2016 Oklahoma State University and Langston University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The Division of Agriculture Sciences and Natural Resources (DASNR) at Oklahoma State University has an integrated approach to research and extension programs. Over the past years the Oklahoma Agricultural Experiment Station (OAES) and the Oklahoma Cooperative Extension Service (OCES) have developed multidisciplinary Teams of research and extension faculty members working on priority research and extension needs. The teams are based on priorities identified by stakeholders, faculty and specialists. Langston University takes a similar approach to research and Extension, integrating these efforts into numerous planned programs responsive to the public needs and their mission. All Planned Program areas as identified in our Plan of Work serve as overarching guides for the priority areas of research and extension. Each of the faculty members and specialists remains administratively connected to a disciplinary department or geographic region unit. However, each also plans and conducts research and/or extension program efforts in close collaboration with other individuals within at least one multidisciplinary team. Some significant research and/or Extension efforts and developments during 2016 are presented following.
Langston University's Research and Extension Programs work collaboratively to make a positive difference in the lives of stakeholders in Oklahoma, the nation and globally. The two major areas being reported on for 2016 are Goat Research/Extension and 4-H and Youth Development/Family & Consumer Sciences.
Program areas included in this Executive Summary play vital roles in reaching and making a difference in the lives of youth, families, producers, consumers, communities, and citizens in the State of Oklahoma.
Executive Summary
1 Animal Enterprises
Oklahoma Quality Beef Network (OQBN) was developed to educate and capitalize on best management practices for producers across the state of Oklahoma. Cattle that are managed according to research based recommendations of OCES are verified and marketed at livestock markets across the state of Oklahoma. Final premiums have not been completely analyzed, but preliminary data shows $10.22/100 lb. increase in price over non-weaned cattle. The average price premium (on average for a 600 lb. calf) is $61.32/animal. The added weight gain over the 45 day preconditioning period on average is 90 lbs. with a value of gain at $76.50/hd for a gross increase in revenue of $137.82/hd. If the price of preconditioning is estimated at $70.00/hd, a **net gain to producers is $67.82/hd. With total enrollments of 11,262 calves, OQBN contributed $763,788 back to the Oklahoma Beef Industry.**
Meat goat production has become an ever growing agriculture enterprise in Oklahoma and the United States. Currently **Oklahoma ranks 3rd in the number of meat goats in the U.S. and meat goats have an annual sales amount of $4.9 million** in Oklahoma according to the 2012 Census of Agriculture. Because of this growth, producers were requesting more and more information about meat goat production. In 2013, the team received a $49,000 grant from the Southern Region Risk Management Education Center. These funds were to be used to help film, edit, develop, and promote the videos. Nine of the twenty five **videos are recorded sessions from the Meat Goat Boot Camp.** Four are presentations of different chapters of the Oklahoma Basic Meat Goat Manual. The remaining videos are demonstration videos of various production practices. Most of the presenters in the videos are county educators and area specialists, but in two videos actual goat producers are used to teach production

techniques. **The videos on the OSU Meat Goat channel have been viewed 793,573 times and 4,192 producers have subscribed to the OSU Meat Goat channel.** The videos have been viewed in all U.S. states and territories. Oklahoma producers have viewed the videos 13,173 times. **The videos have been viewed in 215 countries besides the U.S. and specialists have answered questions via e-mail from producers in other countries.** These videos have been used in educational programming in the Philippines and the Dominican Republic. These videos have generated enough interest that in 2016 the first Advanced Meat Goat Boot Camp was held.

2 Crop Enterprises

Sustainability of agricultural production in the Oklahoma Panhandle is threatened by depletion of the Ogallala aquifer and the resulting reduced irrigation capacity. Much of the irrigation water in the region is currently used to produce corn which requires 24-36 inches of water for full irrigation. Water requirement for grain sorghum is less than half of this amount; however, most producers prefer growing corn because of the perception that it provides short term profit maximization regardless of irrigation capacity. Field studies as well as crop model simulations were utilized to determine the relationship between irrigation capacity and yield for grain sorghum and corn showing **the annual profit/acre from grain sorghum was equal to or greater than that of corn at irrigation capacities less than 5 gpm/acre.** Additional economic simulation suggests **that grain sorghum would generate $30,722 more income than corn over the remaining life of a typical 120 acre pivot.** In addition, more rapid depletion of the aquifer associated with corn production will rapidly result in a loss of the economic viability of corn production and result in 31 acres (25%) being converted to grain sorghum in year 3 with the remainder being converted in year 4. Immediate conversion of corn production to grain sorghum under irrigated pivots in the Oklahoma panhandle alone **could generate an additional $26 million over the next 15 years.**

Preliminary discussions with area extension personnel indicate many **Oklahoma Panhandle irrigation systems are very inefficient and being shut down due to poor performance.** As a pilot project, ten electric and natural gas center pivot systems were tested. There was considerable interaction between the faculty, producers, county extension and experiment station personnel. Only **two of the irrigation systems tested were above the NPPPC (Benchmark) minimum Overall Pumping Efficiency (OPE) standard of 60% energy for electricity.** And **none of the natural gas systems were within 50% of the NPPPC OPE minimums.** Potential efficiency improvements ranged between 10 to 30% for electric and near 100% for natural gas systems. **The savings (economic) of running the systems to NPPPC OPE standards were estimated and ranged from about $200 to $3,000 per year, per system.** Test results were disseminated at several irrigation conferences in Oklahoma and always generated interest from producers who showed a willingness to have their systems tested.

Since 2006, the Oklahoma State University Wheat Improvement Team has developed and released ten wheat cultivars with disease resistance and agronomic performance superior to that of popular varieties, Jagger and Jagalene. By 2012, acreage of Jagger and Jagalene had fallen to 5% and 0%, respectively. Acreage of the disease and Hessian fly resistant cultivar 'Duster' increased from 0.3% in 2007 to almost 20% in 2013. **In 2016, improved cultivars occupy 47% of Oklahoma wheat acres.** Unfortunately, the disease resistance Jagger-derived lines are no losing resistance to foliar disease. Efforts have focused on displacing these varieties with superior genetics of newer lines such as 'Gallagher' and 'Iba'. Gallagher, for example, fits a similar production profile as Duster but offers increased yield potential, foliar disease resistance, and kernel size without sacrificing Hessian fly resistance, acid soil tolerance, or fall forage production for dual-purpose systems. **In 2012 Gallagher offered a 5.9 bu/ac average yield advantage over Duster, indicating a potential increase in Oklahoma farm revenue of $53 million annually if we meet our target of replacing 1.2 million acres of Duster with Gallagher in the next five to seven years.**

3. Plant Biological Technologies

Wheat is the most important crop planted in Oklahoma and provides one of the most important economic resources at the farm gate and in associated industries in this state. Many quantitative trait loci (QTL) or genomic regions have been mapped but account for only small parts of the phenotypic variation for grain yield. We discovered QYld.osu-1BS for grain yield by using genotyping-by-sequencing (GBS) markers to

map a doubled haploid (DH) population derived from two winter wheat cultivars. QYld.osu-1BS explained 23% and 24% of the total phenotypic variation in field-based grain yield tested in 2 trials. The gene causing QYld.osu-1BS will be introduced into extensive breeding lines and germplasm to breed novel hard red winter wheat varieties that adapt to Oklahoma and states in the Great Plains. **This yield gene will be an elite genetic source for winter wheat that occupies 75% of the total wheat in the USA and worldwide**.

Microorganisms literally drive many of the processes that higher forms of life depend upon. All the biological and geochemical cycles are in large part driven by microorganisms. The development of approaches to identify which microorganisms or which genes are important to agricultural productivity would be a big step forward in enhancing our ability to understand agricultural processes. Development of a methodology to identify the good and bad actors in this complex system will go a long way to uncover how the system really works. A better understanding of how the system works will lead to novel technologies to exploit our agricultural practices to improve productivity especially in the light of climate change and dwindling resource availability. Our improved understanding will most certainly highlight the key players in agricultural productivity. The overall economic impact of such an approach is unknown at this time but given the importance of microbes to plant productivity it is likely to be enormous.

4 Commercial and Consumer Horticulture

Oklahoma Cooperative Extension trained and directed Master Gardeners make a big difference in their communities. Oklahoma Master Gardeners are trained, supervised and recruited to: 1) help provide one-on-one service to the non-commercial horticulture clientele in the county, 2) provide group learning and teaching activities for non-commercial clientele, and 3) form a group of Extension volunteers to support additional consumer horticulture efforts. Trainees participate in a 10 - 13 week course receiving between 40 - 56 hours of course work. Upon completion of the training period, satisfactorily passing an exam on materials and topics covered, and donating between 40 - 56 hours of volunteer time to the Horticulture program. Examples of Master Gardener Volunteer activities include: staffing plant clinics to answer phone and walk-in questions, manning educational exhibits, maintaining demonstration gardens, community beautification projects, serving as 4-H horticulture leaders, speaking at club/civic meetings, teaching horticulture activities at nursing homes, and appearing on TV and radio. **Approximately 1,161 active Master Gardeners volunteered their time (196,613 hours), contributing over $4,227,179 in service time donated.** In addition to the many hours **donated, approximately 924 pounds of produce was donated to local food pantries/kitchens, shelters,** and other organizations throughout Oklahoma by the Master Gardeners.

Grape seed oil and grape seed flour are new products that can be extracted and marketed by Oklahoma grape growers. Values for new products are difficult to exactly establish; since grape seed oil and grape seed flour and products obtained from the flour are in the marketplace, current values can be used as a guideline. If Oklahoma's production capacity of 29 tons of dried seed were processed, the seed would yield 7,524 lbs of oil (1,075 gallons) and 50,236 pounds of de-oiled meal (25 tons). Current bulk prices of grape seed oil are $3.34 per pound or $23 per gallon; retail prices for consumer sized quantities range from $13 per 500 ml ($98 per gallon) to $25 per 375 ml ($253 per gallon) for variety specified oils. Oklahoma's potential for grape seed oil production value ranges from $24,725 at bulk prices, $105,350 at consumer-sized prices and $271,975 at boutique, variety specified prices. The flour may be ground and sold as-is in bulk for $7 per pound; prices are as high as $13 per pound for variety specified grape seed flours. The flour would then carry a value of $351,652 if ground as-is and sold in bulk or $653,070 if sold as variety specified seed flours. **The grand total worth of Oklahoma vineyard grape seeds could then range from $376,377 (bulk oil/seed flour sold as-is) to $558,320 (High end oil/grape seed extract) to $925,045 (High end oil/variety specified seed flour).** In 2017 we will initiate a project to reduce bitter flavor and produce an Oligomeric Proanthocyanidin nutraceutical by-product which could add a value of $286,345 if extracted and sold in bulk as a grape seed extract. The extraction would result in about 10 % loss of weight for the flour (reducing its value by 10 %), but should substantially improve the flavor and salability of the flour. **Our industry cooperator is finalizing plans to build a new Oklahoma winery, which includes a new seed products business guided by the results of this study.**

5 Ecosystems and Environmental Quality and Management including Weather and Climate

In the 1990s, water quality concerns related to phosphorus from poultry litter results in litigation and regulation focused on protecting OK watersheds. State legislation mandated that Oklahoma Cooperative Extension deliver a Poultry Waste Management Education Program. **More than 486 people participated in the Oklahoma Poultry Waste Management Education Program during calendar year 2016**. Four Initial 9-Hour (I-9) Education sessions were presented during 2016, educating 76 people as poultry operators or waste applicators. A total **of 2,850 people have received certificates of I-9 completion since the program began in 1998**. Fifteen 2-hour Continuing Education sessions were offered with 30 hours of classroom instruction provided during the education year and 410 individuals completing Continuing Education in 2016. Nutrient sensitive watersheds protected with 90% of poultry litter now exported outside of nutrient sensitive watersheds. **There has been a 31% reduction in phosphorus loading to Beaty and Spavinaw Creeks, both within Eucha Spavinaw watershed**. Phosphorus concentrations have decreased in the Illinois River in NE OK.

Biological invasion by non-native plants is a major cause of native ecosystem loss, reducing agricultural production, lowering water quality and quantity, altering wildlife habitat, and decreasing potential for rural economic development; however, restoration of invaded rangelands has been met with little to no success. We have completed multiple field and greenhouse experiments that show alterations of beneficial soil fungi (arbuscular mycorrhizal fungi) are a major mechanism in native plant growth suppression following non-native plant invasion, and restoration of the native fungi may be a fundamental consideration for successful establishment of native plant species; selection of native inoculum and local plants species is critical. Improving our understanding of the linkages between plants and soil will facilitate the recovery of ecosystems damaged by disturbances, increasing restoration success by both private land managers and government agencies. **Over 15,000 acres are treated for invasive species in Oklahoma each year and an additional 16,000 acres are managed with prescribed fires**.

Rangelands of the Great Plains are critical for livestock production but are also primarily grasslands that are refugia to many imperiled plant and animal species. It is critical to develop alternative rangeland management strategies that are capable of simultaneously maintaining biodiversity and agricultural productivity. The practices we developed indicate that management for heterogeneity can accommodate both species diversity and agricultural production. For instance, we found that greater prairie-chicken hens select for areas away from trees and not recently burned, and that nest survival is influenced by solar radiation, grass height, and operative temperature. This research has **directly led to changed management on over 250,000 acres of the Flint Hills** to benefit the greater prairie-chicken while maintaining profitability of livestock producers.

Our programs **have been integrated into USDA-NRCS conservation practices**, such as the Environmental Quality Incentive Program (EQIP) and the Lesser Prairie Chicken Initiative that have the potential to influence all rangelands and rangeland managers of North America. For example, through programs such as these the NRCS spent over $130,000,000 from 2005-2009 on rangelands of the Oklahoma, Texas, Kansas, South Dakota and North Dakota.

Wind energy is a promising renewable alternative to fossil fuels, and Oklahoma is 4th in the nation in wind energy generation. However, the impacts of wind energy on wildlife remain unclear, particularly for bats, an animal group with many threatened and declining species that are known to collide with wind turbines in high numbers across the U.S. We found that **migratory tree-roosting bats (Hoary Bat, Eastern Red Bat, and Silver-haired Bat) are the most frequent collision victims** and that the most important factor driving mortality is the amount of forest land around wind facilities, with open areas having lower mortality. At a time when wind energy is burgeoning in Oklahoma, throughout the U.S., and worldwide, our findings will help the wind energy industry make environmentally friendly decisions about wind facility siting and also help design mortality surveys that provide an unbiased picture of impacts to wildlife. This system highlights species that could potentially experience population decline caused by wind energy (e.g., many raptors, such as the Ferruginous Hawk, Swainson's Hawk, and Golden Eagle), and species at relatively low risk of population decline (e.g., many songbird species). Our prioritization system is a first step that will help researchers, conservationists, managers, and industry both in Oklahoma and across North America target future study and management activity that will help balance wildlife conservation and renewable energy development.

6 Food Processing, Product Storage, and Food and Product Safety

Oklahoma ranks first in native pecan production, averaging 17 million pounds annually. Native pecan groves are frequently utilized for cattle grazing to increase diversity and profitability. This "dual-purpose agriculture" has played an essential role for many Oklahoma farmers to support and sustain pecan production. **Preliminary results have revealed the presence of two major foodborne human pathogens:** Salmonella and Shiga toxin-producing Escherichia coli (STEC) in soil, cattle feces, and pecan samples. Further experiments will determine the impact of cattle grazing and withdraw periods on the prevalence of these pathogens at these orchards as well as the potential sources of such contaminations. **Economic loss to farm families if grazed groves could not be harvested would range from $150 to $1,375 per acre** depending on the site and grove management based on current price and yield typical for Oklahoma native groves with different management regimes. USDA National Agricultural Statistics Service in 2007 (http://www.nass.usda.gov/index.asp) reported pecans were harvested in Oklahoma from 141, 675 acres representing 3,589 farms, with an additional 17,184 acres of nonbearing age trees. Over 90% of this acreage is native pecan groves and most are combined with cattle grazing. Additional states with substantial native pecan production include Texas, Louisiana, Missouri, and Kansas. Even if grazing increases the risk of human pathogen contamination it is likely that the results from this research could generate clues for strategies to mitigate the risk.

7 4-H Youth Development

The U.S. is falling dangerously behind other nations in developing its future workforce of scientists, engineers, and technology experts. Only 18% of US high school seniors are proficient in science (NAEP, 2005). Oklahoma 4-H is combating this issue by teaching youth about **Science Technology, Engineering, and Math (STEM.)** Oklahoma 4-H Educators spent over 6,000 hours teaching, promoting and evaluating 4-H STEM projects. They held 416 demonstrations, 385 conferences, and almost 2,000 personal visits with 4-H volunteers, parents and youth. In addition to this they reported over 7,000 volunteer hours of working with youth STEM projects. Through their **STEM based educational programming they made over 45,000 contacts teaching youth STEM concepts.** More than twenty-one hundred (>2,100) youth participated in a 4-H Science event or activity. Four thousand eight hundred and twenty three (4,823) youth and volunteers participated in trainings related to science. This included **robotics, STEM Institute and GIS/GPS**.

8 Turfgrass Development and Management

The OSU Turfgrass Management program is based out of the Horticulture & Landscape Architecture Department and it cooperates with turf scientists in the Plant & Soil Science Department and the Department of Entomology & Plant Pathology. The turf extension education efforts are estimated to **have increased profitability for Oklahoma lawn care businesses in an amount exceeding $500,000 in 2016**. This profit increase was realized by following well detailed annual weed control programs which reduce very expensive customer call backs for both annual and broadleaf weed escapes. Identifying and using best management practices for pest control can reduce the amount of pesticides applied which can also reduce negative environmental impacts. Reducing pesticide usage may also contribute to a healthy environment for people, pets, and plants in the landscape. **Over 300 certified turf & ornamental applicators and 68 certified** right-of-way pesticide applicators receive continuing education via our turf extension and right-of-way outreach programing each year, resulting in improved turf management skill sets.

In 2016 we **evaluated 10 final stage advanced lines each of Bermudagrass and Zoysiagrass** for drought resistance. The vital information obtained from these trials will allow cooperating turfgrass breeders to advance and make commercialization decisions concerning their lines. Promising lines exist within each of these species with great potential for commercialization and large industry impact in the future. A total of six turfgrass breeders from the multi-state SCRI Warm-season Turfgrass Improvement Team are using the datasets gained from this research to make decisions on cultivar advancement. Turfgrass breeders cooperating with researchers and extension faculty are from the Oklahoma State University, Texas A&M University, North Carolina State University, the University of Georgia and the University of Florida.

9 Community Resource and Economic Development

OSU Applications Engineers provide technical assistance that **helped Oklahoma manufacturers create or retain more than 100 jobs and increase sales over $28 million in 2016**. Of the over 5000 manufacturers in Oklahoma, approximately half are located in rural areas and are extremely important to their local economies. These rural manufacturers face particular difficulty in getting relevant and usable information and technical assistance that will keep them abreast of the rapid changes in manufacturing technology. To address the difficulties faced by our small- to medium-sized rural manufacturers, OSU Cooperative Extension **provides technical assistance through the Applications Engineering Program**. The impact of this program is measured in several ways. One is the economic value of the service to the company as reported by the client. Another measure is the number of jobs created or retained. Both impacts are measured by an independent survey of the client. In 2016, the Applications Engineers client projects had the following impacts: **Sales increase $ 28,192,500**; **Sales retained** that would have otherwise been lost **$8,005,000**; **Cost savings $4,671,800; Costs avoided $758,425**; Investment in new plant facilities and equipment in amount of $10,859,850; for a **total impact of $52,487,575**.

