersheds deemed critical by state agencies.
- Hispanic entrepreneurship workshops taught in Spanish and tailored to meet the needs of local entrepreneurs.
- Income Tax Schools providing 16 hours of continuing education credit for people preparing income taxes that need continuing education.

• 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.

• The National Agricultural Law Center (NALC) serves as the nation's leading source of agricultural and food law research and information, in partnership with the USDA Agricultural Research Service, National Agricultural Library. The 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.

Educational methods include websites, workshops, webinars, one-on-one interactions, newsletter and direct communications, exhibits, strategic partnerships and collaborations, and social media.

2. Brief description of the target audience

Audiences vary by activity. For each activity we try to involve all stakeholders relevant to the topic at hand. The list below includes all audiences reached at some point during 2016; not all of the audiences are engaged during every activity.

- Attorneys
- Businesses/Industry - small, large, rural, urban, consultants, and other
- 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 and stakeholders
- 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?

Faculty and staff participated in eXtension webinars and discussion groups, served as presenters in webinars, and received and shared information through CoP's including the Community, Local and Regional Food Systems; Creating Heathy Communities; Enhancing Rural Community Capacity; and Entrepreneurs and Their Communities. They have also promoted webinars that might of interest to internal or external clientele through social media and email.

The National Agricultural Law Center used eXtension to host or broadcast several webinars through the Agricultural & Food Law Community of Practice. The webinars were conducted in partnership with the Agricultural & Food Law Consortium and covered topics such as legal issues in agricultural nutrient management, industrial hemp, federal regulation of shale oil and gas, CRISPR biotechnology, biofuels and invasive species, and free internet legal research for attorneys and non-attorneys.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	89127	1263340	3739	5686

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	19	0	19

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
2016	5849

Output #2

Output Measure

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

Year	Actual
2016	1046

Output #3

Output Measure

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

Year	Actual
2016	961270

Output #4

Output Measure

- Number of Tax Preparers certified through Tax Schools

Year	Actual
2016	370

Output #5

Output Measure

- Number of web visitors on program-related web pages

Year	Actual
2016	62557

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 who indicate a change in behavior, based on lessons learned from economic & community development programs
6	Number who indicate new knowledge gained based on lessons learned from economic & community development programs
7	Number of voters who report being better educated about ballot initiatives as a result of public policy programs
8	Dollar value of grants generated by organizations, communities or regions as a result of economic and community development programs
9	Dollar value of other in-kind resources contributed to organizations, communities or regions as a result of economic and community development programs
10	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
11	Number of issue-focused groups formed and sustained after educational program

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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	460

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the fall of 2015, the Perry County Chamber of Commerce began participation in the first year of a community development program. The Uncommon Communities Initiative sponsored by the Winthrop Rockefeller Institute and the University of Arkansas Cooperative Extension Service served a five county area, including Perry County.

What has been done
Community leaders in Perry County chose to hold monthly meetings to identify priority areas. County Extension faculty continued involvement in the monthly steering committee meetings. Five Uncommon Communities seminars were attended by thirty members. Priority areas were focused on by the committee, including Tourism, Beautification, Education, and Economic Development.

Results
Since the development of the brand and attendance at the initial Uncommon Communities seminar, Perry County's representatives were inspired to plan for twenty-eight leadership projects. They have completed at least half of those in the first year. Completed projects range from a successful community garden, "Saturday on the Square"
events once a month, Perry County Jobs Fair, County Beautification
Trash pick-ups, Yard of the Month awards, and most recently the First
Arkansas Goat Festival, which was a huge success!

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and

Communities

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
2016	24056786

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
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
2016	118593753

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Changes in the economy, technology, and population continue to transform communities, the economic climate and the lives of Arkansans. While urban areas in Arkansas have mostly recovered from the Great Recession, rural areas have been slower to rebound. In a constantly changing economic environment, it is important for businesses to be able to identify and access new market opportunities.

What has been done
The Arkansas Procurement Assistance Center (APAC) is operated by the University of Arkansas System Division of Agriculture Cooperative Extension Service under a Cooperative Agreement from the Department of Defense (DOD) through a program administered by the Defense Logistics Agency (DLA). APAC provides statewide business consulting, counseling, contract assistance, and training services on how to participate with government contacting opportunities to both small and large businesses operating in all 75 Arkansas counties.