10 Integrated Pest Management

In 2016, **sugarcane aphid was found in 32 counties, infesting at least half of the 400,000 acres** of grain sorghum planted statewide. Two insecticides, sufoxaflor and flupyradifurone, were identified to be effective in controlling the aphid. Several commercial sorghum hybrids have been identified that show good levels of resistance to sugarcane aphid. The first year of data for the development of a sampling program was collected in 2016. Based on the results of the research/extension demonstrations conducted by the Sugarcane Aphid IPM team, a **poorly controlled infestation of sugarcane aphid was capable of reducing yield by an average of 18-30 bushels per acre. The results of the applied research coordinated by the Sugarcane Aphid IPM Team has potentially saved Oklahoma sorghum growers a minimum of ca. $7.2-$14.4 million per year in lost grain yield from sugarcane aphid.**

There are 62 recorded species of mosquitoes in Oklahoma, many of which are involved in the transmission of diseases with impact humans and animals in the state. **The main mosquito species, Aedes aegypti, that transmits the Zika virus has not been officially verified and reported in Oklahoma since 1940.** In the summer of 2016, six urban areas in Oklahoma were monitored for the presence of Aedes aegypti in addition to many other mosquito species. **Between July and September 2016, Aedes aegypti was identified in four urban areas in southern areas of central and western Oklahoma.** Because of these findings, two official statements were issued by the Oklahoma State Department of Health and Oklahoma State University to the news media. These statements were picked up by local, national, and international news sources, resulting in positive exposure for Oklahoma State University and results in one community meeting. The impact of this finding is still being elucidated but **it is now known that the main mosquito species that transmits Zika, Dengue, and Chikungunya viruses also exists in Oklahoma.**

Sclerotinia blight is a limiting factor in the production of high-yielding peanuts in Oklahoma and Texas. About 25% of the acreage in Oklahoma and about 10% of the acreage in Texas is infested with the fungus that causes Sclerotinia blight, totaling nearly 20,000 acres. Application of fungicide to control Sclerotinia blight typically cost from $50 to $100 /acre and significantly impacts peanut profitability. The Oklahoma Peanut Improvement Team have been working for many years to improve the resistance of peanut varieties to Sclerotinia blight. This has been accomplished partly by identifying resistant germplasm and incorporating it into high O/L peanut varieties using conventional breeding methods. Performance trials demonstrated the value of the disease resistant varieties to growers. **The result has been the development and release of three Sclerotinia blight - resistant varieties (Red River Runner, Lariat, and OLé). These were grown on an estimated 50% of the infested acreage in 2016 resulting in a savings of about $1,000,000 in fungicide costs in the region.** The estimated benefits do not include increased yields and grades associated with the cropping of these varieties.

11. Food Safety - Agricultural Biosecurity

The overall program objective and relevance was to build an infrastructure to use genomic information for microbial forensics applications. **EDNA is a database-based process that efficiently tests sample-derived DNA sequences** for the presence of signs of specific organisms. EDNA has been adapted and

validated for use in the detection of foodborne pathogens by analysis of metagenomic data acquired from alfalfa sprouts. The data support the use of EDNA as a highly specific and accurate detection method with the potential for the simultaneous detection of multiple foodborne pathogens present in a food sample by the development of e-probes for each pathogen. This new approach to analyze NGS data from metagenomic samples offers tremendous potential for improving the response to foodborne pathogen infections both in the initial detection as well as outbreak situations.

12 Farm and Agribusiness Systems Economics

Oklahoma Farm and Business Tax Institutes were initiated in 1961 to educate farmers, tax return preparers, and Extension specialists to properly prepare farm income tax returns. Over the years it has evolved into a professional continuing education program for tax practitioners addressing broader issues affecting individual taxpayers and businesses. The Fall Farm and Business Tax Institutes include nine 2-day sessions providing 16 hours of continuing professional education (CPE). The educational content is updated each year and covers new tax legislation as well as tax preparation issues that affect tax return preparers nationwide. Issues affecting Oklahoma preparers are often included in the workbook and included in the information presented at the institutes. In 2016, **1,435 tax preparers** attended the nine institutes. High quality, professional instruction is provided to make continuing education credit available for Certified Public Accountants, Enrolled Agents, and Tax Attorneys as well as provide technical education for all tax return preparers. Most of the taxpreparers that attend are from Oklahoma however some come from Kansas, Texas, New Mexico, and Arkansas in order to maintain their Oklahoma accreditation. Participants in these schools have indicated on the evaluation form that they file approximately **280,000 Federal income tax returns which include about 52,000 Federal farm returns**. This is roughly **65 percent of the total farm returns (Schedule F) filed in Oklahoma**.

Beef production accounts for approximately one-third of Oklahoma's agricultural production. An interdisciplinary **Beef Cattle Manual** is the basis for the Master Cattleman Program. The manual now contains 45 chapters addressing various business, production, and natural resource topics. To become a Master Cattleman, a producer completes twenty eight hours of instruction from the Beef Cattle Manual and associated quizzes. Approximately 1,327 producers have enrolled in the **Master Cattleman program** since 2004 and 1045 have completed the program, with 76 graduating in 2016. In program evaluation surveys, **graduates estimate annual improvement in their cattle operation's profitability at approximately $3,500**. With an average of 87 producers graduating per year, the impact is approximately $305,000 each year for 12 years for a total impact of **$3.66 million over the program's history if the increase is a one-time event**. Arguably, the $3,500 impact per producer could be in perpetuity for the individual operation, resulting in a much bigger impact. On average, graduates indicate that they use the Beef Cattle Manual at least once monthly and that they have referred 5 additional people to the Beef Cattle Manual and three people to the Master Cattleman program. Approximately 9,000 manuals have been distributed through local Extension offices, area, state and national meetings and from the Master Cattleman website. Beef manual requests have been filled to 37 states and 5 foreign countries. The manual has been used as a textbook in 8 universities and community colleges in 5 states.

The political and legal controversy surrounding the use of the Endangered Species Act (ESA) to protect imperiled species raises questions about the development restrictions and opportunity costs the ESA imposes on private landowners and industry. **In Oklahoma the decision to list the lesser prairie chicken (LPC) in 2014 was controversial because the species' habitat lies in close proximity with agriculture and petroleum development.** This research program has examined the economic ramifications of regulations to protect imperiled species and the effectiveness of conservation incentives to protect habitat. This research shows the economic effects of protecting the lesser prairie chicken have been small. **There was little evidence showing that regulations affected land values.** However, after looking for macro-level effects in employment data, the regulations did modestly reduce the number of jobs, although primarily in priority habitat areas. While some petroleum firms have participated in voluntary habitat offset programs to protect the species, many responded to the risk of regulatory penalties by avoiding the habitat area.

13 Integrated Bioenergy and Biobased Products Development

The development and production of fuels and chemicals from readily available renewable sources or

waste materials is essential to supplement the petroleum-based economy with more environmentally sustainable biobased economy and improve the U.S energy security. Thermochemical, biochemical and hybrid conversion technologies are in early stages of development. These technologies can be employed in different parts of the U.S. and abroad, based on the type of feedstock used and availability of other resources to sustain the biorefinery. Currently, high capital costs and technological obstacles hinder the development of a viable biorefinery industry.
There are opportunities to apply the hybrid conversion technology in different regions of the country to meet our increasing energy needs. Upon its full development, this **hybrid technology can provide 35% more ethanol from the same amount of biomass** as compared to the biochemical conversion technology. Also, this technology can produce fuels from natural gas and industrial waste gases that contains carbon monoxide and hydrogen, and from gasified petroleum wastes. If fuel producers **adopt this hybrid technology to produce 25% of the mandated 16 billion GPY renewable transportation fuels** such as ethanol (i.e., 4 billion GPY), our research suggests a projected annual savings of over $650 million due to the use of 13.1 million tons less biomass with the hybrid technology.

14 Childhood Obesity

Oklahoma ranks as the **8th most obese state in the nation**, with 17% of Oklahoma youth considered overweight or obese. This ranking reflects the state's high density of fast food establishments and low fruit, vegetable, dairy and whole grains consumption. In 2016, programs were presented to 23,972 participants. Oklahoma youth attended programs through 15 different curricula. Oklahoma adults attended programs through 22 different curricula. Programs presented include: **OrganWise Guys** program focusing on Oklahoma youth in the areas of increasing servings of fruit and vegetables, skim milk, hand-washing before eating, and physical activity. **Growing Strong Bodies and Minds** aims to promote the development of healthful food preferences, physically active lifestyles and literacy skills in young children. The **Farm to You** The exhibit, when combined with the classroom-based nutrition program, enhanced nutrition behavior change for upper-elementary grade students beyond that achieved with only the classroom-based program. Three different surveys with a total of over 2,000 respondents showed: **116% increase in youth who plan to eat a serving of fruit 2 or more times each day**; **166% increase in youth who plan to eat a serving of vegetables 3 or more times each day; 58% decrease in youth who plan to eat snack foods (chips, cookies, candy, etc.) 1 or more times a day;** 79% increase in adults who plan to eat a serving of vegetables 3 or more times each day; 70% increase in adults who plan to eat a whole grain food 3 or more times each day; 69% increase in adults who plan to eat or drink a serving of calcium-rich food 2 or 3 times each day; 36% decrease in adults who plan to eat snack foods (chips, cookies, candy, etc.) 1 or more times a day; and 90% increase in adults who plan to eat a serving of fruit 2 or more times each day.

15 Structure and Function of Macromolecules

To replace the obsolete Roche sequencing instrument and provide inexpensive and high-capacity sequencing, a successful NSF Major Research Infrastructure (MRI) grant purchased an Illumina NextSeq500 genome sequencer. The sequencer is located in the Genomics and Proteomics Center (GPC); an established core facility (12 years). The NextSeq500 can produce **up to 120-billion base pairs of data in a single 28-hour run**; enough to sequence a human genome 40-fold over, or sequence 500 bacterial genomes at 50-fold coverage. The large capacity of the instrument enables multiplexing, i.e. the simultaneous sequencing of multiple samples that are indexed and can be separated after a sequencing run is complete. The BRAVO robot is capable of preparing 96 libraries with individual indexing and with greater accuracy than a human.
The instrument will serve 43 faculty, 36 postdoctoral or staff, 81 graduate students, and 87 undergraduate students. Users come from four colleges (ten departments) at OSU in Stillwater and Tulsa, 2 PUIs, 1 HBCU, and 2 government laboratories that work with OSU on research projects. **Cost savings to OSU researchers is estimated at $15,000 annually**.
The Center also performed quantitative analysis of 524 protein mixtures (proteomes), generating approximately 500,000 shotgun identifications and quantifications of individual proteins. These **analyses supported 115 individual research projects, representing 63 researchers from 17 departments** spread among 5 OSU colleges.

18 Food Safety - Hunger, Health, Safety

Nine percent of Oklahomans have limited access to healthy food. In the United States, food waste is estimated at between 30-40 percent of the food supply. Total annual health-related costs of food borne illness in the United States, including medical expenses, lost productivity, and even death, totals exceeds $15 billion. In 2016, **1,171 youth and adults participated in educational programs on safe food handling, home hazards and safety,** and low-impact exercise to improve balance and mobility. Surveys of participants showed - **37% increase in those planning to use safe food handling practices**; 26% increase in those planning to use safe food storage practices; **146% increase in those who plan to use safe food preservation practices; 75% increase in those who plan to manage safety hazards in or near their home; 325% increase in the ability to move without the risk of injury despite their current health condition**;

19 Global Food Security and Hunger - Families and Youth

Food security and hunger programs for families reaches a broad audience. In 2016, 17% of Oklahomans did not have access to a reliable source of food and 9% had limited access to healthy food. The Regional Food Bank of Oklahoma feeds more than 126.000 Oklahomans every week, 37% of which are children. The Community Food Bank of Eastern Oklahoma provides more than 339,000 meals to Oklahomans each week. **Oklahoma Extension Service reached over 4,000 Oklahomans with educational programs relating to money management and reducing hunger**. The following planned behavior changes were reported from these efforts: **162% increase in those who plan to use money saving meal planning or food shopping practices**; 75% increase in those who plan to grow, produce, hunt or fish for some of their own food; 61% increase in those to plan to regularly track income and spending; **102% increase in those who plan to regularly make a written spending pla**n; **163% increase in planning to regularly write down financial goals.**

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	240.0	17.0	85.0	26.0
Actual	244.0	20.0	78.0	20.0

II. Merit Review Process

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

- Internal University Panel
- External University Panel
- Combined External and Internal University Panel
- Expert Peer Review
- Other (Administrative Review)

2. Brief Explanation

All Oklahoma Experiment Station projects, whether supported by Hatch or McIntire-Stennis funds, are peer reviewed prior to submission. It should be noted that stakeholder input into the planning process, position priorities, and research areas to be pursued by the scientists could be considered as the initial step in the

review process. This valuable input helps in the merit and relevancy of our projects; it is a continual practice during the decision process to fill new positions, and direct research efforts and approaches to high priority needs.
Each department in OAES is required to have three reviews for a project (selected by the appropriate Department Head), with one of those reviews being external to the department. In those cases, this will be from another department in the Division, from another College at OSU, or another state with expertise in the area. These reviews are approved at both the departmental and OAES Directorate levels before submission to NIFA. The principal investigator is required to respond to the comments provided by the reviewers before final approval is granted. Most departments utilize the attached checklist.
All OAES/OCES teams are required to have a team plan of work which is reviewed by team members, the administrative leaders, and the appropriate OAES/OCES assistant and associate directors. All team plans of work are reviewed with respect to relevance, the Division Strategic Plan, stakeholder input, and team competitive advantage. All individual OCES plans of work developed by county, area, district and state program professionals are reviewed in reference to quality and relevance by at least two individuals with program and/or administrative responsibility pertinent to the individual's program area. The reviewers assess the merit of the program plans of work with respect to issues, needs, and the problems identified through stakeholder input, quantity of effort planned in relation to appointment, and plans to evaluate and report program quality and impact. County plans are reviewed by the appropriate district subject matter specialist, district director, and/or state program leader. Area and district specialist plans are reviewed by the district director, and the subject matter department head. State specialist plans are reviewed by the appropriate department head and/or the appropriate assistant director/state program leader.
The merit review process for Langston University research programs included individuals from within the University, external reviewers, advisory groups and USDA/NIFA personnel. The merit review from extension programs included individuals from within the University, advisory groups and staff members. Previous merit reviews conducted by the Advisory Council for Langston University goat programs provided input on ways to improve these programs. These suggestions included design more programs aimed at better internal parasite control, modification of cattle barb wire fencing with electric fencing for goats and invest in developing more studies on alternative dewormers. These merit review points were incorporated into our programs.
Previous merit reviews for Langston University aquaculture programs were conducted by an advisory group. Suggestions for improving the programs included engaging the Oklahoma Department of Wildlife Conservation regarding the sale of triploid grass carp; address angler organizations regarding the possibilities of transferring aquatic nuisance species; and suggestions on modifying project proposals and fact sheets. These merit review points were incorporated into programs.
The merit review of Langston University 4-H, Youth Development and Family & Consumer Sciences was conducted by an advisory group consisting of 4-H volunteer leaders, parents and concerned community members. Suggestions for improving our programs included tailoring 4-H activities for the needs of members based upon their financial resources and geographical location; suggestions on ways to improve the mathematics and reading curriculum of our extended education program; and suggested action plans to enhance our programs. These merit review points were incorporated into our programs during 2016.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (Professional journals, meetings, etc.)

Brief explanation.

A broad array of actions was used to encourage stakeholder input for Oklahoma State University research and Extension programs. Personal invitation and public notice are regularly used in Extension Program Advisory Committees as well as when we seek input to experiment station projects. Most all statewide and unit advisory groups are notified through direct contact. Several programs have targeted nontraditional stakeholder participation including sustainable agriculture, agribiosecurity, water, wildlife, youth, human health, Spanish speaking audiences, Native American tribes, etc. OAES and OCES have been in discussions with the new Director of the OSU Center for Sovereign Nations in order to see how we can better serve Native Americans in Oklahoma. Numerous Native American tribal leaders have been invited to state and district discussions. Farm commodity groups regularly are invited to campus and we attend most of their meetings in order to hear input. A few of our advisory groups are statuary in nature such as out Food and Agriculture Products Center advisory group.
The Vice President for Agriculture and Natural Resources at OSU began the planning process in 2015 to identify future priorities for the Division. This process continued in 2016. A multi-round, consensus seeking approach, commonly known as the Delphi method, will be employed to gather input from stakeholders. The process collects data utilizing a series of questionnaires administered to a panel of experts. For the purposes of this study, the panel was identified by DASNR administrators with a goal

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups

- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

Dialogue with individual stakeholders led to the identification of additional stakeholders for Langston University research and Extension programs. Stakeholders were also identified at field days, meetings, workshops, farm visits and through e-mail correspondence. When people contacted us to request information on published materials, they were identified as stakeholders and placed on our contact lists. New stakeholders were identified via these methods in 2016.
Every Oklahoma Cooperative Extension (OCES) County office holds 2-4 program advisory meetings annually. OCES and OAES also meet with numerous boards, commissions, associations, public agencies, departmental advisory committees, special needs groups, consumers, school leaders, government officials, and individuals each year. See section 2(b) of this state report to get a partial list of groups providing input.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- 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
- Other (Peer reviews, grant proposal reviews, telephone surveys)

Brief explanation.

Following are some examples of stakeholder groups providing input to Oklahoma State research and Extension programs (OAES, OCES) - this list is in no way exhaustive. Representatives from OAES and/or OCES met with the following stakeholder groups.
Division of Agricultural Sciences and Natural Resources Advisory Council (twice per year)
Oklahoma Wheat Commission (ten times per year)
Oklahoma Peanut Commission (twice per year)
Oklahoma Sorghum Commission (twice per year)
Oklahoma Wheat Growers Association Board (twice per year) Oklahoma Oilseed Commission
Soil Fertility Research and Education Advisory Board (two times per year) Great Plains Canola Association
Oklahoma Grain and Feed Association Oklahoma Seed Trade Association Oklahoma Genetics Inc. Board Oklahoma Cattleman's Association
Oklahoma Home and Community Education

Oklahoma Ag in the Classroom Advisory Committee (Quarterly)
4-H Shooting Sports Committee
Land Judging Committee Oklahoma Farm Bureau
OK Youth Forestry and Wildlife Camp Committee (six times) Northeast Oklahoma Beekeepers Association
USGA Advisory Committee
Oklahoma Pecan Growers Association American Farmers and Ranchers Rural Health Works Committee
Rural Health Works National Advisory Committee Stormwater Advisory Committee
Tribal On-Site Waste Project Advisory Committee
Integrated Environmental Research and Education Site Advisory Committee
Oklahoma Sustainable Agriculture Research and Extension Advisory Committee Oklahoma Food and Agricultural Advisory Center Advisory Committee (twice per year)
In all these settings we listen to the expressed problems, concerns, opportunities and situations faced by the various groups. This is in addition to the county PACs which were described earlier and result in over 1,000 people providing input at the local level. Likewise we periodically conduct surveys with respect to particular issues or groups of people.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities
- Other (In team planning and budget requests)

Brief explanation.

For Oklahoma State University, input was used in decisions to fill vacant positions in a difficult budget time. These decisions resulted in approval for filling two faculty positions focused on small grain production to strengthen this high priority program area. One position specialized in agronomic production issues and the other emphasizes weed science in small grain production systems. Additionally, two Extension area agronomists were hired to serve the western part of the state.

Brief Explanation of what you learned from your Stakeholders

Downward trend in commodity prices continues to be a concern. Other areas of concern expressed by Oklahoma State University Extension and research PAC attendees included:
The state economy and economic development
Forage production and management
Herd health issues
Cattle nutrition
Veterinary feed directive
Wheat variety selection and marketing
Pest and weed management in crops
Herbicide resistance and drift and invasive species
Nitrogen management
Local food production

Health issues
Managing personal finances
Farm bill and government programs
Risk management and crop insurance
Local leadership development
Mental health and chronic illness
Water use and water conservation
Employment and job creation and skills
Youth alcoholism and teen pregnancy
Youth leadership development
Youth health and safety
Alternative crops
No-till cropping systems
Improved parenting
Science projects for youth
Cattle management
Gardening and consumer Horticulture
Use of cover crops and crop rotations
Tax laws
Food Safety
Other implications relating to water use and availability continued to be of high interest. These included irrigation, water quality, quantity, pond management, and water rights.
Langston University learned about some of the needs of our stakeholders.
Examples
(i) Youth participating in the extended program need ways to maintain and/or strengthen their mathematics and reading skills over the summer months.
(ii) Fish producers need to diversify their production systems to increase their profits and control phytoplankton.
(iii) Clientele need to enhance their knowledge and skills in purchasing healthy foods and preparing healthy meals.
(iv) Meat goat producers need accurate performance measurements to project the productivity of their meat goat bucks.
(v) There is a need for a dependable (non-chemical) method for internal parasite control in goats.
(vi) Goat milk producers need to learn value-added techniques to help increase their profits.
We learned about some of the challenges faced by our stakeholders.
Examples
(i) Internal parasite problems in goats
(ii) Off-flavor taste of catfish from phytoplankton build-up in ponds
(iii) Poor diets contributing to health problems
(iv) Youth digressing over the summer months and losing skills learned during the previous school year in mathematics and reading

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
5813537	2067170	4088342	2428356

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	5636774	281040	3283212	95005
Actual Matching	5636774	316320	3313212	158160
Actual All Other	27691707	1291531	18376323	959773
Total Actual Expended	38965255	1888891	24972747	1212938

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	5636774	0	0	0

V. Planned Program Table of Content

28	Fishery Management (Aquaculture) (Langston University)
29	Sustainable Internal Parasite Control for Small Ruminants (Langston University)
30	Goat Internet Website (Langston University)
31	Development of New Dairy Goat Products (Langston University)
32	Demonstration Clinic: Artificial Insemination for Goats (Langston University)
33	Fish Marketing (Aquaculture) (Langston University)
34	Meat Buck Performance Test (Langston University)
35	Goat Dairy Herd Improvement (DHI) Laboratory (Langston University)

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Animal Enterprises

☑ 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
121	Management of Range Resources	9%	0%	15%	0%
302	Nutrient Utilization in Animals	12%	0%	20%	0%
303	Genetic Improvement of Animals	9%	0%	10%	0%
304	Animal Genome	0%	0%	10%	0%
305	Animal Physiological Processes	7%	0%	10%	0%
306	Environmental Stress in Animals	10%	0%	10%	0%
307	Animal Management Systems	20%	0%	10%	0%
308	Improved Animal Products (Before Harvest)	11%	0%	5%	0%
311	Animal Diseases	12%	0%	5%	0%
315	Animal Welfare/Well-Being and Protection	10%	0%	5%	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	19.0	0.0	15.0	0.0
Actual Paid	20.0	0.0	12.2	0.0
Actual Volunteer	1.4	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**
523028	0	512441	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
523028	0	512441	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2255324	0	2868159	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct fundamental and applied research
- Construct research facilities
- Write extramural grant proposals
- Conduct workshops and other educational meetings and conferences
- Provide in-service trainings
- Provide one-on-one consultation
- Develop and maintain numerous newsletters, web sites, press releases, Sun Up programs, and other mass media resources

2. Brief description of the target audience

Managers, owners and employees of farms, ranches and agribusinesses, research scientists, extension personnel, beef cattle producers, meat goat producers, consumers, and policy makers.

3. How was eXtension used?

Active participation in the Horse CoP. We are collaborating to develop an online curriculum for an introductory horse management university credit course through Michigan State University. The curriculum will be repurposed as an e-course book for use by universities, community colleges and high schools and as the core content for a massively open online course (MOOC) targeting general horse enthusiasts.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	94726	4069000	3500	450000

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	10	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational meetings, class guest lectures, conferences organized, in-service trainings held, state and local educational presentations

Year	Actual
2016	1036

Output #2

Output Measure

- Number of fact sheets, proceedings publications, newsletters, popular press articles and other non-peer reviewed extension publications produced

Year	Actual
2016	209

Output #3

Output Measure

- Number of Animal Enterprise television and radio spots or segments produced

Year	Actual
2016	12

Output #4

Output Measure

- Number of web sites maintained

Year	Actual
2016	4

Output #5

Output Measure

- Number of decision making tools developed
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of peer reviewed manuscripts published

Year	Actual
2016	10

Output #7

Output Measure

- Number of beef and pork quality assurance program participants

Year	Actual
2016	180

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of cattle enrolled in value enhancement programs
2	Number of producers participating in beef cattle value enhancement programs
3	Number of participants gaining knowledge in methods to decrease the incidence and severity of bovine viral diarrhea virus and bovine respiratory disease
4	Number of producers gaining knowledge in pasture and rangeland management, forage use efficiency and pasture and rangeland recovery
5	Number of producers and educators with access to resources regarding adaptation solutions for climate change
6	Livestock dietary impact on nutrient excretion
7	Tool for Predicting Environmental Stress in Cattle
8	Meat goat education using online video

Outcome #1

1. Outcome Measures

Number of cattle enrolled in value enhancement programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	11262

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Past OSU research demonstrates that most Oklahoma cow-calf producers do not utilize management practices that are proven to add value to calves. Practices, including vaccinating, weaning, dehorning/polled, and castration, are neglected by the majority of producers.

What has been done
A multidisciplinary team from Animal Science, Agricultural Economics, Vet Med, and Entomology developed a brand-neutral health management protocol, verify its use, and sponsor sales at Oklahoma livestock marketing barns. The Oklahoma Quality Beef Network was relaunched in 2008 with the goal of helping producers add value to their calf crops. The team promotes OQBN through Extension programming throughout the calendar year and provides timely research to monitor the value of OQBN practices to Oklahoma cattle producers. In Fall 2016, over 6,000 OQBN-certified calves were marketed through marketing barns.

Results
The Oklahoma Quality Beef Network sponsored feeder cattle auctions increased revenue to Oklahoma cow-calf producers by an estimated $777,379 in 2016. The overall impact of OQBN is, however, much higher. The educational efforts of the OQBN team, including faculty, state staff, and county staff, have increased the use of value-added marketing practices substantially since the relaunch of the program in 2008. A new survey effort in 2017 will help to quantify those gains.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

315 Animal Welfare/Well-Being and Protection

Outcome #2

1. Outcome Measures

Number of producers participating in beef cattle value enhancement programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	180

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cattle sickness costs the beef cattle industry millions of dollars each year. These losses negatively impact producer profitability and they impact each and every level of the beef production chain. Negative impacts are felt at the producer level through decreased performance, death loss, increased costs associated with treating sick animals, increased labor expenses and additional expenses for equipment, to name a few. At times, these losses extend beyond the cow-calf producer to each of the other sectors of the beef economy. Chronically ill cattle place a huge financial burden on the entire industry as the cost of carrying such cattle replicates itself throughout the life of the calf. Unfortunately the cost burdens associated with cattle sickness do not stop once the cattle are harvested. There are a number of well-documented studies including the 1995, 2000 and 2005 Beef Quality Audits that clearly illustrate that sickness in cattle, at even an early age, can have dramatic impacts on carcass quality, tenderness, and in some extreme cases the condemnation of entire carcasses.

What has been done
OQBN was developed to educate and capitalize on best management practices for producers across the state of Oklahoma. Cattle that are managed according to research based recommendations are verified and marketed at livestock markets across the state of Oklahoma. OQBN held 8 sales for verified cattle in Oklahoma throughout 2016. A total 11,262 calves were enrolled representing 180 producers which is an increase of 21% in total cattle enrolled from 2015 and an increase of 13% of producers.

Results
Final premiums have not been completely analyzed, but preliminary data shows $10.22/cwt increase in price over non weaned cattle. The average price premium (on average for a 600 lbs calf) is $61.32/hd. The added weight gain over the 45 day preconditioning period on average is 90

lbs with a value of gain at $76.50/hd for a gross increase in revenue of $137.82/hd. If the price of preconditioning is estimated at $70.00/hd, a net gain to producers is $67.82/hd. With total enrollments of 11,262 calves, OQBN contributed $763,788 back to the Oklahoma Beef Industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #3

1. Outcome Measures

Number of participants gaining knowledge in methods to decrease the incidence and severity of bovine viral diarrhea virus and bovine respiratory disease

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of producers gaining knowledge in pasture and rangeland management, forage use efficiency and pasture and rangeland recovery

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cow/calf production is an important part of the Oklahoma and U.S. economy. In fact, beef production accounts for approximately one-third of Oklahoma?s agricultural income and the Oklahoma beef cow inventory ranks 2nd or 3rd among states in most years. Refining production efficiency and resource utilization in the beef industry is a challenge. This challenge arises

because genetic changes that improve beef carcass quality or post-weaning performance may be antagonistic to cow/calf economic and biological efficiency. In fact, continued aggressive selection for growth rate, carcass weight, and milk production could be leading to increased annual carrying costs in the beef cow enterprise. Said another way, more inputs are required to maintain reproduction in a cow herd as the mismatch between nutrient requirements and ranch forage capacity to meet those requirements expands. This mismatch is not easily identified as cow requirements and input costs increase gradually over time and these changes are extremely difficult to track. For example, ranchers cannot measure and track the trend in annual forage consumption of their beef cows.

What has been done

A series of experiments has been conducted to characterize and document the impact that selection for various traits can have on maintenance requirements and annual costs in a cow herd. In addition, a model was developed to estimate the production and economic impact of selection for these traits. Results have been presented in national, regional and local seminars and conferences (including webinars) as well as peer reviewed publications, national conference proceedings, press releases, and video segments. The program has enjoyed wide acceptance across the state and country and continues to be a staple in educational programming and research planning.

Results

Continued aggressive selection for growth results in increased finished steer carcass weights with the current rate of change documented at about 5.7 lb per year. Selection for growth and carcass weight has led to increased mature cow size and in fact, average mature cow weight appears to be increasing at about 7 lb per year. For perspective, our findings suggest that each 100 lb of increased cow weight results in about 6 to 17 lb of increased weaning weight. The value of the increased weaning weight to the ranch (cow/calf enterprise) is about $6 to $20, whereas we estimate that the cost of the additional 100 lb of cow weight costs the ranch about $40 per year. Similarly, aggressive selection for milk production continues in some of the popular U.S. beef cattle breeds. Our research has shown that each one pound of added weaning weight resulting from increased milk production requires about 55 lb of additional feed. Consequently, the true cost of increasing milk yield for the purpose of increasing calf weaning weight is about twice that of the value.

The impact of this program should eventually be readily apparent in the genetic trend over time for some of these traits. For example, voluntary feed intake is a good index of overall nutrient requirements of cattle. The genetic trend for feed intake has been consistently increasing rapidly over the past 20 years. However, in 2015, this trend stabilized in the Angus breed and actually declined for the first time in 2016. If our program is having an impact, the trend in voluntary feed intake and aggressive selection for other traits such as growth and milk yield should stabilize or decline as we get the word out about the need to balance selection considering the potential cost to the cow/calf enterprise.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems

Outcome #5

1. Outcome Measures

Number of producers and educators with access to resources regarding adaptation solutions for climate change

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	165

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While the world's population is expected to dramatically increase over the next four decades, the demand/need for animal protein will also dramatically increase. However, availability of grazing land will continue to decline. As a result of these factors, the cost of grazing land (both land ownership and rental rates) continues to escalate. Therefore, development of management systems to enhance animal protein production with less land area is critical to meeting future food security needs. Additionally, changing environmental conditions have the potential to impact cattle management and nutrition related to climate change.

What has been done
Research projects and extension educational programs have been developed to address this critical issue from a beef production perspective. A multiple-year beef production systems project is underway evaluating the incorporation of cropland to provide winter supplement in the form of high quality forage and summer grazing a cover crop on the same cropland. The primary forage base is native rangeland in both the traditional and the intensified system. Research and educational programs are underway to explore the opportunity to use excess feed yard capacity and inexpensive concentrate feed resources to expand/intensify cow/calf production in the region. A national conference was held to explore these possibilities and provide research program updates from 3 academic institutions working in this area. Research has been initiated to monitor long term core body temperatures of grazing and feedlot cattle. This data is being used to identify conditions that result in both critical heat and cold stress of cattle.

Results
After two years of research, results indicate that land area required can be reduced by about 35% to produce the same amount (or slightly more) weaned calf weight. In the semi-confinement work,

preliminary results suggest that feed energy required to maintain beef cows is reduced by about 18% when compared to animals consuming free-choice forage diets. Approximately 165 producers and industry professionals from across the U.S. attended the national educational program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #6

1. Outcome Measures

Livestock dietary impact on nutrient excretion

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nutrient excretion from livestock facilities is a potential environmental threat that has received much media attention in recent years. For non-ruminants (swine and poultry), the issue is much more problematic due to the consolidation of these industries into smaller geographic areas. The nutrients of greatest concern are nitrogen and phosphorus. Nitrogen is a problem because it can leach to groundwater increasing nitrate levels which have severe human health consequences. Nitrogen is also implicated in air pollution due to a direct association with ammonia emission. Phosphorus, on the other hand, can affect surface water leading to eutrophication of lakes, ponds, and streams.

What has been done
Research at the new OSU Swine Research and Education Center is evaluating the effect of dietary manipulation on nutrient excretion by swine. Dietary manipulations include the form and

level of nutrients fed, enzyme additions to the diet, and feed additives. Each of these is being evaluated to determine the magnitude of reduction in nitrogen, phosphorus, and other mineral excretion that can be achieved with changes in the diet. Additionally, the effects of these manipulations on ammonia and hydrogen sulfide emissions from the barns are being evaluated.

Results

Diet can be considered the first line of defense against excess nutrient excretion. Results, to date, suggest dietary manipulation can have a profound effect on nutrient excretion and ammonia emissions from swine facilities. A 30 to 50% reduction in nitrogen and phosphorus excretion is attainable with little effect on pig performance or carcass traits. These reductions in excretion would thus require less land mass for application and less concentration of these nutrients in the crop application stream. Limiting nutrients excreted by these amounts would limit the potential environmental impact, but not totally eliminate the risk. Additionally, these dietary manipulations can reduce ammonia emissions from facilities by approximately 40 to 60%, thereby, limiting the potential for air pollution. These reductions in nutrient excretion from diet manipulation alone combined with treatment of the waste and exhaust air stream have the potential to markedly reduce the potential environmental impact of swine facilities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #7

1. Outcome Measures

Tool for Predicting Environmental Stress in Cattle

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increased focus of consumers and producers on the wellbeing of cattle and concerns related to

environmental change have created heightened interest in environmental stress of cattle. Major production issues related to heat stress include reduced reproduction, reduced performance, and mortality. Conditions which increase susceptibility to heat stress include poor health, heavy conditioning, and lack of prior adaptation. It has been estimated that the impact to the feedlot industry alone is over $7.5 million per year. While weather events are not avoidable, producers can develop plans and implement management to reduce the effects of environmental stress.

What has been done

In partnership with the Oklahoma Mesonet, a previously developed tooled called the Oklahoma Cattle Comfort Advisor served as a base for development of a separate National Cattle Comfort Advisor tool (http://cattlecomfort.mesonet.us/). This tool advances on previous heat stress tools as it calculates a Cattle Comfort Index that applies to both heat and cold stress in a single product and is more dynamic due to the inclusion of solar radiation influences. In addition to current conditions, national maps can be produced for points in time starting from January 2016. Informational sheets have been created to aid users of the product. The current tool is fully functional and has been soft launched. Additional promotional materials are being developed for a full print, traditional press, video, and social media national launch during 2017.
Similar to previous models, the underlying Cattle Comfort Advisor model was largely developed from growing cattle feedlot data. To refine the model and improve the quality of the stress predictions, we have initiated the collection of continuous cattle temperature data via remote core temperature monitoring devices in a diverse range of cattle types, seasons, and locations across the country.

Results

Conversion of the Cattle Comfort Advisor from an Oklahoma based tool to a new national format provides a significant benefit for the cattle industry. The cattle industry continuously transports cattle across the country and owners, managers, and consultants to the cattle industry can reside great distances from where the cattle are located. A national tool allows for use in the transportation industry as well as for production management. Use of the tool allows for the implementation of management that reduces cattle thermal stress which will improve cattle production efficiency and well-being.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #8

1. Outcome Measures

Meat goat education using online video

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Meat goat production has become an ever growing agriculture enterprise in Oklahoma and the United States. Currently Oklahoma ranks 3rd in the number of meat goats in the U.S. and meat goats have an annual sales amount of $4.9 million in Oklahoma according to the 2012 Census of Agriculture. Because of this growth, producers were requesting more and more information about meat goat production.

What has been done
In 2013, the team received a $49,000 grant from the Southern Region Risk Management Education Center. These funds were to be used to help film, edit, develop, and promote the videos. The group decided to tape some of the sessions taught during boot camp as well as create videos covering various topics from the Oklahoma Basic Meat Goat Manual. Overall, twenty five videos were created ranging from 5 minutes to 58 minutes in length and cover such topics as Body Condition Scoring for Goats, How to Give Medication, Predator Control, Birthing Process, How to Trim Goat Hooves, Record Keeping, How to Tube a Goat, How to Castrate a Goat, Ear Tagging, Aging, Developing a Meat Goat Marketing Plan, Farm Business Planning, Hay and Forage Evaluation, Nutrition, Parasite Control, Common Diseases, Meat Goat Selection, Housing and Shelters, and Forages. Nine of the twenty five videos are recorded sessions from the meat goat boot camp. Four are presentations of different chapters of the Oklahoma Basic Meat Goat Manual. The remaining videos are demonstration videos of various production practices. Most of the presenters in the videos are county educators and area specialists, but in two videos actual goat producers are used to teach production techniques.

Results
YouTube uses Google analytics to measure numerous areas of impacts and observations to help their clients analyze and determine the effectiveness of their videos. Below is list of impacts and observations from the OSU Meat Goat channel as of December 12, 2016.

The videos on the OSU Meat Goat channel have been viewed 793,573 times and 4,192 producers have subscribed to the OSU Meat Goat channel. The videos have been viewed in all U.S. states and territories. Oklahoma producers have viewed the videos 13,173 times. The videos have been viewed in 215 countries besides the U.S. and specialists have answered questions via e-mail from producers in other countries. These videos have been used in educational programming in the Philippines and the Dominican Republic. Viewers in the U.S. are 69% male and 31% female. Worldwide 73% of the viewers are male and 27% are female.

Overall, the YouTube videos and channel have surpassed all expectations. Not only have we had an impact for the producers in Oklahoma, but all over the country and the world. The videos continue to get views, comments and questions on a regular basis. 39% of the participants of the 2015 OSU Meat Goat Boot Camp stated in their evaluations that they attended because of the videos on YouTube. These videos have generated enough interest that in 2016 the first Advanced Meat Goat Boot Camp was held.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

none

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Crop Enterprises

☑ 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	18%	0%	5%	0%
133	Pollution Prevention and Mitigation	3%	0%	5%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	7%	0%	20%	0%
204	Plant Product Quality and Utility (Preharvest)	13%	0%	10%	0%
205	Plant Management Systems	26%	0%	20%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	6%	0%	10%	0%
212	Pathogens and Nematodes Affecting Plants	5%	0%	10%	0%
213	Weeds Affecting Plants	10%	0%	5%	0%
215	Biological Control of Pests Affecting Plants	3%	0%	5%	0%
216	Integrated Pest Management Systems	5%	0%	10%	0%
405	Drainage and Irrigation Systems and Facilities	4%	0%	0%	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	18.0	0.0	10.0	0.0
Actual Paid	25.0	0.0	11.2	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**
534348	0	469492	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
534348	0	469492	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3130264	0	2627771	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Wheat cultivar performance testing and demonstration throughout Oklahoma
2. Wheat breeding, variety development, and introgression of new traits into elite germplasm
3. Publication of web sites, web-based updates, video presentations, and printed extension materials that disseminate research findings and address current and emerging issues in Oklahoma agriculture
4. Provide effective, non-classroom educational opportunities for industry professionals, Extension educators, farmers, and ranchers.
5. Conduct on-farm research and demonstration of nitrogen rich strips and use of hand-held sensors
6. Evaluate alternative irrigation methods and strategies that increase sustainability of irrigated cropping systems in the presence of changing climatic conditions and decreasing water resources.

2. Brief description of the target audience

Wheat growers, dual-purpose wheat producers, millers, bakers, wheat importers, seed growers and dealers, wheat breeders, crop producers, canola, peanut, sunflower and other crop producers and nutraceutical producers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	56041	3717838	0	0

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	11	10	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Field Demonstrations, field days, and conferences

Year	Actual
2016	1085

Output #2

Output Measure

- Regionally adapted wheat cultivars

Year	Actual
2016	1

Output #3

Output Measure

- Educational materials developed

Year	Actual
2016	11

Output #4

Output Measure

- Web-based educational materials such as web sites, videos, and social media applications

Year	Actual

2016	15

Output #5

Output Measure

- Locally-controlled evaluations and agronomic data for small grains crops

Year	Actual
2016	98

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of wheat varieties released to address agronomic and end-use quality needs of the hard red and hard white winter wheat industries.
2	Percentage of wheat acres sown to varieties with improved pest resistance, yield potential, and end-use quality.
3	Number of on-farm demonstrations of nitrogen rich strips and of hand-held sensors
4	Locally-controlled evaluations and agronomic data for small grains crops
5	Systems Based Canola Management
6	Increasing return on irrigation investment with grain sorghum
7	Translational genomics for Oklahoma winter wheat populations
8	Center Pivot Irrigation Energy and Water Use Efficiency Tests and Information Dissemination

Outcome #1

1. Outcome Measures

Number of wheat varieties released to address agronomic and end-use quality needs of the hard red and hard white winter wheat industries.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Hard white (HW) wheat is the market class of choice for domestic and international wheat buyers who source comparable levels of protein content and protein strength in hard red winter (HRW) wheat. The HRW class is the predominant class of wheat produced and thus exported by the USA. Domestic demand for HW white is being driven, in part, by market pressure and consumer preference for whole grain formulations and by the national school lunch program, which encourages the consumption of meal and snacks containing whole grain ingredients. The milling industry is satisfying this demand with increased sourcing of hard white wheat, none of which comes from Oklahoma, leaving Oklahoma wheat producers missing out on an elevated price structure during a time of depressed commodity price.

What has been done
The OAES released Stardust HW wheat for adoption in the same area where hard white wheat is most likely to be sourced if available, rather than transporting HW wheat from neighboring states. While the output is only one variety, the breakthrough is nonetheless significant and could open the door for follow-up improvements. Stardust is known to have yielding ability similar to leading HRW wheat varieties (including Gallagher), but with equivalent pre-harvest sprout tolerance to most HRW varieties. Thus a major impediment to choosing HW over HRW varieties is now effectively eliminated in an area where wheat production is most intense.