Results
In 2016, APAC assisted Arkansas companies in securing 845 local, state and federal contract awards as reported by our clientele. The value of these awards is over $118.5 million, a significant economic contribution to Arkansas communities and the state. Using Department of Defense conversion rates ($50,000 is equivalent to 1 job), this has resulted in nearly 2,372 jobs that have been created or retained as a result of the program this year.

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

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2407

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number who indicate a change in behavior, based on lessons learned from 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
2016	2988

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Van Buren County has suffered greatly with natural disasters & loss of major employers. This has led to decline of businesses in the area. VBC was organized to revitalize economical sustain ability of Van Buren County starting with downtown Clinton. Van Buren County was then accepted into the Uncommon Communities Initiative.

What has been done
Community leaders were accepted into the Uncommon Communities initiative, a collaboration of the Winthrop Rockefeller Institute, Vaughn and Sandy Grisham, & the U of A Cooperative Extension Service. Community leaders participated in 5 seminars addressing 21st century community and economic development opportunities for the county. Leaders also learned about funding and financing community and economic development projects at the local level. A journey center in Clinton and a floating mall at Fairfield Bay are being explored.

Results
Clinton is developing a wayfinding system, similar to Fairfield Bay's. County leaders met with property owners and a major investor to plan the Van Buren County Journey Center, to include a plaza and microbusinesses to draw visitors to downtown Clinton. The Dirty Farmers Market raised over $5,000 by an on-line fund-raiser to support "Feed the Seniors" program. Jackie Sikes of the Dirty Farmers Market spoke at the 2016 Breakthrough Solutions Pre-Conference Workshop on Funding and Financing Community and Economic Development. Fairfield Bay is continuing efforts to attract a hotel.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
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 #6

1. Outcome Measures

Number who indicate new knowledge gained based on lessons learned from 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
2016	5309

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dallas County has a total of 89 cemeteries located within its borders. Almost every family within the county has a family member buried here. Many of the cemeteries need help with maintenance and safety issues to ensure that they remain a memorial to the ones buried there.

What has been done
Dallas County Cooperative Extension Service collaborated with the Arkansas Historical Preservation Program and Rusty Brenner with Texas Cemetery Restoration LLC to provide a workshop and demonstrations to educate the public. Topics included cemetery safety, landscape problems, proper headstone cleaning and repair procedures, cemetery grant opportunities, fire ant abatement and fence row herbicide weed control . CES advertised the workshop through 11 news agencies, Facebook, e-mail, websites and flyers.

Results
As a result, 65 people were in attendance at the workshop and 90% indicated that they would use the information presented to make their cemeteries safer and more aesthetic. Information from the workshop was also emailed to 5 persons across the state. As a result, a second workshop was held in Cleveland County with 25 persons in attendance and an educational program was given to the Dallas/Cleveland County Retired Teachers Association with 20 in attendance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
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 voters who report being better educated about ballot initiatives as a result of public policy programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2561

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
On election day, voters are asked to decide on many different issues. In a Presidential Election year a lot of excitement is generated and its easy for all other issues to be overshadowed. Voters may not be well informed when they go to the polls to vote. Effort needs to be made to help insure voters are well informed on the issues.

What has been done
To aid voters to become informed of the issues on the 2016 ballot, the 2016 Voters Guide to Arkansas Ballot issues was and is being distributed to civic groups, churches, businesses, government offices, and individuals throughout the county. Additionally, Extension Agents speak at various gatherings helping attendees sift through the information and providing clarification as needed.

Results
Even though Election Day has not yet arrived, we have distributed or are in the process of distributing 200+ voter guides to voters in Lee County, and one agent has spoken to one professional organization with an invitation to come speak again closer to election day. Several requests for a copy of the voters guide have come in as word spread after the presentation. Participants at the presentation said they are glad to see someone helping inform the public on

the issues before the election.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

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
2016	312000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A county struggling to overcome 20 years of limited economic development, change, or improvements for itself. Faced with vacant store fronts, declining population, and a stagnant economy, community leaders are searching for ways to re-invent Cleveland County and make it the talk of south-central Arkansas. This is common across Arkansas, as rural counties face the loss of jobs to third world countries and outmigration of young people to more urban centers. Faced with vacant store fronts in downtown Rison, declining population, and a stagnant economy, community leaders in the Rison community in Cleveland County came together in 2012 to discuss how to take action. This led to the formation of Rison Shine Downtown Development, a grassroots organization dedicated to revitalizing downtown Rison, the county seat of Cleveland County. Rison Shine created the first Cleveland County Christmas Parade, a pocket park, and a new farmers? market. But the larger issues remained, and interest was expressed by the Rison Shine Downtown Development group to include leaders from other communities within the county. As a result of bringing together community leaders from all corners of the county, on February 12, 2015 Kickstart Cleveland County was formed to facilitate economic opportunities and improve the quality of life for residents throughout the county.