Results
Adoption of Stardust HW wheat would translate into $3M additional income to wheat producers in northern Oklahoma, based on current shipments of HW wheat received from Kansas (4.3M bushels x 70 cents per bu premium paid in 2016) into Enid that is either milled on site or shipped elsewhere. Even greater income would be realized as the HW market matures. Milling facilities in Oklahoma would capture savings from reduced transportation costs, which could conceivably create investment opportunities back to OSU and strengthening of HW wheat research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Percentage of wheat acres sown to varieties with improved pest resistance, yield potential, and end-use quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2006 over half (54%) of all wheat acres were sown to the cultivar Jagger or the Jagger-by-Abilene cross Jagalene. In addition, many newer wheat cultivars have offered increased yield as compared to Jagger and Jagalene, but have relied on Jagger resistance genes to fight the problematic foliar diseases leaf and stripe rust. Shifts in disease races over the past four years have made these genes largely ineffective, presenting an unnecessary production risk for farmers and grain merchandisers.

What has been done
Since 2006, the Oklahoma State University Wheat Improvement Team has developed and released ten wheat cultivars with disease resistance and agronomic performance superior to that of Jagger and Jagalene in targeted environments. In addition, our newest releases and advanced experimental lines contain insect and disease resistance genes different from those in Jagger. A comprehensive educational campaign has made farmers and ranchers aware of improved cultivars released by land-grant institutions and private breeding companies in the region.

Results
In 2012 acreage of Jagger and Jagalene had fallen to 5% and 0%, respectively. Acreage of the disease and Hessian fly resistant cultivar Duster increased from 0.3% of acreage in 2007 to 19.7% in 2013 and improved cultivars now occupy 47% of Oklahoma wheat acres. Unfortunately,

the disease resistance of Jagger-derived lines such as ?OK Bullet? and ?Fuller? are no longer highly effective at preventing foliar disease and future efforts will focus on displacing these varieties with superior genetics of newer lines such as Gallagher and Iba. Gallagher, for example, fits a similar production profile as Duster but offers increased yield potential, foliar disease resistance, and kernel size without sacrificing Hessian fly resistance, acid soil tolerance, or fall forage production for dual-purpose systems. In 2012 Gallagher offered a 5.9 bu/ac average yield advantage over Duster, indicating a potential increase in Oklahoma farm revenue of $53 million annually if we meet our target of replacing 1.2 million acres of Duster with Gallagher in the next five to seven years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #3

1. Outcome Measures

Number of on-farm demonstrations of nitrogen rich strips and of hand-held sensors

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Current global nitrogen use efficiency for cereals production is estimated to be 33%. Environmental concerns and increasing fertilizer prices have necessitated improved precision in determining crop nitrogen requirements.

What has been done
Previous team efforts led to the release of the pocket sensor which led to an increase of the application of N-Rich Strips in 2015. An increased effort in promoting N-Rich Strip application in 2016 coupled with the low market value of winter wheat has led to an increase in application of N-Rich Strips in the fall of 2016. Based upon observation and conversations with area agronomist

and service providers, an estimated 750,000+ acres of winter wheat and canola had N-Rich Strips applied.

Results

During the 2016 harvest multiple reports of success stories were shared with OSU extension. Some of which sub samples of grain was shared to determine quality. In three cases producers raised 75 to 85 bushel per acres of grain yield on less than 60 lbs of nitrogen fertilizer. All the situations grain samples were collected from the N-Rich Strip and field to determine protein. In all cases the grain protein of the field was 12% or greater. For these three fields each 80 acres in size N rate was reduced by 90 to 100 lbs resulting in a savings of approximately $35 per acre. Additionally in all 3 cases the N-Rich strips of the fields lodging while the rest of the field did not. Indicating if the producer had applied full rate the full field would have lodged resulting in grain lost and slow harvest. Based upon past research it is estimated the use of N-Rich Strips and GreenSeeker sensors will result in an economic impact to the state of Oklahoma of $7.5 million dollars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #4

1. Outcome Measures

Locally-controlled evaluations and agronomic data for small grains crops

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	65

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Choosing the right cultivar is essential to ensuring economic profitability of any production system. Wheat yield data collected in 2010, for example, show that cultivar choice can easily increase gross income by more than $120 per acre and dramatically reduce pesticide use.

What has been done
The Oklahoma State University small grains variety testing program tests 25 to 45 released wheat cultivars and advanced experimental lines in replicated test plots at 25 to 30 sites throughout Oklahoma on an annual basis. The wheat multi-use team sows 40 to 45 additional non-replicated wheat variety demonstration tests at sites throughout Oklahoma. All but five of these sites are located on-farm and are conducted with the assistance of farmer-cooperators.

Results
Field day attendees typically represent over 1.7 million acres of wheat and report an average perceived value of the information received at field day events to be $21.46 per acre for a total impact of over $37 million annually.

Wheat phenological data, forage yield, grain yield, test weight, and protein content data were collected and posted near real time on the Oklahoma small grains variety testing site at www.wheat.okstate.edu and at the OSU Small Grains blog at www.osuwheat.com. These sites received over 15,000 page views in 2016 and was reinforced with the @OSU_smallgrains Twitter feed which currently has over 1,500 followers. Hard copies of results were distributed to over 8,000 stakeholders in the state of Oklahoma via direct mailing and to over 700 producers via electronic copy. In-season recommendations and progress reports were provided by the World of Wheat blog at www.osuwheat.com. The blog received 17,918 page views in 2016 and visitors represented over 100 countries with most visitors originating from the US, France, and Canada.

One of the major areas of emphasis in 2016 was keeping producers aware of foliar disease progression. The foliar disease ?stripe rust? devastated the 2015 wheat crop in the region and resulted in large economic losses. Efforts to educate producers regarding stripe rust progression in 2016 were effective, as agricultural retailers reported a doubling of fungicide treated wheat acres as compared to 2015.

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 #5

1. Outcome Measures

Systems Based Canola Management

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oklahoma has historically been a very winter wheat dominated state, typically growing winter wheat and a continuous monoculture system. This has led to a stagnation in wheat yields as well as high foreign material and low wheat quality. In order to overcome these issues, growers can integrate crop rotation. One of the most promising crop rotations with winter wheat is winter canola. Winter canola not only has a very similar management system that wheat has but previous efforts have shown up to a 25% increase in wheat productivity following canola. While many benefits are present, many growers find consistently growing a successfully winter canola crop difficult. Many challenges exist, but a majority of growers believe that lack of optimized management information and drastically different production systems compared to other canola producing areas are the reason for low adoption and low success rates for the crop.

What has been done

To overcome these challenges, it has been a major push to develop and demonstrate local data and management practices that can be successful in the state. A comprehensive and systems-based research and extension program has been developed centered around winter canola production and successful management. This has been a team effort integrating individuals from Plant and Soil Science, Entomology and Plant Pathology, Biosystems and Agricultural Engineering, and extension state out in the state. Several research topics have been or are currently being addressed, including: no-till management, cultivar selection, fertility management, proper IPM management, and proper harvest techniques as well as trials documenting the benefit winter canola has on crop rotations, pollinator health and management, and soil health. In addition to the expansive research focus, a comparable extension effort has been put forth as a means to disseminate the information gathered from these trials to growers, so they can implement them onto their individual crop production systems. Several field days and conferences have been dedicated to the results garnered from this program, including: Canola College, summer canola meetings, turn row field days, and in-serves training.

Results

The benefits of this project are wide ranging. In a recent survey, over 75% of canola growers questioned utilized the Oklahoma State canola variety testing report to help guide their cultivar selection the next year. In utilizing this information, yield differences between individual varieties can be great, resulting in significant shifts in economic gains. In expanding this, growers will be questioned on whether they have heard educational programs highlighting many aspects that are covered in this program and what they have gained from the program. In addition, it is the intent of the project to increase the amount of material from the research aspect to be put in documented forms (i.e. factsheets, current reports, videos, or blog entries) to allow for long-term educational use. Once these have been obtained, an analysis of economic return for these educational programs or individual projects can be obtained and reported.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #6

1. Outcome Measures

Increasing return on irrigation investment with grain sorghum

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sustainability of agricultural production in the Oklahoma Panhandle is threatened by depletion of the Ogallala aquifer and the resulting reduced irrigation capacity. Much of the irrigation water in the region is currently used to produce corn which requires 24-36 inches of water for full irrigation. Water requirement for grain sorghum is less than half of this amount; however, most producers prefer growing corn because of the perception that it provides short term profit maximization regardless of irrigation capacity.

What has been done
Field studies as well as crop model simulations were utilized to determine the relationship between irrigation capacity and yield for grain sorghum and corn. This analysis found that when using a center pivot the annual profit/acre from grain sorghum was equal to or greater than that of corn at irrigation capacities less than 5 gpm/acre. Incorporation of assumptions about the relationship between water withdrawal and the decline in pumping capacity allowed us to simulate the long-term water use, grain yield, net annual profit, and the net present value for future production for corn and grain sorghum.

Results
The economic simulation suggests that grain sorghum would generate $30,722 more income than corn over the remaining life of a typical 120 acre pivot. In addition, more rapid depletion of the

aquifer associated with corn production will rapidly result in a loss of the economic viability of corn production and result in 31 acres (25%) being converted to grain sorghum in year 3 with the remainder being converted in year 4. Immediate conversion of corn production to grain sorghum under irrigated pivots in the Oklahoma panhandle alone could generate an additional $26 million over the next 15 years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #7

1. Outcome Measures

Translational genomics for Oklahoma winter wheat populations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
On average a traditional wheat breeding program takes 10-12 year before a developed variety is ready for commercial release; it is considered time- and resource- consuming and requires extensive institutional commitment. As the demand for wheat consumption is exceeding current supply and threat from climate uncertainty increases, it is imperative to incorporate emerging technologies to ensure productivity meeting these challenges. Genomic selection (GS), which employs genome-wide SNP (single nucleotide polymorphism) to predict individuals? performance known as the genomic estimated breeding values (GEBVs), is an exciting approach for accelerating breeding process.

What has been done
It has been a decade since the first study of GS in plant breeding was published. Though a substantial amount of evidence has shown the potential of GS in crop improvement, most research focusses on evaluation of algorithm performance and very few studies have considered

the practical implications of these results in the context of a breeding program. This current study on genomic selection is intended to address:
1) The performance of GS algorithms of wheat grain yield cross breeding cycles, where year effect can be evaluated by treating as environmental variation in the line evaluation stage.
2) The possible upward bias in predictive ability from within-year cross-validation compared to cross-year prediction was investigated.
3) The effect of SNP marker information on GS predictive ability was evaluated.

Results
With a more realistic two-generation validation, our result verified the superiority of the RKHS method over the whole-genome regression GBLUP. The slightly larger errors observed in RKHS was mainly due to model overfitting. Model performance evaluation based on within-year cross-validation is likely to be biased, and when aiming to shorten breeding cycles in the line development stage of a wheat breeding program, a more ideal design like our two-generation validation should be considered with multi-location field data to handle correlated errors. Given the considerable differences in the predictive abilities from the various models examined in the present, forward selection for high performer was consistent and the ranking differential was small, even with a moderate number of SNP markers. The application of GS is shown in this study with the increase in the efficiency of line selection. Also, inclusion of the GxE effect in GS prediction models could guide selection to the best performers across environments, hence increasing selection precision. In summary, our positive results from this study, along with other potential benefits advocate a broader application of GS in wheat variety development.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

Outcome #8

1. Outcome Measures

Center Pivot Irrigation Energy and Water Use Efficiency Tests and Information Dissemination

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Agricultural production in the arid Oklahoma Panhandle relies on the availability of water in the Ogallala (High Plains) aquifer. Since about 1950 and the advent of pressurized irrigation systems, this water supply has been depleted at an alarming rate. In some areas the water table has dropped over 150 feet (USGS 2008). Preliminary discussions with area extension personnel indicate many panhandle irrigation systems are very inefficient and being shut down due to poor performance. Current total aquifer discharge rates are about twice the charge rates. If the discharge rates were lowered by decreasing the inefficient use of water, the Ogallala resource could be extended.

What has been done

Ten electric and natural gas center pivot systems were tested in 2015-2016. Producers were identified and contacted. There was considerable interaction between the faculty, producers, county extension and experiment station personnel. Reports were generated specific for the producers who participated. Test results were disseminated at several irrigation conferences in Oklahoma and always generated interest from producers along with willingness to have their systems tested.

Results

Only two of the irrigation systems tested were above the NPPPC (Benchmark) minimum Overall Pumping Efficiency (OPE) standard of 60% energy for electricity. And none of the natural gas systems were within 50% of the NPPPC OPE minimums. Potential efficiency improvements ranged between 10 to 30% for electric and near 100% for natural gas systems. The savings (economic) of running the systems to NPPPC OPE standards were estimated and ranged from about $200 to $3,000 per year, per system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
405	Drainage and Irrigation Systems and Facilities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

none

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Plant Biological Technologies

☑ 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
123	Management and Sustainability of Forest Resources	0%	0%	5%	0%
132	Weather and Climate	0%	0%	5%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	25%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	15%	0%
206	Basic Plant Biology	0%	0%	15%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	0%	0%	10%	0%
212	Pathogens and Nematodes Affecting Plants	0%	0%	25%	0%
	Total	0%	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	0.0	0.0	11.0	0.0
Actual Paid	0.0	0.0	8.0	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**
0	0	336855	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	366855	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1885396	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Design and conduct research, including the development of methods and procedures
- Write and submit grant proposals to private, state and federal agencies
- Generate scientific publications - communicating scientific results to a wide range of scientists
- Training of professional scientists - graduate and undergraduate students, technicians and post docs in the scientific discipline
- File patents
- Provide research opportunities for students at OSU. Maintain a diverse environment in the lab and continue to support group members in their career development

2. Brief description of the target audience

- Scientists and scientific societies
- Governmental science organizations
- Educational institutions
- Applied researchers and extension specialists
- Students
- Private, federal, state, and industrial funding agencies
- Other stakeholders (producers, consumers, educators, public)

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	46	46

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2016	14

Output #2

Output Measure

- Peer-reviewed publications including journal articles

Year	Actual
2016	46

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Graduate students graduated
2	Bermudagrass cultivars to resist abiotic stress
3	Rapid utilization of a major gene for grain yield in winter wheat
4	Productivity Associated Microorganisms/Genes Project
5	Testing of drought tolerance genes in crop plants

Outcome #1

1. Outcome Measures

Graduate students graduated

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

Outcome #2

1. Outcome Measures

Bermudagrass cultivars to resist abiotic stress

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Bermudagrass is the most widely used turfgrass in the southern USA and throughout tropical and warmer temperate regions of the world. Over much of the southern USA turfgrass managers and users desire new bermudagrass varieties with greater cold tolerance, enhanced turf quality, improved drought resistance, increased host plant disease resistance [i.e., spring dead spot (SDS) and leaf spot disease], reduced requirements for mowing and fertilization, better shade tolerance, and faster divot recovery rate.

What has been done
The turf bermudagrass breeding program at OSU developed seed- and vegetatively-propagated turf bermudagrass experimental varieties with improved turf quality and increased stress resistance. Our breeding methods included recurrent selection to improve plant populations and inter-specific hybridizations of selected plants in common bermudagrass and African bermudagrass to produce F1 hybrid progeny.

Results
Bermudagrass varieties improved in turf performance traits and resistance/tolerance to stresses (i.e., drought, cold and diseases) will benefit the turf industry by improving turf playability on sports fields and golf courses, enhancing aesthetic beauty of residential lawns, conserving limited natural resources such as water, and reducing turf management risks and costs. Use of cold hardy bermudagrass varieties would reduce the winter kill risk in the US transition zone. Potential exists for the development of bermudagrasses with improved sod-tensile strength, water-use efficiency, shade tolerance, and/or tolerance to spring dead spot and leaf spot diseases. Drought resistant bermudagrass cultivars could reduce 20-40% water use annually.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

Outcome #3

1. Outcome Measures

Rapid utilization of a major gene for grain yield in winter wheat

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat is the most important crop planted in Oklahoma and provides one of the most important economic resources at the farm gate and in associated industries in this state. In the USA, more than 50% of the total 48 million metric tonnes of winter wheat are produced in the Great Plains as hard red winter wheat. Many quantitative trait loci (QTL) or genomic regions have been mapped but account for only small parts of the phenotypic variation for grain yield and they may be subject to large genotype-environment interactions, the sum of which has inhibited rapid utilization of yield genes in wheat breeding.

What has been done
In our most recent study, we discovered QYld.osu-1BS for grain yield by using genotyping-by-sequencing (GBS) markers to map a doubled haploid (DH) population derived from two winter wheat cultivars ?Duster? and ?Billings?. QYld.osu-1BS explained 23% and 24% of the total phenotypic variation in field-based grain yield tested in 2014 and 2015, respectively. Their identical long-term yield profiles notwithstanding, the Duster allele at the QYld.osu-1BS locus increased yield by 16% in 2014 and 23% in 2015, relative to the Billings allele.

Results
The gene causing QYld.osu-1BS will be introduced into extensive breeding lines and germplasm to breed novel hard red winter wheat varieties that adapt to Oklahoma and states in the Great Plains. This yield gene will be an elite genetic source for winter wheat that occupies 75% of the total wheat in the USA and worldwide.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

206 Basic Plant Biology

Outcome #4

1. Outcome Measures

Productivity Associated Microorganisms/Genes Project

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Microorganisms literally drive many of the processes that higher forms of life depend upon. All the biological and geochemical cycles are in large part driven by microorganisms. Decisions that impact the sustainability of agriculture all have microbial components that are often not well understood. Thus the development of approaches to identify which microorganisms or which genes are important to agricultural productivity would be a big step forward in enhancing our ability to understand agricultural processes.

What has been done
We are developing an experimental and statistical methodology to identify productivity associated microorganisms and are considering the same approaches to identify productivity associated genes. We have identified taxonomic groups that are associated with productivity and have developed an overall method to identify the community impact on productivity. We have used these methods to demonstrate microbe impact on wheat and on wheat systems with organic and inorganic N amendments. Our results suggest that continuous use of inorganic Nitrogen will continue to support high productivity but at the expense of agriculture response to abiotic and biotic stressors.

Results
Microbes drive our food production systems. Development of a methodology to identify the good and bad actors in this complex system will go a long way to uncover how the system really works. A better understanding of how the system works will lead to novel technologies to exploit our agricultural practices to improve productivity especially in the light of climate change and dwindling resource availability. Our improved understanding will most certainly highlight the key players in agricultural productivity. The overall economic impact of such an approach is unknown at this time but given the importance of microbes to plant productivity it is likely to be enormous.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

Outcome #5

1. Outcome Measures

Testing of drought tolerance genes in crop plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Due to a reciprocal relationship between stress tolerance and yield, our ability to select for drought tolerant varieties using conventional breeding is limited. However, DNA-based approaches provide considerable promise to increase plant stress tolerance without compromising yields under favorable conditions.

What has been done
Transgenic Arabidopsis plants that ectopically express eight distinct cotton ABF genes were created and tested for changes in stress tolerance. ABF genes encode abscisic acid responsive transcription factors that activate drought responsive protective genetic programs. These plants showed significantly increased tolerance to both water deficit and cold temperatures. Selected ABF transgenes were then introduced into cotton plants and the stress tolerance of these plants was tested under both greenhouse and field conditions.

Results
The results showed that increase ABF expression in cotton is associated with increased drought tolerance and yield maintenance under water-limited conditions. With changes in climate, aquifer depletion, and diversion of surface water, the availability of water for agriculture is diminishing. Genetic research to increase drought stress tolerance in plants will increase our ability to produce agricultural products with less water and provide farmers with the ability to meet the growing demand for food and fiber.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

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

Decreased availability of research funding. Application to external granting agencies is continuing but the success rate for basic research is often very low.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Significant milestones include the publication of our work on transgenic cotton plants with modified expression of brassinosteroid receptor BRI1 and our work on the chromatin-based regulation of seed maturation genes by HSI2. These publication signal our continuing efforts to develop a research program at the cutting edge of molecular genetics and biochemistry.
Research work has received over 1500 google scholar citations, which demonstrate the scientific impact of our work

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Commercial and Consumer Horticulture

☑ 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
124	Urban Forestry	7%	0%	10%	0%
202	Plant Genetic Resources	10%	0%	10%	0%
204	Plant Product Quality and Utility (Preharvest)	14%	0%	15%	0%
205	Plant Management Systems	38%	0%	40%	0%
502	New and Improved Food Products	15%	0%	20%	0%
901	Program and Project Design, and Statistics	3%	0%	5%	0%
903	Communication, Education, and Information Delivery	13%	0%	0%	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	12.0	0.0	2.0	0.0
Actual Paid	16.0	0.0	3.5	0.0
Actual Volunteer	23.0	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**
488669	0	149096	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
488669	0	149096	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1833482	0	834500	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct research to evaluate cultivars of traditional and nontraditional horticultural crops and ornamental plants. •Conduct research to improve crop production in controlled environments. •Conduct research into crop cultural systems, particularly the feasibility of horticultural crops in rotation with agronomic crops. •Conduct research to develop "seed to market" production systems for high-value alternative horticultural crops like cilantro and herbs. •Conduct research to develop sustainable and/or organic production systems for commercial horticultural crops. •Provide demonstrations and education and disseminate information to support Oklahoma's commercial horticulture industry, with emphasis on electronic resources. •Develop cultural practices to reduce pecan alternate bearing and provide consistent nut quality. of research based information for clientele •Conduct "New Farmer" workshops and short courses for edible horticultural crops •Survey Oklahoma Consumers (Gardeners) at the county level to assess the needs and wants of the gardening public •Upgrade the web-based delivery •Review and revise annually or as needed Fact Sheets and other publications •Educational programs focused on Consumer Best Management Practices (BMP) for the conservation of energy, water resources, water pollution prevention, Integrated Pest Management (IPM), and urban landscape wildlife conservation •Educational programs are conducted based on public interest and County Educator requests •Participate and support eXtension Consumer Horticulture/Master Gardener Community of Practice •Conduct Master Gardener/Junior Master Gardener Training •Conduct pesticide training and education •Provide Education on Backyard Food Production •Assist in Youth at Risk - Obesity/School Gardens

2. Brief description of the target audience

Horticultural crop producers, commodity groups, food processors, landscape professionals, input suppliers such as seed and chemical companies, peer scientists, extension specialists and county professionals, horticultural dealers and merchants, greenhouses, Master Gardeners, home owners, communities, and youth.

3. How was eXtension used?

Specialists respond to horticulture questions through the Ask-an-Expert feature of eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	117962	20761165	4500	3000000

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	9	5	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- New Master Gardeners trained

Year	Actual
2016	247

Output #2

Output Measure

- Manuscripts submitted for consideration of publication in peer-reviewed journals

Year	Actual
2016	28

Output #3

Output Measure

- Number of Extension publications completed - fact sheets, newsletters, trial reports, web-based materials

Year	Actual
2016	153

Output #4

Output Measure

- Number of statewide "Oklahoma Gardening" shows produced

Year	Actual
2016	36

Output #5

Output Measure

- Number of Funded Grant Proposals

Year	Actual
2016	27

Output #6

Output Measure

- Number of potential fresh market growers of horticulture crops trained
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of horticultural crop producers newly certified as organic

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of volunteer hours provided to community horticulture programs statewide

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	196613

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rapid urban growth in many areas of the United States coupled with increased interest in the environment and home gardening have prompted an ever-increasing number of garden and landscape inquiries. Along with this interest, comes a multitude of gardening questions needing individual explanation and too few Extension staff members to answer each question. Many of these questions are seasonal in nature and are relatively easy to answer assuming that one has horticulture training.

What has been done
Oklahoma Master Gardeners are trained, supervised and recruited to: 1) improve overall efficiency in providing one-on-one service to the non-commercial horticulture clientele in the county, 2) provide group learning and teaching activities for non-commercial clientele, 3) allow agents to develop proactive Extension programs, and 4) form a group of Extension volunteers to support additional consumer horticulture efforts.

Trainees participate in a 10 - 13 week course receiving between 40 - 56 hours of course work on subjects including: basic plant science, vegetables, fruits, nuts, ornamentals, lawns, diagnosing pest problems, soils, and other related topics. Upon completion of the training period, satisfactorily passing an exam on materials and topics covered, and donating between 40 - 56

hours of volunteer time to the Horticulture program, the trainees are certified and awarded the title of Oklahoma Master Gardener.

Examples of Master Gardener Volunteer activities include: staffing plant clinics to answer phone and walk-in questions, manning educational exhibits, maintaining demonstration gardens, community beautification projects, serving as 4-H hort leaders and judges, speaking at club/civic meetings, teaching horticulture activities at nursing homes, etc., assisting in horticulture mailings, newsletters, etc., and appearing on TV and radio.

Results

The service from the Extension Master Gardener volunteer program has proven to be a highly popular means of extending the knowledge of the Oklahoma State University Cooperative Extension Service to the residents of Oklahoma. The Oklahoma Extension Master Gardener Program now has 27 counties participating in the program as of January 2017. The following data was provided by 20 of the 27 counties. Approximately 247 new Extension Master Gardeners were trained during the 2016 training season. Close to 1,161 active Master Gardeners volunteered their time, contributing approximately 196,613 volunteer hours resulting in over 2,321,347 educational interventions with Oklahomans and as many as 2,522+ educational and community programs and activities being conducted in their communities in 2016. This translates to over $4,227,179.00 in service that was donated by volunteers (wage rate of $21.50/hour was used, which includes a 12% estimate of fringe benefits). This hourly rate is the assigned wage for non-management, non-agricultural workers in 2015 for the state of Oklahoma as published by The Independent Sector, an organization that ?serves as a national forum to encourage giving, volunteering and not-for-profit initiative,? http://www.independentsector.org/programs/research/volunteer_time.html). Reports are gathered yearly at the beginning of the following year.

In addition to the many hours donated, approximately 925 pounds of produce was donated to local food pantries/kitchens, shelters, and other organizations throughout Oklahoma by the Extension Master Gardeners.

4. Associated Knowledge Areas

KA Code	Knowledge Area
124	Urban Forestry
205	Plant Management Systems
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Number of home gardeners experiencing increased awareness and knowledge about environmental issues and IPM principles

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Grape Seed Oil and Grape Seed Flour are New Products that can be Extracted and Marketed by Oklahoma Grape Growers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Finding new ways to use existing products can be beneficial in maintaining market edge of Horticultural growers.

What has been done
The OSU Postharvest Physiology program is investigating the extraction of grape seed oil and grape seed flower as value-added products for the grape producers.

Results
Values for new products are difficult to exactly establish; since grape seed oil and grape seed flour and products obtained from the flour are in the marketplace, current values can be used as a guideline. If Oklahoma?s production capacity of 29 tons of dried seed were processed, the seed would yield 7,524 lbs of oil (1,075 gallons) and 50,236 pounds of de-oiled meal (25 tons). Current bulk prices of grape seed oil are $3.34 per pound or $23 per gallon; retail prices for consumer sized quantities range from $13 per 500 ml ($98 per gallon) to $25 per 375 ml ($253 per gallon) for variety specified oils. Oklahoma?s potential for grape seed oil production value ranges from $24,725 at bulk prices, $105,350 at consumer-sized prices and $271,975 at boutique, variety specified prices. The flour may be ground and sold as-is in bulk for $7 per pound; prices are as high as $13 per pound for variety specified grape seed flours. The flour would then carry a value of $351,652 if ground as-is and sold in bulk or $653,070 if sold as variety specified seed flours. The grand total worth of Oklahoma vineyard grape seeds could then range from $376,377 (bulk oil/seed flour sold as-is) to $558,320 (High end oil/grape seed extract) to $925,045 (High end oil/variety specified seed flour). In 2017 we will initiate a project to reduce bitter flavor and produce an Oligomeric Proanthocyanidin nutraceutical by-product which could add a value of $286,345 if extracted and sold in bulk as a grape seed extract. The extraction would result in about 10 % loss of weight for the flour (reducing its value by 10 %), but should substantially improve the flavor and salability of the flour. Our industry cooperator is finalizing plans to build a

new Oklahoma winery, which includes a new seed products business guided by the results of this study.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
502	New and Improved Food Products

Outcome #5

1. Outcome Measures

Oklahoma Gardening Provides Consumer Education on Horticulture and the Environment

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2014, the monarch butterfly was being petitioned to be protected by the Endangered Species Act. Currently a Species Status Assessment if being conducted until June of 2019. This assessment will serve as a scientific framework to determine whether there is a need to list the monarch butterfly as an endangered species. Sometimes early conservation efforts can prevent the need to list a species.

What has been done
Education is a key component to conservation. We highlighted the valuable efforts Oklahoma is conducting and why our state plays such a key role in the monarch migration. Research that Department of Horticulture and Landscape Architecture is doing with the Oklahoma Department of Transportation (ODOT) on mowing schedules in order to identify the most beneficial timing to not disrupt the monarch migration was highlighted in the spring of 2016. This was followed by a segment with ODOT that shared their perspective and why all taxpayers would benefit. A public access monarch waystation garden was highlighted to encourage viewers to plant their own waystation. This complimented several additional butterfly gardening plant-related segments also featured. Finally, Dr. Kristen Baum?s research with monarch monitoring was highlighted and tied in with the research between ODOT and the Horticulture Dept. In the fall, the season concluded with information about how homeowners, gardeners, and school groups could get involved with

monarch tagging.

Results

With over 170,000+ viewers watching Oklahoma Gardening weekly and 18,000 YouTube channel subscribers, we reach all sectors of Oklahoma from backyard gardens, to urban dwellers, to people who may not feel this effects them. In the 2016 season when Oklahoma Gardening highlighted monarch habitats, according to MonarchWatch.org, there was a 70% increase in the number of registered monarch waystation gardens added in Oklahoma. While it is unknown the number of Oklahoma participants in the monarch tagging program, it is estimated that 100,000+ students and adults participate in the tagging activities each fall nationwide. Although the fate of the monarch is still being assessed, the efforts to keep the monarch off the endangered species list are growing stronger in Oklahoma and nationally.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Use of Optical Sensors for Nutrient Management in Horticultural Crop Production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maintaining top quality of horticultural plants is important in meeting the needs/desires of consumers. Better quality plants bring a higher price at the marketplace than plants of lower quality. Even consumers with little horticultural experience can often detect quality differences in plants and will purchase accordingly. At the same time, growers must keep prices low in order to maintain an adequate profit margin to stay in business. Identifying ways to reduce production inputs while maintaining plant quality can help growers better manage crops for the most return.

What has been done
The use of nondestructive optical sensors was investigated on twelve different greenhouse crops to improve nitrogen use efficiency, increase plant quality, develop a sampling protocol, and reduce costs associated with other sampling methods. Over the last three years, two graduate students have been trained to determine nutrient status using optical sensors. A fact sheet was developed to inform growers and has been viewed over 2,000 times, which has led to an increase in awareness of alternative nondestructive methods to evaluate crop nitrogen status.

Results
In all but one crop, the atLEAF chlorophyll sensor performed as well as the SPAD chlorophyll meter, which is considered the standard but costs ten times as much as the atLEAF sensor. This has helped change the attitude of growers that a cheap alternative chlorophyll sensor is just as good as the old standard. In addition, a new mobile iPhone app was developed to aid growers and homeowners using optical sensors to reduce fertilizer costs, plant death, and nutrient runoff by inputting atLEAF, SPAD, or leaf nitrogen lab analysis values into the app for over 150 different ornamental crops. The app then gives a recommendation if additional fertilizer is needed or if no additional fertilizer is needed potential saving hundreds of thousands of pounds of fertilizer being applied to plants that is not needed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #7

1. Outcome Measures

Utilizing Hydroponics to Improve Growing Conditions Improves Horticulture Crop Quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Major challenges with growing horticultural crops in the field include soil-borne diseases, temperature fluctuations, water availability, and disease and pest infestations. Thus, in the last

12 years, there has been increasing interest in hydroponic or soilless techniques for producing greenhouse horticultural crops. Some estimates put the number of commercial hydroponic greenhouses in the U.S. at 65,000 and there are over a dozen in Oklahoma. Hydroponics is a technique of growing plants without soil using water, soil-less substrates, and nutrient solutions. Information on what nutrient products produce the greatest yields for different vegetable and herb cultivars is need to expand hydroponic greenhouse production in Oklahoma.

What has been done

With the help of the Oklahoma Specialty Crop initiative grant through the Oklahoma Department of Agriculture Food and Forestry (ODAFF), a nutrient film technique (NFT), vertical tower, and Dutch bucket hydroponic systems were built in April 2016. Since that time, three fertilizer products have been evaluated and 16 different cultivars of vegetables within lettuce, basil, Swiss chard, bell peppers, and eggplant along with three different cultivars of strawberries. Over the last year, one graduate student has been trained to manage the different types of hydroponic systems.

Results

A fact sheet was developed to inform growers about pH and EC management and has already been viewed over 250 times, which has led to an increase in awareness of how to manage the water. One current hydroponic operator and two potential growers have toured our production system learning what has and has not worked well in terms of system construction, cultivars, and fertilizers. Three manuscripts are currently being developed to disseminate results further to growers and researcher.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

none

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Ecosystem and Environmental Quality and Management including Weather and 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
104	Protect Soil from Harmful Effects of Natural Elements	5%	0%	10%	0%
111	Conservation and Efficient Use of Water	17%	0%	10%	0%
112	Watershed Protection and Management	13%	0%	10%	0%
121	Management of Range Resources	6%	0%	15%	0%
123	Management and Sustainability of Forest Resources	3%	0%	10%	0%
132	Weather and Climate	10%	0%	5%	0%
133	Pollution Prevention and Mitigation	5%	0%	5%	0%
134	Outdoor Recreation	4%	0%	5%	0%
135	Aquatic and Terrestrial Wildlife	5%	0%	5%	0%
136	Conservation of Biological Diversity	5%	0%	5%	0%
141	Air Resource Protection and Management	8%	0%	5%	0%
205	Plant Management Systems	8%	0%	5%	0%
403	Waste Disposal, Recycling, and Reuse	5%	0%	5%	0%
605	Natural Resource and Environmental Economics	6%	0%	5%	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	10.0	0.0	13.0	0.0
Actual Paid	10.0	0.0	15.7	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**
373591	0	660657	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
373591	0	660657	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
752818	0	3697734	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Submit grant proposals and conduct research that addresses priorities

Forge collaborative relationships that build on current strengths in research in management.

Partner with state and federal agencies to address pressing needs in conservation.

Produce scientific publications; disseminate information through other print and online media outlets.

Conduct workshops, field days, and other personal information exchanges to promote issues and alternatives in natural resource management.

Conduct Poultry Waste Management Education

Conduct research and develop weather-based plant biomass models as a tool in ecosystem, rangeland and pasture management adaptation to climate changes.

Conduct multi-disciplinary research on grassland fuel modeling as part of an awarded Joint Fire Science Program grant.

Provide agriculture and natural resource management technical expertise for weather and climate data and models maintained and operated by the Oklahoma Mesonet.

Create and deliver weather and climate education for the general public, agriculture and natural resource sectors through OSU SUNUP TV, online video/audio tutorials, fact sheets, email newsletters, educational programs, seminars and workshops.

Create factsheets, videos and webcontent to explain anaerobic digestion of animal manure to the layman and provide practicing engineers material to aid in design and operation.

2. Brief description of the target audience

Scientists, students, related agencies (Federal, State, private), land owners, farmers, ranchers,

communities, consumers, land developers, state legislators, commodity groups, community leaders, homeowners,

3. How was eXtension used?

Prescribed Fire CoP is maintained through OCES.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	14124	76659	4000	23000

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	82	101

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2016	0

Output #2

Output Measure

- Manuscripts submitted for consideration of peer-reviewed publication

Year	Actual
2016	82

Output #3

Output Measure

- Extension conferences, workshops and training sessions

Year	Actual
2016	202

Output #4

Output Measure

- Research and Extension reports, fact sheets, and other media presentations

Year	Actual
2016	0

Output #5

Output Measure

- Number of weather-based agricultural decision support tools

Year	Actual
2016	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of poultry producers and poultry litter applicators acquiring initial waste managment certification and number maintaining certification
2	Number of animal waste analyses conducted for land application of beef, dairy or swine waste.
3	Number of animal waste analyses conducted for poultry litter application
4	Number of users accessing website designed to deliver information about water policy, conservation and efficient use
5	Number of downloads of Extension fact sheets and related education materials
6	Number of enrollments in conservation-related land management programs
7	Land area restored in Oklahoma through invasive/encroaching species removal
8	Land area restored in Oklahoma through prescribed fire or other practices
9	Access by users of Oklahoma Mesonet computer and mobile device weather and climate data and tools
10	Prairie grouse management in the southern Great Plains
11	Climatic Variability and Streamflow Responses
12	Wind Energy and Wildlife Ecology

Outcome #1

1. Outcome Measures

Number of poultry producers and poultry litter applicators acquiring initial waste managment certification and number maintaining certification

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	76

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the 1990s, water quality concerns related to phosphorus from poultry litter results in litigation and regulation focused on protecting OK watersheds. State legislation mandated that Oklahoma Cooperative Extension deliver a Poultry Waste Management Education Program.

What has been done
More than 486 people participated in the Oklahoma Poultry Waste Management Education Program during calendar year 2016. Four Initial 9-Hour (I-9) Education sessions were presented during 2016, educating 76 people as poultry operators or waste applicators. A total of 2,850 people have received certificates of I-9 completion since the program began in 1998. Fifteen 2-hour Continuing Education sessions were offered with 30 hours of classroom instruction provided during the education year and 410 individuals completing Continuing Education in 2016.

Results
Nutrient sensitive watersheds protected with 90% of poultry litter now exported outside of nutrient sensitive watersheds. There has been a 31% reduction in phosphorus loading to Beaty and Spavinaw Creeks, both within Eucha Spavinaw watershed. Phosphorus concentrations have decreased in the Illinois River in NE OK.

Program participant evaluations indicate:
-98% said class topics were timely
-99% gained knowledge on waste management topics
-96% will use what they learned

4. Associated Knowledge Areas

KA Code	Knowledge Area

112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Number of animal waste analyses conducted for land application of beef, dairy or swine waste.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of animal waste analyses conducted for poultry litter application

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	479

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
133	Pollution Prevention and Mitigation
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #4

1. Outcome Measures

Number of users accessing website designed to deliver information about water policy, conservation and efficient use

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	12814

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Number of downloads of Extension fact sheets and related education materials

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Number of enrollments in conservation-related land management programs

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Land area restored in Oklahoma through invasive/encroaching species removal

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	15000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Biological invasion by non-native plants is a major cause of native ecosystem loss, reducing agricultural production, lowering water quality and quantity, altering wildlife habitat, and decreasing potential for rural economic development; however, restoration of invaded rangelands has been met with little to no success.

What has been done
Improving our understanding and management of this important plant-soil-micorbial symbioses will increase our ability to successfully restore damaged lands and generate highly productive ecosystems.

Results
We have completed multiple field and greenhouse experiments that show alterations of beneficial soil fungi (arbuscular mycorrhizal fungi) are a major mechanism in native plant growth suppression following non-native plant invasion, and restoration of the native fungi may be a fundamental consideration for successful establishment of native plant species; selection of native inoculum and local plants species is critical. Improving our understanding of the linkages between plants and soil will facilitate the recovery of ecosystems damaged by disturbances, increasing restoration success by both private land managers and government agencies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #8

1. Outcome Measures

Land area restored in Oklahoma through prescribed fire or other practices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	15828

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As prescribed fire becomes an increasingly important land management tool, there is a need to train practitioners and educate the public about its potential, ecology and limitation.

What has been done
Our department has developed an active ?hands-on? approach to training students in the classroom and the field and educating the public about how to apply prescribed fire and what role fire plays in forest, rangeland and riparian ecosystems.

Results

Results of a published survey indicated that since the year 2000, former students of NREM 4783/5783 Prescribed Fire and NREM 4793/5793 Advanced Prescribed Fire have conducted 6,247 burns on over 1.8 million acres since taking these courses. Many students reported that the courses changed their career trajectories by stimulating interest in obtaining fire-related jobs. NREM Prescribed Fire extension is impacting the use of prescribed not only in Oklahoma, but throughout the US and Canada. This can be seen from enrollment of nearly 600 students in our online fire courses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
205	Plant Management Systems
605	Natural Resource and Environmental Economics

Outcome #9

1. Outcome Measures

Access by users of Oklahoma Mesonet computer and mobile device weather and climate data and tools

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4129174

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The challenge in implementing weather-based agricultural management includes: providing intuitive decision-support tools, enhancing mobile device information delivery, expanding grower

weather and climate knowledge, and simplifying weather data display. These challenges are further complicated by agriculture?s need for forecast, current, and climate perspectives in supporting farm and ranch management decisions.

What has been done

The Oklahoma Mesonet has created multi-faceted agricultural and natural resource extension/outreach online data and models. Mesonet.org provides desktop and tablet access to weather data and products at no cost to Oklahoma farmers and ranchers. An Agriculture section organizes decision support products by crop and livestock commodity. Android and iPhone apps provide 5-minute Mesonet weather data and maps, NOAA National Weather Service (NWS) forecasts, NWS weather alerts, and NWS radar. Ongoing extension/outreach efforts inform growers about and how to use Mesonet and NWS products via farm show exhibits, educational presentations, television, YouTube videos and web tutorials, web blog, and printed materials.