What has been done

Extension worked with the Kickstart Cleveland County and responded by continuing a County-wide community development initiative; implementing the program Breakthrough Solutions; collaborating with grassroots working/action groups; promoting county trends, assets, and key drivers; following a mutually agreed upon Vision; facilitating stakeholder meetings; and sharing and promoting successes with other counties and groups.

Results

As a result of Extensions efforts the Kickstart Cleveland County Blueprint and Action plan has been released; 8 businesses have opened increasing the number of businesses by 25%; 7 action teams have been formed; a Pioneer Village Commission was appointed and tasked with restoration efforts at the village; 2 buildings have been restored; over $20,000 has been received through grants, fund-raisers, and donations; 4 new events have been developed reaching over 10,000 people; and over 5000 volunteer hours have been logged in community projects.In addition to these results, three new farmers? markets were established, plans have been made to create a new Johnny Cash museum, and local students have been involved in creating videos and a website to promote the county.

The results have been very impressive and Kickstart Cleveland County has become a state-wide model for successful rural community development. The team is eager to share the plan and lessons learned with Extension employees and community leaders of other counties.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
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

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
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	378769

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
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 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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	48

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Studies have shown that community gardens offer unique opportunities for new immigrants and allow people from diverse backgrounds to work on common goals without speaking the same language. In Clarksville, a community plan was developed to provide gardening access to residents.

What has been done
Due to the recent influx of Burmese immigrants, a community meeting was held to explain the services provided by local county government offices and agencies. Participants meeting with the Johnson County Cooperative Extension Service expressed an interest in growing vegetables, but they did not have access to garden spots. A Community Garden Committee was formed to explore garden site options.

Results
The Clarksville School District agreed to donate the property, and local farmers tilled the land and donated topsoil. The Clarksville FFA club erected a fence, and Arkansas Farm Bureau supplied grant money to purchase hand tools. The committee developed rules for the garden and mapped out 25 plots. Clarksville Light and Water supplied water and plumbed hose spigots to each of the 25 plots. With the continued success of the garden, a second community garden has been established on the east side of Clarksville with help from the University of Ozarks Planet Club. The community garden has given residents the ability to grow non-traditional foods that are unavailable locally.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
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

Number of issue-focused groups formed and sustained after educational program

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	15

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
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

Brief Explanation

Funding constraints as a result of the external factors listed limited our ability to replace staff members who left the organization for retirement or other reasons, which impacted the reach of our programs.

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 2016 include:

- Over 7,800 program participants reported gaining knowledge, understanding, awareness, or skills as a result of our programs.
- Nearly 3,000 program participants reported a change in behavior as a result of programs including implementing new strategies, tools, or technology.
- APAC clientele reported receiving over $118 million in government contracts.
- Over 2,400 jobs were reported being created or retained as a result of our programs.
- Organizations, communities and regions took the knowledge and skills learned through our programs to generate over $690,000 in grants and other resources to support local community development initiatives.

Quotes from clientele:

- "Booklet and display have made a huge impact on voters understanding the issues."
- "After Mr. Baker spoke to our group we could tell not enough time was allotted to adequately cover the subject, and invited him to come back again before the election so the issues can be covered in more detail. This is a very good service to the citizens of Lee County."
- "The Lonoke Leadership class has helped me develop networking opportunities and become more involved in the betterment of my community."
- "Helping to plan and conduct the next class has given me more confidence in my ability to be a leader and a desire to become more involved in my community government."
- "The Extension Service is one of the strongest educational partners that we have in the County."
- "Breakthrough Solutions has helped us unite toward a common goal as a community. We have loved working with all of the folks that are a resource for the Breakthrough Solutions program."

Key Items of Evaluation

Economic and community development programs have resulted in knowledge gained and behavioral changes in thousands of Arkansans. Businesses have increased revenues and created thousands of jobs. Communities and regions have increased capacity and leveraged their assets 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)	
15089	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
6	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
12044	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)	
1	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
1	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)	
540000	Tons of feedstocks delivered.