Results

Farmers and ranchers turn to the Mesonet to monitor rainfall and soil moisture on a regular basis to monitor for drought. Conservative estimates of on-farm losses from the 2010-2015 drought in Oklahoma were over $3 billion. An economic survey completed by OU graduate student Kim Klockow using recognized economic analysis techniques, estimated that the 10% of Oklahoma crop land being managed with Oklahoma Mesonet data saved $8 million in production costs in 2008. This estimated value did not include the Mesonet value to livestock producers for that year and only covered 10% of Oklahoma cropland.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
132	Weather and Climate
134	Outdoor Recreation
205	Plant Management Systems

Outcome #10

1. Outcome Measures

Prairie grouse management in the southern Great Plains

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rangelands of the Great Plains are critical for livestock production but are also primarily grasslands that are refugia to many imperiled plant and animal species. It is critical to develop alternative rangeland management strategies that are capable of simultaneously maintaining biodiversity and agricultural productivity. Strategies such as fire management in the Flint Hills may not be compatible with greater prairie-chicken conservation.

What has been done
We have established large-scale replicated experiments to combine fire and grazing to promote heterogeneity and compare them to traditional range management approaches. We have also attached radio transmitters to over 100 female greater prairie-chickens to monitor habitat selection and survival in these rangelands.

Results
The practices we have developed have indicated that management for heterogeneity can accommodate both species diversity and agricultural production. For instance, we found that greater prairie-chicken hens select for areas away from trees and not recently burned, and that nest survival is influenced by solar radiation, grass height, and operative temperature. This research has directly led to changed management on over 250,000 acres of the Flint Hills to benefit the greater prairie-chicken while maintaining profitability of livestock producers.
Our programs have been integrated into USDA-NRCS conservation practices, such as the Environmental Quality Incentive Program (EQIP) and the Lesser Prairie Chicken Initiative that have the potential to influence all rangelands and rangeland managers of North America. For example, through programs such as these the NRCS spent over $130,000,000 from 2005-2009 on rangelands of the Oklahoma, Texas, Kansas, South Dakota and North Dakota.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
205	Plant Management Systems

Outcome #11

1. Outcome Measures

Climatic Variability and Streamflow Responses

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Environmental flows are an important legal designation for streamflows that help protect rivers from flow alterations where society deems appropriate and attempts to maintain or mimic some portion of the natural flow regime. The streamflow in the Arkansas River and Red River basin is highly variable, however it is not well known why this is the case.

What has been done
We investigated the relationship of PDO, AMO and ENSO indices with annual precipitation in the Arkansas River and Red River basin and the effects of PDO on annual precipitation and streamflow in watersheds. We are working to identify fishes most susceptible to stream drying by assessing habitat loss and reduced connectivity between instream habitats during summer low flows in Oklahoma and surrounding states.

Results
Our results showed that annual total P from 1932 to 2014 was significantly correlated with PDO in all watersheds in the western basin but AMO was significantly correlated with annual P in watersheds in the east basin, resulting high variability in precipitation and streamflow within this river basin, especially for the central part of the basin. Farmers, ranchers and resource managers should be aware of increased drought probabilities associated with the negative phases of the PDO by planting drought resistant crops, reducing herd size and purchasing drought insurance. Further, these efforts will establish relationships between flow metrics and ecological trait combinations to show how fishes are affected by flow alteration. Our results will provide a useful tool for evaluating the effects flow releases will have on fishes and help predict which traits and species are most susceptible to flow alteration.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
132	Weather and Climate
135	Aquatic and Terrestrial Wildlife

Outcome #12

1. Outcome Measures

Wind Energy and Wildlife Ecology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wind energy is a promising renewable alternative to fossil fuels, and Oklahoma is 4th in the nation in wind energy generation. However, the impacts of wind energy on wildlife remain unclear, particularly for bats, an animal group with many threatened and declining species that are known to collide with wind turbines in high numbers across the U.S.

What has been done
We compiled the largest database of bat collision mortality records in existence, including 218 studies from 100 U.S. wind facilities, to assess factors driving variation in bat mortality across wind facilities. We also used this database to identify biases in how bat fatality surveys are conducted and make recommendations about best practices for future studies of bat collision mortality. OSU-NREM in collaboration with U.S. Geological Survey researchers are developing a national prioritization system to identify the bird species most likely to experience population declines from wind facilities based on their conservation status and expected risk from turbines.

Results
We found that migratory tree-roosting bats (Hoary Bat, Eastern Red Bat, and Silver-haired Bat) are the most frequent collision victims and that the most important factor driving mortality is the amount of forest land around wind facilities, with open areas having lower mortality. At a time when wind energy is burgeoning in Oklahoma, throughout the U.S., and worldwide, our findings

will help the wind energy industry make environmentally friendly decisions about wind facility siting and also help design mortality surveys that provide an unbiased picture of impacts to bats. This system highlights both species that could potentially experience population decline caused by wind energy (e.g., many raptors, such as the Ferruginous Hawk, Swainson?s Hawk, and Golden Eagle), and species at relatively low risk of population decline (e.g., many songbird species). Our prioritization system is a first step that will help researchers, conservationists, managers, and industry?both in Oklahoma and across North America?target future study and management activity that will help balance wildlife conservation and renewable energy development.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

None.

Key Items of Evaluation

None.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Processing, Product Storage, and Food and Product Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
216	Integrated Pest Management Systems	10%	0%	5%	0%
401	Structures, Facilities, and General Purpose Farm Supplies	11%	0%	5%	0%
403	Waste Disposal, Recycling, and Reuse	5%	0%	5%	0%
501	New and Improved Food Processing Technologies	15%	0%	10%	0%
502	New and Improved Food Products	9%	0%	10%	0%
503	Quality Maintenance in Storing and Marketing Food Products	9%	0%	10%	0%
701	Nutrient Composition of Food	5%	0%	10%	0%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	3%	0%	10%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	11%	0%	25%	0%
723	Hazards to Human Health and Safety	22%	0%	10%	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	2.0	0.0	4.0	0.0
Actual Paid	3.0	0.0	4.2	0.0
Actual Volunteer	0.2	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**
186796	0	179375	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
186796	0	179375	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
116838	0	1003974	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Food Safety:

- Conduct research on preventing contamination of foods with pathogenic microorganism during production, processing, storage, distribution, and/or consumer use.
- Conduct research on eliminating or reducing the numbers of potential pathogenic microorganisms in foods during production, processing, storage, distribution, and/or consumer use.
- Conduct research on detecting contamination of foods with pathogenic microorganisms.
- Conduct research on detecting microbial toxins in foods.
- Conduct research on detecting undeclared allergens in foods.
- Provide technical information and assistance to food industry and/or consumers to determine safe food production, food processing, and/or food handling procedures.
- Conduct food safety workshops designed to provide certification in recognized food safety systems such as Hazard Analysis Critical Control Points (HACCP).
- Conduct technical assistance projects designed to assist food production / food processing enterprises in developing comprehensive, written food safety programs and to pass third-party audits of comprehensive food safety programs.
- Disseminate food safety recommendations to industry and consumers via popular press, fact sheets, eXtension publications, web-based outreach, workshops, and/or peer-reviewed journal articles.

Food Processing:

- Conduct research on improving or maintaining the quality of processed foods.
- Conduct research on developing profitable new food products and food processing technology.
- Conduct research on maximizing the efficiency and sustainability of food processing operations.
- Conduct research on improving the healthfulness and nutritional value of processed food products.
- Conduct research on evaluating the economic feasibility of food processing activities.
- Provide technical information and assistance related to processing, analyzing the chemical and physical properties, and improving or maintaining the quality of processed food products.
- Provide technical information and assistance related to food product formulation and new food product development.
- Provide technical information and assistance related to selection and evaluation of processing technology
- Provide technical information and assistance related to food process evaluation.
- Provide technical information and assistance related to processed-food business economic planning and product marketing.

• Serve as a resource to help commercial food processors recognize and comply with applicable food product processing and labeling regulations.

• Disseminate recommendations for food processing industry best practices via popular press, fact sheets, eXtension publications, web-based outreach, workshops, and/or peer-reviewed journal articles.

Product Storage:

• Conduct research that evaluates agricultural product storage and handling technologies with the aim of improving quality, safety, and costs. Provide technical applications, demonstrations and education for grain and food storage providers and handlers.

2. Brief description of the target audience

Food processors; handlers, manufacturers, and marketers of grain, feed and food; food safety regulators

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	660	2100	0	0

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	10	16	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of conferences and other extension outreach presentations

Year	Actual
2016	116

Output #2

Output Measure

- External funding obtained

Year	Actual
2016	1558900

Output #3

Output Measure

- Workshops, symposia, short courses, and round tables conducted

Year	Actual
2016	85

Output #4

Output Measure

- Technical assistance projects completed

Year	Actual
2016	46

Output #5

Output Measure

- Manuscripts submitted for publication in peer-reviewed journals

Year	Actual
2016	40

Output #6

Output Measure

- Extension publications completed

Year	Actual
2016	10

Output #7

Output Measure

- Number of air quality monitors tested
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Grain storage, food or pest control entities adopting new process or product
2	Number of food industry personnel newly certified as HAACP trained
3	Number of food industry personnel newly certified as having attended food safety and processing workshops
4	Number of food industry jobs created
5	Number of new food businesses started
6	New or improved food processing, food safety and/or product storage adopted by industry
7	Number of emergency response teams available in Oklahoma
8	Number of food producing/food processing enterprises that implemented a comprehensive food safety plan with team assistance
9	Number of food producing/food processing enterprises that passed a third-party food safety program audit with team assistance
10	The impact of cattle grazing in pecan groves on human pathogens

Outcome #1

1. Outcome Measures

Grain storage, food or pest control entities adopting new process or product

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of food industry personnel newly certified as HAACP trained

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	117

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Number of food industry personnel newly certified as having attended food safety and processing workshops

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	704

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Number of food industry jobs created

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	183

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

Outcome #5

1. Outcome Measures

Number of new food businesses started

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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 #6

1. Outcome Measures

New or improved food processing, food safety and/or product storage adopted by industry

2. Associated Institution Types

- 1862 Extension
- 1862 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)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
401	Structures, Facilities, and General Purpose Farm Supplies
403	Waste Disposal, Recycling, and Reuse
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
701	Nutrient Composition of Food
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

Number of emergency response teams available in Oklahoma

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Number of food producing/food processing enterprises that implemented a comprehensive food safety plan with team assistance

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	58

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

Number of food producing/food processing enterprises that passed a third-party food safety program audit with team assistance

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
723	Hazards to Human Health and Safety

Outcome #10

1. Outcome Measures

The impact of cattle grazing in pecan groves on human pathogens

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recent outbreaks of foodborne illnesses associated with almond and walnuts have increased attention to food safety issues related to tree nut production. Currently there is a limited understanding of the natural occurrence and potential sources or contributing factors leading to tree nut contamination by human pathogens especially at orchard level. Furthermore, recently, in an effort to improve food safety, FDA, under the ?Food Safety Modernization Act?, has established a new produce safety rule that requires ?an adequate waiting period between animal grazing and harvesting for covered produce?. However, it is not clear what ?an adequate waiting period? is for produce in general, and in particular, for cattle grazing which is a common practice for native pecan groves to increase diversity and profitability in Oklahoma.

What has been done
Lack of information renders informed decisions impossible for developing ?good agricultural practices? (GAP) or mitigation procedures/policies for produce production. To address this gap, we are conducting a comprehensive microbiological survey in native pecan groves including grazed (cattle) and non-grazed 1) to determine the natural prevalence of pecan contamination with human pathogens; 2) to assess potential contamination routes of human pathogen to native

pecan; and 3) to evaluate the impact of cattle withdrawal periods from the grove on human pathogen contamination of native pecan.

Results

Preliminary results have revealed the presence of two major foodborne human pathogens: Salmonella and Shiga toxin-producing Escherichia coli (STEC) in soil, cattle feces, and pecan samples. Further experiments will determine the impact of cattle grazing and withdraw periods on the prevalence of these pathogens at these orchards as well as the potential sources of such contaminations.

The impacts of this project are several folds. First, it provides much-needed baseline information on the natural occurrence and prevalence of human pathogens in pecan orchard environment and on tree nuts in general. Currently, such data is limited although it is critical for overall risk assessment and intervention strategies deployed to control such hazards. Secondly, it provides scientific data on the actual impact of grazing practice on the food safety risk for native pecan. Information is required to avoid losing the grazing option by law or simply due to decisions by shellers. This has direct impact to Oklahoma. Our state ranks first in native pecan production, averaging 17 million pounds annually. Native pecan groves are frequently utilized for cattle grazing to increase diversity and profitability. This ?dual-purpose agriculture? has played an essential role for many Oklahoma farmers to support and sustain pecan production. Economic loss to farm families if grazed groves could not be harvested would range from $150 to $1,375 per acre depending on the site and grove management based on current price and yield typical for Oklahoma native groves with different management regimes. USDA National Agricultural Statistics Service in 2007 (http://www.nass.usda.gov/index.asp) reported pecans were harvested in Oklahoma from 141, 675 acres representing 3,589 farms, with an additional 17,184 acres of nonbearing age trees. Over 90% of this acreage is native pecan groves and most are combined with cattle grazing. Additional states with substantial native pecan production include Texas, Louisiana, Missouri, and Kansas. Even if grazing increases the risk of human pathogen contamination it is likely that the results from this research could generate clues for strategies to mitigate the risk. However, we are currently operating in an information vacuum that could result in the loss of this option, negatively impacting many Oklahoma and other states farm families. Thirdly, it provides much needed scientific data to determine an ?adequate? waiting period between grazing forage in the grove and harvesting of native pecans. The withdrawal period for grazing cattle prior to harvesting is an important economic issue not only to the native pecan growers in Oklahoma but also other states. From regulatory perspective, such data would serve as baseline for decision making instead of operating in a void. Fourthly, the general public would benefit from such a balanced approach to this food safety issue by ensuring the produce is safe and is as economical as possible since unneeded regulations leading to added production and processing costs could be avoided with well documented information. Finally, if the research determines there is a significant risk of human pathogen contamination of pecan the potential contamination routes could be identified during orchard production and harvesting. Novel approaches could then be developed to eliminate or control such contamination.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Extension program were evaluated primarily based on before and after assessments of attendee knowledge using questionnaires. The number of people receiving training and the publications generated shows impact in the state of Oklahoma.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

4-H Youth 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
806	Youth Development	100%	100%	100%	100%
	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	56.0	0.0	0.0	0.0
Actual Paid	78.0	1.1	0.2	0.0
Actual Volunteer	52.0	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**
1030394	40377	8421	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1030394	26360	8421	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
7654131	121921	47135	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Volunteer Development & Management - Recruit, orient and train adult volunteers to serve as club and project club leaders and to assume leadership on committees which plan and coordinate local and

county activity and events.

Develop four initiative teams made up of state and county 4-H staff and appropriate partners to design and deliver curriculum and in-service training in each of the four initiatives.

Utilize 4-H curriculum, including printed materials, events, contests and or web-based content to support the four initiatives.

Design and implement events in each of the four initiative areas which may include, but not be limited to the following:

Leadership and Citizenship: 4-H Volunteer & Parent Conference, District Volunteer Conferences, District Youth In Action Conferences, Leadership Team Retreats, State and District 4-H Officers, Ambassador Training, 4-H Citizenship Washington Focus and Operation Military Kids events.

Agricultural and Natural Science: Big Three Field Days, State Fairs, Spring Livestock Shows and Oklahoma Youth Expo, Judging Events and Camps, District and State 4-H Horse Shows, Land, Range and Pasture Judging, Companion Animal Events, Shooting Sports, Wildlife Habitat Evaluation, Insect Zoo, Junior Master Gardeners and Forestry Camp.

Science and Technology: STEM Institute, TechXcite, Digital Media, Robotics and GIS/GPS programs.

Healthy Living: Food Show Down, Overcoming Obstacles, Healthy Living Grants, ATV Safety.

Some events like State 4-H Roundup and both state fairs contribute to a wide range of priorities.

The 4-H program will conduct meetings, training sessions, classes and use other learning vehicles to help youth develop life skills.

2. Brief description of the target audience

Youth, children, parents, teachers, youth and adult volunteers, middle to low income families; race and ethnicity will also be recognized as an identifier of audiences; caretakers, agencies and service providers, schools, policy makers.

Youth in Oklahoma who qualify for the program.

3. How was eXtension used?

- 547 volunteers and educators completed the 4-H Youth Development Working with Minors Training.
- Thirty-five staff and volunteers participated in one or more of the OK 4-H Risk Management lessons. Planning for Potential Incidents and Accidents (21) and Event Crisis Management (14)

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	150	50	2000	200

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of in-service training sessions for Extension educators

Year	Actual
2016	59

Output #2

Output Measure

- Number of educational trainings offered for volunteers, teen leaders and ambassadors

Year	Actual
2016	360

Output #3

Output Measure

- Number of educational events and contests conducted

Year	Actual
2016	680

Output #4

Output Measure

- Number of partnerships and collaborative efforts engaged in to accomplish 4-H Goals

Year	Actual

2016 26

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adult volunteers will maintain or improve the skills necessary to provide appropriate leadership for 4-H club, camp, after-school and special interest programs.
2	Teen volunteers, officers and ambassadors will learn the leadership skills to become contributing partners with adult volunteers and Extension educators in the design and delivery of 4-H programs.
3	4-H youth will practice "contribution and caring" through citizenship and community service activities.
4	Youth will utilize agricultural and natural science programs to: improve the profitability of agricultural resources; enhance the sustainability of natural resources and improve their understanding of career and leisure activities related to these programs.
5	Youth will increase their ability to use STEM technologies and their awareness of career opportunities in science and technology.
6	Youth will develop an understanding of the relationship between diet/nutrition/exercise and physical, mental and emotional health and will demonstrate an increase in healthy lifestyle choices.

Outcome #1

1. Outcome Measures

Adult volunteers will maintain or improve the skills necessary to provide appropriate leadership for 4-H club, camp, after-school and special interest programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	18062

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Based on research by the National Camping institute there is an appropriate youth to adult ratio, which helps to insure successful contact and good risk management practices. The ratio varies by age.

Programs that intentionally plan for positive youth development have been shown to make students four times more likely to make contributions to their communities, two times more likely to make healthy choices, and two times more likely to engage in STEM activities outside of school.

What has been done
We have strengthened our efforts with the counties to insure adult volunteers are in place for all chartered clubs. With the 4HOnline Data Management System it is going to be much easier to monitor a club?s ratio of certified volunteers to enrollment.

Provide ongoing training to State 4-H Ambassador Advisors to develop a growth mind-set, practice self-reflection and goal setting skills while working with State 4-H Ambassadors. The goal of training is to help youth succeed and thrive in leadership positions.

4-H Curriculum Workshops held at State 4-H Parent/Volunteer conference and District Volunteer conferences. Participants were instructed on the importance of utilizing 4-H curriculum with members to enhance their project learning experience.

Multiple workshops presented around the state to update volunteers on the new projects and expanded Design & Construction project (formerly Fabric and Fashions)

Both emerging and current recreational professionals were taught how to incorporate the essential elements of youth development into their recreational programming. They were provided resources to use in training their own staff and volunteers.

Trainings for OCES educators, Master Gardeners, childcare workers and 4H/FCS adult volunteers were given in Craig county, Washington county, in Stillwater at an in-service for FCS educators, the Myriad Botanical Gardens, the National Children?s and Youth Gardening Symposium. Six gardening lessons were presented to youth and adults at the OSU Family Resource Center. Six ?Oklahoma Gardening? segments featured gardening activities appropriate to complete with youth. The ?Children?s Gardens in Which to Learn and Grow? fact sheet was updated. The Facebook page, ?Oklahoma School Garden Network? advertised lesson plans, grants, and ideas for gardening with youth throughout the year.

Results

It is difficult to divide out 4-H volunteers from other episodic volunteers reported through school enrichment. We have used the total adult volunteers to figure adult to youth ratios ? 18,062 adult volunteers/19,438 4-H members resulting in a 1:1 ratio of adults to youth.

State 4-H Ambassador Advisors structure committee work and Ambassador responsibilities to include goal setting, planning, self-reflection and growth of leadership skills

4-H volunteers utilize 4-H curriculum and learning products designed to provide the highest quality positive youth development experience. 4-H curriculum materials are filled with fun, engaging experiences that cultivate abilities youth need for everyday living as they progressively gain subject matter knowledge.

Multiple workshops presented around the state to update volunteers on the new projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Teen volunteers, officers and ambassadors will learn the leadership skills to become contributing partners with adult volunteers and Extension educators in the design and delivery of 4-H programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	894

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research indicates youth involved with caring and qualified adults will be prepared for successful lives as contributing citizens.

Oklahoma State 4-H Ambassadors have expanded opportunities to serve and promote the Oklahoma State University 4-H Youth Development Program.

Through leadership development, youth have the opportunity to develop life skills which will help them become contributing members of society.

4-H Camps are a rich and exciting venue for young people to learn life skill development. The success and safety of our camps is highly dependent on the quality of camp counselors and the training that they receive. In order to ensure that all Oklahoma 4-H camp counselors receive a consistent and quality training that provides 4-H members the best camp experience possible, it is imperative that counselors receive quality training.

What has been done
With the migration to 4HOnline we will be able to track how many volunteers received New Volunteer Orientation, WWM, Title IX, and other continuing education opportunities at the county level.

Over the course of 2016 State 4-H Ambassadors (25 teens) participated in a 4-H Ambassador Retreat, Leadership Team Retreat, Fall and Spring training sessions. Trainings included information on telling the 4-H story, working with donors and the importance of making the 4-H program visible across the state of Oklahoma.
The 4-H State Council Team have received formal instruction in leadership development at Leadership Team Retreat, State Council Orientation, and at their quarterly meetings. Additionally, they have been provided an on-going experiential leadership program in which as a group they plan, develop, and implement, service projects, instructional outreach, and events statewide.

A camp counselor training was conducted prior to a quad county camp. Counselors were taught the importance of incorporating positive youth development elements into the camping experience; safety and risk management; and behavioral management and camp guidelines. Nine of the counties conducted camp evaluations in the areas of perceived competence, teamwork, and affinity for nature.

Results
Volunteers completing annual continuing education are better prepared to meet the needs of the youth and more capable of being prepared to handle the mission and objectives of positive youth development. According to PARS more than 110,000 volunteer hours were reported.

At this time, we are unable to accurately report the number of volunteer receiving training to be certified volunteers with the closing of ACCESS 4-H. Parameters have been built into 4HOnline to track each individuals training.

State 4-H Ambassadors conducted events reaching over 6,000 people. Activities included corresponding with current donors, working exhibits and telling the 4-H story, advocating for 4-H youth and telling the impact that 4-H has on youth to state legislators and potential funders.

State Council set a goal and raised $15,000 for the Children?s Hospital, conducted workshops in over 40 counties, helped plan and implement State 4-H Roundup, provided leadership at 4-H Day at the Capitol, and successfully planned and conducted; four state council meetings, four executive council Meeting, and 20 different committee meetings. As a result, they learned valuable leadership skills in communication, responsibility, citizenship, and knowledge in conducting orderly business meetings.

20 counselors learned and demonstrated knowledge in the intentional incorporation of the essential elements of positive youth development, risk management, and leadership. Of the campers responding, 81% indicated an increase in perceived competence, 80% said they increased in teamwork, and 82% indicated an increase in affinity for nature.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

4-H youth will practice "contribution and caring" through citizenship and community service activities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	33325

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Essential elements are critical to effective youth development programs. These elements help youth become competent, contributing citizens. Created from traditional and applied research characteristics that contribute to positive youth development, they help professionals and volunteers who work with youth view the whole young person, rather than focus on a single aspect of life or development. These elements focus on social, physical, and emotional well-being, and are necessary for positive youth development. All eight elements are present in a healthy 4-H club.

Community service teaches compassion and understanding. Caring and compassion are two of the traits identified as vital components to positive youth development.

What has been done
Oklahoma 4-H requires that all clubs be chartered and that as a charter there are specific standards which need to be met annually for a charter to be renewed. This is one means for our system to insure clubs are safe and healthy environments where youth want to participate.

Through the State Council leadership not only was $15,000 raised for Children?s Hospital, 2 meals were served to families, crafts were made with patients at Christmas, and families that have been served by the hospital were invited to speak at both state and county 4-H events. Additionally, over 3,000 pounds of pop-tabs were collected to help fund the Ronald McDonald House in Oklahoma City. Counties were encouraged to take their tabs to the facility and many toured the facility and provided meals to the families.

Results
According to PARS over 600 demonstrations/conferences were conducted on Club Management.

With the migration to 4HOnline Data Management systems we will have increased accountability in the charter renewal process, increasing our ability as a program to insure and manage safe and healthy clubs. It may be 2017 before we begin to actually report numbers.

Life skill development including empathy, citizenship, and leadership occurred due to a yearlong effort to promote the positive benefits that the Children?s Hospital and Ronald McDonald House Charities provides to Oklahoma families.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Youth will utilize agricultural and natural science programs to: improve the profitability of agricultural resources; enhance the sustainability of natural resources and improve their understanding of career and leisure activities related to these programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	96341

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth need to learn acceptable animal husbandry practices, demonstrating knowledge about animal health, breeding, production, marketing and meat science while being conscientious about product quality assurance, animal welfare/well-being and protection and effects on the environment while having positive family experiences.

Childhood obesity is prevalent in Oklahoma and has been partially attributed to decreased times spent outdoors. Backcountry programs not only teach fitness and nutrition but also provide children the skills and confidence to incorporate outdoor recreation into their lifestyles.

What has been done
Adults worked with youth to help them prepare for their outdoor adventure. As a result, 6 youth and adults participated in a 3-day camping weekend in state and then took an 11 day trip to New Mexico where they packed in to experience a remote backcountry experience.

Twelve (12) Shooting Sports certification workshops were hosted where 156 adult volunteers received certification as a shooting sports instructor.

Camp TURF is a two-week residential summer academy for Oklahoma youth entering grades 9 and 10, specifically focused on exploring careers in horticulture science. Camp TURF provides active learning in water conservation, solid waste management, plant science, ag communications, landscape architecture, greenhouse management, etc. In 2016, 20 youth from around the state participated in Camp TURF.

Over thirty-one thousand (31,221) youth and volunteers participated in educational trainings,

events and activities related to Agriculture and Natural Science project areas.

Over twenty thousand (>20,000) participated in agriculture literacy and Ag in the Classroom activities and trainings.

Results

One thousand three hundred and eighty-five (1,385) youth participated in state sponsored shooting sports events.

Sixty-six youth experienced 2-, 5-, or 13-days of intensive horticulture training.

Within the Agriculture/Natural Science project areas, when 9-12 year-olds were asked to compare themselves against peers:

?86% knew food comes from the farm to the dinner plate.
?74% indicated a better understanding of how to take good care of their pets and/or livestock by feeding them and meeting their other needs.
?82% were setting goals but have not thought much about trying to reach a goal.
?79% indicated they tended to more closely identify with their peers when it came to topics like:
?The importance of caring for things in nature.
?The degree to which they like science and want to learn more about it.
?Doing what they have to do or are told to do
?Intended to pursue a college education

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Youth will increase their ability to use STEM technologies and their awareness of career opportunities in science and technology.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	45372

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The US is falling dangerously behind other nations in developing its future workforce of scientists, engineers, and technology experts. Only 18% of US high school seniors are proficient in science (NAEP, 2005). Oklahoma 4-H is combating this issue by teaching youth about Science Technology, Engineering, and Math (STEM.)

What has been done
The Oklahoma 4-H program has taken this statistic to heart and is addressing the issue through training teens, educators and adults in STEM curriculum.

In 2016:
Five in-depth STEM trainings were held for 4-H CES Educators
Two workshops for 4-H volunteers
Two in-depth STEM trainings for teams of youth and adults. Part of this activity included the purchase and distribution of 100 National Youth Science Day kits which were used to train volunteers and adults in the engineering design process and experimental design. Each kit was designed for minimum if eight youth. Over 2,100 youth were introduced to science skills and careers through this single activity.

Results
According to the 2016 Program Activity Reporting System
Oklahoma 4-H Educators spent over 6,000 hours teaching, promoting and evaluating 4-H STEM projects.

They held 416 demonstrations, 385 conferences, and almost 2,000 personal visits with 4-H volunteers, parents and youth.

In addition to this they reported over 7,000 volunteer hours and 90,000 multimedia contacts. Through their STEM based educational programming educators taught 4,823 youth STEM concepts.

More than twenty-one hundred (>2,100) youth participated in a 4-H Science event or activity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

Youth will develop an understanding of the relationship between diet/nutrition/exercise and physical, mental and emotional health and will demonstrate an increase in healthy lifestyle choices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	58874

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The 2014 State of the State?s Health Report (Oklahoma) reveals ongoing challenges as well as signs of promise for improved health status. However, areas of continued challenges include:
?Oklahoma has the third highest rate of death due to heart disease in the nation
?Oklahoma has the fourth highest rate of death due to stroke in the nation
?Oklahoma has the fourth highest rate of death due to diabetes in the nation contributing to our high mortality rates are behavioral risk factors that disproportionately overburden Oklahomans and negatively affect our children?s future health, academic achievement and our economy.
?Oklahoma has the next to the lowest rate of fruit consumption in the nation
?Oklahoma has the 44th lowest rate of vegetable consumption in the nation
?Oklahoma is the 44th leas physically active state in the nation
?Oklahoma has the sixth highest rate of obesity in the nation
?Without question, there is much work to do to improve the health of our state. However, there are reasons for hope and celebration.

What has been done
The goal of Oklahoma 4-H Healthy Living is to improve the health and fitness levels of Oklahoma children and families through food and nutrition education and physical fitness programming. Teens across the state were trained to serve as teachers and to assist with the implementation of various physical fitness and nutrition programs as we worked together to reach well over 5,000 underserved children. The ?teens as teachers? trainings focused on education and activities to engage youth in developing a positive understanding of health, so they make healthier food and nutrition choices and incorporate daily exercise that leads to healthier lives.

Over nine thousand (>9,000) youth participated in a 4-H event or activity related to Healthy Living

Results
A $68,000 Youth Voice/Youth Choice Walmart Healthy Living grant was awarded through National 4-H Council.

To achieve our goals 33 healthy living mini-grants were awarded to county sites around the state and four Extension districts where healthy living projects were implemented in both urban and extremely rural parts of the state.

Additionally, five state wide programming efforts were implemented to help achieve our goals
1)Yoga for Kids (2 State-wide educator trainings)
2)Get Fit 4 Life (OK 4-H curriculum supported and district kits stocked) curriculum supports 10 lessons on food/beverage choices and each lesson contains a physical activity and take home component for families
3)Team of Oklahoma youth attended the National 4-H Healthy Living Summit and have provided activities and education since returning home
4)4-H HERO (Health Educators Reaching Others). Development of county-based healthy living ambassadors (4-H HERO) and partnership with Oklahoma State University, America?s Healthiest Campus? as part of OSU Wellness Strategy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Turfgrass Development and Management

☑ 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
111	Conservation and Efficient Use of Water	19%	0%	10%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	5%	0%
202	Plant Genetic Resources	8%	0%	10%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	8%	0%	10%	0%
204	Plant Product Quality and Utility (Preharvest)	8%	0%	5%	0%
205	Plant Management Systems	25%	0%	15%	0%
206	Basic Plant Biology	0%	0%	5%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	11%	0%	10%	0%
212	Pathogens and Nematodes Affecting Plants	11%	0%	10%	0%
216	Integrated Pest Management Systems	10%	0%	20%	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	1.7	0.0	2.0	0.0
Actual Paid	5.0	0.0	2.5	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**
149437	0	103583	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
149437	0	103583	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
151126	0	579759	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

New turf germplasm/varieties having improved abiotic and biotic stress resistance/tolerance will be generated by our program.
Research will identify the elite performing species and varieties from both our program and from industry. We will identify new or refined integrated management practices to achieve goals. Research and extension activities will be conducted to improved efficiency of water application and to reduce runoff.
Educational materials will be developed featuring improved varieties and how to properly install and maintain them.
Highly effective educational programming and consultations will be conducted for professionals and consumers to help integrate this information into existing management programs.

2. Brief description of the target audience

Audiences include governmental, private industry and multiple end-user areas. Research audiences: basic and applied plant science/turf science researchers, including those from the CSSA, and ASHS. Funding agency audiences: USGA, GCSAA, USDA, OTRF and many private corporations. New cultivars developed as well as products such as trade articles, fact sheets, and educational programming will be provided to the target audiences characterized as the turfgrass production sector (sod and seed producers), service sector (landscape/lawncare and pest control operators) and turf managers (which include the golf course, parks & grounds, right of way managers and home consumers).

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	9280	71911	400	0

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	2	7	12

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of final stage experimental bermudagrasses sent to national testing phase in the NTEP bermudagrass trial once every 5 years

Year	Actual
2016	0

Output #2

Output Measure

- Number of fine turf program and roadside vegetation management workshops conducted and trade presentations presented each year.

Year	Actual
2016	75

Output #3

Output Measure

- Number of new bermudagrasses developed by our program that are commercially released to the trade for production.

Year	Actual
2016	0

Output #4

Output Measure

- Number of cultivar evaluation trials; weed control trials; management factor trials; and physiological, morphological or other investigations conducted on turfgrass.

Year	Actual
2016	80

Output #5

Output Measure

- Number of scientific abstracts, posters or oral presentations presented to scientific audiences.

Year	Actual
2016	20

Output #6

Output Measure

- Number of turfgrass managers trained in recognition and selection of improved varieties and implementation of integrated turfgrass management systems

Year	Actual
2016	501

Output #7

Output Measure

- Number of email and news releases generated

Year	Actual
2016	0

Output #8

Output Measure

- Number of consultation phone calls and emails completed

Year	Actual
2016	0

Output #9

Output Measure

- Number of Extension reports and fact sheets generated

Year	Actual
2016	0

Output #10

Output Measure

- Number of extension field days, workshops, short courses and conferences conducted

Year	Actual
2016	0

Output #11

Output Measure

- Number of pesticide applicators receiving continuing education training (CEU workshops). Not reporting on this Output for this Annual Report

Output #12

Output Measure

- Number of initial pesticide applicator certification schools conducted. Number of initial pesticide applicator certification schools conducted. Number of initial pesticide applicator certification schools conducted. Number of initial pesticide applicator certification schools conducted Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of ODOT employees achieving certified pesticide applicator status following initial certification training.
2	Percentage of professional fine turf managers continuing adoption of improved BMPs and IPM practices when surveyed following educational events.
3	Percentage of ODOT roadside vegetation managers continuing adoption of improved BMPs and IPM practices
4	Number of licensed or sublicensed sod producers and seed producers producing OSU developed turfgrasses. Both new and retained production licenses each year.
5	Number of Oklahoma sod producers producing improved turfgrasses suggested for use by OSU Turfgrass Extension Program.

Outcome #1

1. Outcome Measures

Percentage of ODOT employees achieving certified pesticide applicator status following initial certification training.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Percentage of professional fine turf managers continuing adoption of improved BMPs and IPM practices when surveyed following educational events.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	90

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma Lawncare Business operators use pesticides to control weeds, insects, and diseases in lawns. These businesses serve consumers as they treat home landscapes and commercial businesses with lawns. They may also contract with public entities such as public gardens or parks to maintain turfgrass areas. Pest control is challenging and treatments for pest control can have unintended affects to the environment.

What has been done
Identifying and using best management practices for pest control can reduce the amount of pesticides applied which can also reduce negative environmental impacts. Reducing pesticide usage may also contribute to a more healthy environment for people, pets, and plants in the landscape.

Results
The OSU Turfgrass Management program is based out of the Horticulture & Landscape Architecture Department and it cooperates with turf scientists in the Plant & Soil Science Department and the Department of Entomology & Plant Pathology. The turf extension education

efforts of my program are estimated to have increased profitability for Oklahoma lawn care businesses in an amount exceeding $500,000 in 2016. This profit increase was realized by following my well detailed annual weed control programs which reduce very expensive customer call backs for both annual and broadleaf weed escapes. Use of Lawncare Best Management Programs also increase lawn care business owner profits while reducing off-target environmental damage from pesticide and nutrient runoff and leaching. We do not have a monetary value for the reduced environmental damage by implementation of suggested BMPs such as confining phosphorus applications to lawns where only a phosphorus application is needed as determined by soil testing. Over 300 certified turf & ornamental applicators and 68 certified right-of-way pesticide applicators receive continuing education via our turf extension and right-of-way outreach programing each year, resulting in improved turf management skill sets.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Percentage of ODOT roadside vegetation managers continuing adoption of improved BMPs and IPM practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	90

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Maintaining roadside right-of-ways is expensive due to the amount of labor needed to mow vegetation. Yet, maintaining roadside right-of-ways is vital to public safety. If vegetation is not controlled, sightlines can be reduced, resulting in potential for vehicular accidents.

What has been done
Oklahoma State University?s turfgrass program has been working with the Oklahoma Department of Transportation (ODOT) for many years to train ODOT employees best management practices for roadside vegetation management. The program has also completed many research projects

investigating various methods of vegetation control and also performance of many wildflowers or other desirable species in roadside areas.

Results

The comprehensive contracted research and extension training services provided by the OSU Dept of Horticulture & Landscape Architecture?s Roadside Vegetation Management Program (OSU RVM) saves the ODOT a conservative $500,000 per year and possibly up to $3.8 million per year in operating expenses. This is achieved by ODOT following a research-based integrated mowing and herbicide program for weed control as opposed to a ?mowing only? program on Oklahoma roadsides. ODOT manages over 800,000 acres of roadside right-of-way. Around 140,000 acres of this are mowed roadsides managed with three to four mowings per year. Between 90,000 and 110,000 acres of mowed state roadside is also treated by ODOT with herbicides each year as a part of the integrated program. Without the integrated program, even more mowing would need to be performed simply to reduce the height of several taller weed species which simply are not killed by mowing. The actual mowing savings may be 1.0 to 2.5 mowing cycles if mowing were used alone to achieve policy objectives of maintaining vegetation below the required maximum height in the safety zone. The safety zone has a 12 inch maximum vegetation height limit, so as to help the motoring public see upcoming hazards. The OSU RVM Program trains over 700 ODOT employees each year in effective, reduced risk pesticide selection and use. Between 75 and 100 new right of way applicators receive initial certification training and sprayer calibration training each year to improve their skills in roadside vegetation management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Number of licensed or sublicensed sod producers and seed producers producing OSU developed turfgrasses. Both new and retained production licenses each year.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2016 75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oklahoma has experienced mild to severe droughts during the past several years. Dry conditions result in the need to irrigate turfgrass more or in turfgrass that goes dormant during hot, dry summers.

What has been done

Identifying turfgrass cultivars that perform well under drought conditions would benefit the turfgrass industry and consumers. In Oklahoma, bermudagrass and zoysiagrass are the turfgrasses of choice because they are warm season grasses that can survive during hot summers.

Results

In 2016 we evaluated 10 final stage advanced lines each of Bermudagrass and Zoysiagrass for drought resistance. Improvements in visual quality and drought resistance were found in several experimental lines as compared to existing commercial standards. The vital information obtained from these trials will allow cooperating turfgrass breeders to advance and make commercialization decisions concerning their lines that were included in these trials in 2016. Promising lines exist within each of these species with great potential for commercialization and large industry impact in the future. A total of six turfgrass breeders from the multi-state SCRI Warm-season Turfgrass Improvement Team are using the datasets gained from this research to make decisions on cultivar advancement. Turfgrass breeders cooperating with researchers and extension faculty are from the Oklahoma State University, Texas A&M University, North Carolina State University, the University of Georgia and the University of Florida.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)

Outcome #5

1. Outcome Measures

Number of Oklahoma sod producers producing improved turfgrasses suggested for use by OSU Turfgrass Extension Program.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

During 2016 there were very few factors that hindered adoption of IPM, BMPs and use of new or better adapted species with the exception of those areas that continued in drought or were inundated by excess rain. California turfgrass installation markets were somewhat suppressed due to chronic drought and either real or anticipated new regulations concerning turfgrass usage in the landscape. With respect to the implementation of BMPs, the lingering drought in western Oklahoma and other western states increased the willingness to adopt future BMPs. This is due to the drought causing focus on the most fundamental problems (drought resistant varieties) and minor distractions such as lighter color or coarser leaf texture become tertiary compared to having a grass with improved stress tolerance and or lower water use rate

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Adoption of new cultivars and educational practices are informally assessed during one-on-one consultations by phone, email and site visits. Formal post-educational session adoption of new varieties and management techniques is regularly assessed at the OSU Turf TIP Team's premier educational event, the Oklahoma Turfgrass Conference and Trade Show as well as in one-on-one consultations following the annual Turfgrass Short Course, at Turfgrass Field Day and during the time of end-user site visits. Eight one-half day round table discussions are held around Oklahoma in September to respond to concerns and questions posed by Oklahoma Department of Transportation field yard managers. This round table discussion yields insights following the preliminary annual survey of ODOT roadside programs and allows our team insight into the changes undertaken by ODOT during the current season and those planned in the upcoming year.

Key Items of Evaluation

Perceived quality and value of education offered, perceived quality and value of education offered by trade show vendors, was education valuable enough that you would participate in educational sessions in the future, increase in knowledge, increase in management effectiveness, use of new or improved varieties, use of scouting techniques, pest id prior to pesticide selection and use, and planned changes to management programs in the next calendar year.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Community Resource and Economic 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
608	Community Resource Planning and Development	100%	0%	100%	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	9.0	0.0	1.0	0.0
Actual Paid	10.0	0.0	1.1	0.0
Actual Volunteer	2.5	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**
298873	0	46419	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
298873	0	46419	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1082274	0	259808	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Strategic planning training and strategic planning for communities, infrastructure planning, community

service plans, training of county elected officials, engineering and manufacturing consulting, solid waste management technical assistance, community economic development studies, community leadership and agricultural leadership development, and entrepreneurship training and development.

2. Brief description of the target audience

The target audience includes community leaders (volunteer and elected), agricultural leadership participants and alums, and business owners/prospective owners, hospitals, schools, chambers of commerce, entrepreneurs, other agencies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	16828	952548	400	50000

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	4	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of community services plans completed

Year	Actual
2016	1

Output #2

Output Measure

- Number of education modules (written curricula) completed

Year	Actual
2016	2

Output #3

Output Measure

- Number of county officer training courses conducted

Year	Actual
2016	52

Output #4

Output Measure

- Number of manufacturing firms receiving applications engineering assistance

Year	Actual
2016	27

Output #5

Output Measure

- Number of county officials completing an educational certificate of achievement

Year	Actual
2016	125

Output #6

Output Measure

- Number of solid waste-related trainings completed

Year	Actual
2016	14

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number improving business skills
2	Number of manufacturing jobs created or retained
3	Number of communities where capacity was increased
4	Number of participants that plan to open/expand a business
5	Number of communities that build plans for growth and/or improvement
6	Number of leadership class graduates actively participating in community or industry
7	Rural Library Hotspot Lending Program

Outcome #1

1. Outcome Measures

Number improving business skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	151

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Number of manufacturing jobs created or retained

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Of the over 3500+ manufacturers in Oklahoma, over one-third are located in rural areas and are extremely important to their local economies. The loss or downsizing of even one of the wealth-generating small- or mid-sized companies can have devastating consequences for the host and surrounding communities. With agriculture and energy industries no longer requiring large labor forces, rural manufacturers supply much needed jobs in rural communities. These rural manufacturers face particular difficulty in getting relevant and usable information and technical assistance that will keep them abreast of the rapid changes in manufacturing technology.

What has been done
To address the difficulties faced by our small- to medium-sized rural manufacturers, the Division of Agricultural Sciences and Natural Resources (DASNR) in association with the College of Engineering, Architecture and Technology (CEAT) at Oklahoma State University work in partnership to provide technical assistance through the Applications Engineering Program, which is evolving to the Manufacturing Design and Technology Transfer Program, while maintaining the presence of the Applications Engineers. Since 1997, Applications Engineers have been deployed across the state to provide on-site engineering assistance to small and medium-sized manufacturers. Funded by the NIST (National Institute for Standards and Technology) Manufacturing Extension Partnership (MEP) and OCAST (Oklahoma Center for the Advancement of Science and Technology) in partnership with the Oklahoma Cooperative Extension Service and entities mentioned above and including Technical Schools across Oklahoma, this multi-faceted program, with engineering services, is unique among MEP programs across the country.

Results
For a client to receive engineering assistance, they must agree to a post-project impact assessment. This impact assessment uses procedures developed by NIST for the MEP. The client is contacted some months after the completion of an activity and is asked a series of questions designed to assess the impact of the effort.
The impact of this program is measured in several ways. One is the economic value of the service to the company as reported by the client. Another measure is the number of jobs created or retained. Both impacts are measured by an independent survey of the client. Number of jobs created or retained is translated into economic impact using an income multiplier to compute the direct, indirect, and induced effects due to a change in the number of jobs in the manufacturing sector.

The multiplier was developed from data collected from two different sources. First, the average salary for manufacturing in Oklahoma ($34,323) was taken from the U.S. Bureau of Labor Statistics published information for 2001. Secondly, the income multiplier of 2.2 was obtained from IMPLAN data for Oklahoma. The total economic impact can be computed by multiplying the average annual salary times the income multiplier to arrive at $75,511 for each new or retained job in the manufacturing sector.

In 2016, the Applications Engineers client projects had the following impacts:

New sales$28,192,500
Sales retained that would have otherwise been lost$8,005,000
Cost savings$4,671,800
Costs avoided$758,425
Bottom line impacts (new facilities and equipment, new jobs, etc.)$10,859,850
Total impact$52,487,575

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

Number of communities where capacity was increased

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Communities lack resources to create a culture of wellness and encourage healthy behaviors.

What has been done
As part of a national program known as Stronger Economies Together, I facilitated seven strategic planning meetings in the four county region known as ?Crossing Borders Region,? which included Adair, Cherokee, Delaware and Sequoyah Counties. One of these meetings was a Civic Forum at which over 90 people from throughout the region attended ? one of the largest turnouts for this event in the nation. The program was funded by a USDA-Rural Development grant administered by the Southern Rural Development Center. The culmination of the program was the completion of a ?High Quality Plan? and a $5,000 seed grant from USDA-Rural Development.

Results

For several of the participants, this was the first time they were asked to be involved with economic development in their region, such as Renee Fite (President, Arts Council of Tahlequah) and Tamara Hibbard (Mayor of Marble City, OK). The process also empowered communities throughout the region to common issues by providing them with data for grant writing, networking opportunities for sharing ideas and resources, and connecting participants with state agencies and funding sources (such as the Oklahoma Water Resources Board?s grant and loan programs to fund rural water district consolidation).

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

Number of participants that plan to open/expand a business

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Number of communities that build plans for growth and/or improvement

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #6

1. Outcome Measures

Number of leadership class graduates actively participating in community or industry

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	23

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers, ranchers and rural residents feel threatened by the urbanization of Oklahoma and the subsequent shift in legislative power to the urban parts of the state. Additionally, the existing leadership in Agriculture is aging and there is a need to identify and cultivate new leadership.

What has been done
The Oklahoma Agriculture Leadership Program (OALP) is a year-long leadership development program that educates individuals about new facets of agriculture, the political process and government agencies, and encourages networking and collaboration across the state.

OALP graduates have a greater understanding of people and processes. They also have a greater understanding of various systems of economics and government, both locally and nationally, and are able to solve problems and explore opportunities for Oklahoma agriculture and rural communities. During 2016, 23 participants spent 26 days learning about leadership and empowering their leadership skills. This experience resulted in participants being more vocal in sharing with their local representatives about issues that are important to Oklahoma agriculture and their rural communities, especially after visiting with legislators in Washington, D.C.

Results
We have 27 current members in Class XVIII who started this program in August 2016 and all of them are active in the community and their industry. Members of Class XVIII live in 22 different communities throughout the state and make an impact in their agricultural activities by being more knowledgeable about agricultural issues and can communicate these issues to members of their local community. The service projects which we conduct at every seminar have caused some class members to become more involved in service activities in other groups to which they belong in their local communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #7

1. Outcome Measures

Rural Library Hotspot Lending Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Access to (and use of) broadband Internet has become essential to fully participating in today?s society. Use of this technology has spread across nearly every facet of our lives, including keeping in touch with family and friends, searching or applying for jobs, or staying up-to-date on local events. There is, however, a very real ?digital divide? between those who have their own home broadband connection and those that do not. Census survey data from 2015 indicates that only 44% of households with annual incomes of $25,000 or less have a home broadband connection, which is less than half of the rate for households making $100,000 or more (91%).

What has been done
This extension program seeks to build upon recent library efforts to ?loan out the Internet.? By lending wireless hotspot devices (which connect to a local cellular provider), participating libraries are providing home (and road!) broadband connections for their constituents to use as they please. Nearly all of these programs to date are based in urban areas, and the only existing one in Oklahoma is in Tulsa. Such lending programs are ripe for success in rural areas, where adoption rates are lower and access issues are higher than in more urban parts of the country. Funded by an IMLS grant in 2016, this program began by making site visits to 23 libraries in rural parts of Kansas and Maine to discuss their participation in a pilot lending program that ran during 2015. In addition to library personnel, we talked to community stakeholders such as individuals working in economic development, healthcare, telecommunications, religious organizations, and non-profits to uncover potential program impacts. We also held 2 focus groups with actual users of the library devices in 2016 (significantly more will follow in 2017). Our project has resulted in a ?How-to-Hotspot? guide that walks rural libraries through the basics of setting up this type of program.

Results
The current actual impact of this extension program is limited, since we are still in the middle of our research and have only just begun disseminating several initial findings. However, the potential impact is dramatic given the array of categories in which residential Internet access can affect individual?s lives. In our focus groups and site visits, we heard stories of income earned, social connections made, educational opportunities pursued, and improvements in mindset that came about due to this program. For example, several parents who home school their children use the devices to find exercises and curricula for specific topics. Others explored business opportunities or career changes by searching online. Our work will push for more rural libraries across the nation (and in Oklahoma) to implement these lending programs ? and impact many lives by providing them with broadband access. We hope to quantify the economic and social

outcomes associated with this access. Future iterations of these annual impact reports should be able to more accurately quantify the difference that these programs are making for the public good.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Competing Public priorities

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Integrated Pest Management

☑ 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
133	Pollution Prevention and Mitigation	6%	0%	10%	0%
202	Plant Genetic Resources	5%	0%	5%	0%
205	Plant Management Systems	9%	0%	10%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	16%	0%	20%	0%
212	Pathogens and Nematodes Affecting Plants	10%	0%	20%	0%
213	Weeds Affecting Plants	17%	0%	5%	0%
215	Biological Control of Pests Affecting Plants	11%	0%	5%	0%
216	Integrated Pest Management Systems	20%	0%	20%	0%
601	Economics of Agricultural Production and Farm Management	4%	0%	5%	0%
901	Program and Project Design, and Statistics	2%	0%	0%	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	4.0	0.0	5.0	0.0
Actual Paid	5.0	0.0	3.2	0.0
Actual Volunteer	0.5	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**
164644	0	134321	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
164644	0	134321	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
371712	0	751802	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Fulfill the specific Inputs and Activities outlined in the "Oklahoma State University Coordination Program for IPM Oklahoma!" (as made to USDA-NIFA "Extension Integrated Pest Management Coordination and Support Program (EIPM-CS)") , including the identification of new program priorities for future funding.

Provide information on IPM upon request to stakeholder groups, and attend stakeholder sponsored meetings as invited.

Conduct targeted research on pest status, suppression and IPM approaches for crop, animal, and urban systems in Oklahoma.

Develop and deliver extension IPM programs to stakeholders, in the form of workshops, field demonstrations and meetings.

Develop pesticide applicator education and pesticide information through printed media, fact sheets and current reports.

Assess impact of educational activities on stakeholder IPM

2. Brief description of the target audience

Agricultural Producers, Agricultural Groups, Commercial Growers, Retailers, Agricultural Professionals (private, commercial and non-commercial), and landowners, nurseries, individual stakeholders, storers and handlers of grain

3. How was eXtension used?

Specialists participate in the Food Safety, Grapes, Red Imported Fire Ant, and Urban IPM CoPs.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	880	505505	0	0

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	5	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Stakeholder assessment

Year	Actual
2016	1

Output #2

Output Measure

- Pesticide applicator education schools and workshops

Year	Actual
2016	15

Output #3

Output Measure

- County-based variety field tours of row-crops and small grains for Oklahoma growers

Year	Actual

2016	13

Output #4

Output Measure

- Extension publications will be created or revised

Year	Actual
2016	10

Output #5

Output Measure

- News releases on the subject of IPM horticulture crops, livestock, agronomic crops and urban systems (Public Housing).

Year	Actual
2016	223

Output #6

Output Measure

- A summarized annual report will be developed for distribution to involved stakeholders demonstrating the impact of IPM programs to Oklahoma citizens.
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased use of pest management approaches for targeted cropping system acres
2	Number of trained certified pesticide applicators
3	Increase in percent of growers with knowledge and adoption of iWheat program for winter wheat.
4	Home gardeners will gain knowledge about IPM practices for their home gardens.
5	People will gain knowledge about IPM programs by visiting the IPM Oklahoma! booth at various meetings, including the Oklahoma Ag Expo and the Oklahoma School Plant Managers Association.
6	Participants will understand connections between pest management of bed bugs, the near environment, housing, health, and well-being resulting in an increase in the number of Oklahoman's practicing bed bug risk reduction.
7	Stakeholders will increase awareness of invasive species in Oklahoma (such as saltcedar, brown marmorated stink bug, emerald ash borer, etc) and how they might be managed.
8	Sugarcane Aphid Management in Grain Sorghum
9	Monitoring mosquitoes for Zika virus detection
10	Cotton insect monitoring

Outcome #1

1. Outcome Measures

Increased use of pest management approaches for targeted cropping system acres

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	20000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sclerotinia blight is a limiting factor in the production of high-yielding peanuts in Oklahoma and Texas. About 25% of the acreage in Oklahoma and about 10% of the acreage in Texas is infested with the fungus that causes Sclerotinia blight, totaling nearly 20,000 acres. Application of fungicide to control Sclerotinia blight typically cost from $50 to $100 /acre and significantly impacts peanut profitability.

What has been done
The Oklahoma Peanut Improvement Team have been working for many years to improve the resistance of peanut varieties to Sclerotinia blight. This has been accomplished partly by identifying resistant germplasm and incorporating it into high O/L peanut varieties using conventional breeding methods. Performance trials demonstrated the value of the disease resistant varieties to growers.

Results
The result has been the development and release of three Sclerotinia blight - resistant varieties (Red River Runner, Lariat, and OLé). These were grown on an estimated 50% of the infested acreage in 2016 resulting in a savings of about $1,000,000 in fungicide costs in the region. The estimated benefits do not include increased yields and grades associated with the cropping of these varieties.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

Number of trained certified pesticide applicators

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2762

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Pesticide Safety Education Program: teaching, training, and outreach impacts 10,000s of private and commercial pesticide applicators, Master Gardeners, several native American Tribes pest control operators, government workers, and 1,000?s of Oklahoma citizens, and citizens of contiguous states. This results in conscientious use of pesticides for household and structural insect pests and reduces the probability of environmental pollution.

What has been done
Pesticide Safety Education programs have been expanded and revised to meet changing needs of pesticide applicators. Additional ?Test Help? sessions have been implemented to meet growing needs of the pest control industry.

Results
General household pests and structural pest control training programs resulted in a 90% reduction of OK citizen complaints to ODAFF concerning problems with pest management company services and successful pest control operations. Commercial applicators certified or recertified numbered 2,348, and 2,893 additional training manuals distributed. Private applicators received 1,105 training manuals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
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
901	Program and Project Design, and Statistics

Outcome #3

1. Outcome Measures

Increase in percent of growers with knowledge and adoption of iWheat program for winter wheat.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Home gardeners will gain knowledge about IPM practices for their home gardens.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

People will gain knowledge about IPM programs by visiting the IPM Oklahoma! booth at various meetings, including the Oklahoma Ag Expo and the Oklahoma School Plant Managers Association.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Participants will understand connections between pest management of bed bugs, the near environment, housing, health, and well-being resulting in an increase in the number of Oklahoman's practicing bed bug risk reduction.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Stakeholders will increase awareness of invasive species in Oklahoma (such as saltcedar, brown marmorated stink bug, emerald ash borer, etc) and how they might be managed.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Sugarcane Aphid Management in Grain Sorghum

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sorghum is grown on 310,000-400,000 acres in Oklahoma. In 2013, sugarcane aphid was found infesting sorghum in 2013, including one county in Oklahoma. It caused significant yield losses in sorghum in Texas, Louisiana, and Mississippi. Research conducted in 2013, and reports indicated that currently registered products for sugarcane aphid control in sorghum were ineffective.

What has been done
The discovery of this aphid in 2013 prompted the Oklahoma sorghum growers to ask the OSU IPM coordinator and the Pesticide Education Program coordinator to support an emergency Section 18 registration for the use of sulfoxaflor to help control them. In 2014, a team of OSU researchers and extension specialists formed a Sugarcane Aphid IPM team to address this crisis. The team obtained support from the Sorghum Checkoff program to conduct research/extension demonstrations in 2015 and 2016 to evaluate chemical and varietal control options and the impact of the aphid on grain sorghum production. In addition, Dr. Royer obtained a $300,000.00 multi-state Crop Protection and Pest Management grant from USDA?s National Institute for Food and Agriculture to develop a rapid, easy-to-use sampling program to assist growers in making

control decisions. We provided results of our efforts to Oklahoma sorghum growers through news releases, blogs, field day presentations and television programs (Sunup; viewership 20,000) to assist them in identifying sugarcane aphid, and determining the need for control.

Results

From 2014-2016, sugarcane aphid infested a minimum of 200,000 acres in 32 counties statewide. Two insecticides, sufoxaflor and flupyradifurone, were identified to be effective in controlling the aphid. Several commercial sorghum hybrids have been identified that show good levels of resistance to sugarcane aphid. The first year of data for the development of a sampling program was collected in 2016. Based on the results of the research/extension demonstrations conducted by the Sugarcane Aphid IPM team, a poorly controlled infestation of sugarcane aphid was capable of reducing yield by an average of 18-30 bushels per acre. The results of the applied research coordinated by the Sugarcane Aphid IPM Team has potentially saved Oklahoma sorghum growers a minimum of ca. $7.2-$14.4 million per year in lost grain yield from sugarcane aphid.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #9

1. Outcome Measures

Monitoring mosquitoes for Zika virus detection

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are 62 recorded species of mosquitoes in Oklahoma, many of which are involved in the transmission of diseases with impact humans and animals in the state. The main mosquito species that transmits the Zika virus has not been officially verified and reported in Oklahoma since 1940.

What has been done

In the summer of 2016, six urban areas in Oklahoma were monitored for the presence of Aedes aegypti, the main mosquito species which transmits Zika virus, in addition to many other mosquito species.

Results
Between July and September 2016, Aedes aegypti was identified in four urban areas in southern areas of central and western Oklahoma. Because of these findings, two official statements were issued by the Oklahoma State Department of Health and Oklahoma State University to the news media. These statements were picked up by local, national, and international news sources, resulting in positive exposure for Oklahoma State University and results in one community meeting. The impact of this finding is still being elucidated but it is now known that the main mosquito species that transmits Zika, Dengue, and Chikungunya viruses also exists in Oklahoma.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #10

1. Outcome Measures

Cotton insect monitoring

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The bollworm/tobacco budworm complex has been the target of insecticide applications applied annually to a few acres of non-Bt cotton. Monitoring moth activities helps determine species ratio and peak ovipositional activity for these insects.

What has been done
Traps were located near the communities of Altus, Ft Cobb, Hollis, and Tipton. In addition to Heliothine activity, beet armyworm catches were also monitored at each location. Traps were maintained between June 1 and October 1, 2016. Although both species do coexist and are considered the same by growers, this species ratio is important since tobacco budworms exhibit a

higher level of resistance to insecticides than bollworms. Also, it would be important to know this ratio in the event of Bt cotton failures. It is extremely important to detect fluctuations in species ratio of each ovipositional period and adjust insecticide recommendations accordingly if necessary.

Results

A total of 1,227 moths were captured between the weeks of June 1 and October 1. This is a decrease of 28.1% percent of 2015 trap totals. Bollworms comprised 89.6% of the total catch in 2016. Beet armyworm moth catches were low.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

none

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Food Safety - Agricultural Biosecurity

☑ 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
211	Insects, Mites, and Other Arthropods Affecting Plants	5%	0%	5%	0%
212	Pathogens and Nematodes Affecting Plants	0%	0%	50%	0%
213	Weeds Affecting Plants	10%	0%	0%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%	0%	35%	0%
903	Communication, Education, and Information Delivery	75%	0%	10%	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	0.5	0.0	3.0	0.0
Actual Paid	0.5	0.0	3.5	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**
0	0	147374	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	147374	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
75000	0	824861	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Maintain and expand, as appropriate, the OSU National Institute for Microbial Forensics & Food and Agricultural Biosecurity, a multi-disciplinary unit to support and address issues of crop and food safety and biosecurity, and their impacts.
2. Conduct scientific research targeted specifically towards plant pathogen forensics, produce safety, sociological impacts of terrorism and other areas of agricultural biosecurity.
3. Continue to offer targeted coursework for students seeking M.S. or Ph.D. degrees in established programs such as Plant Pathology, Biochemistry, Plant Sciences or Forensic Sciences, who seek plant pathogen forensics. Consider establishing an academic "track"leading to a certificate or Minor in this area.
4. Work with other members of the Entomology & Plant Pathology Department to revise and enhance the Bioforensics Option within the undergraduate Entomology Degree Program.
5. Increase visibility and impact of NIMFFAB through education and outreach (an interactive website, student internships, field exercises, hosting meetings).
6. Participate on/in local and national grant panels, advisory boards, review committees, expert bodies and other activities, as appropriate, to maintain visibility of OSU and NIMFFAB in the national biosecurity, homeland security, microbial forensics, and food safety communities.

2. Brief description of the target audience

Key members of National and Oklahoma homeland security community (DHS, FBI, CIA, etc)
Key members of National and Oklahoma agricultural leaders and representatives
Oklahoma extension personnel
Master gardeners
Oklahoma producers and crop consultants
OSU students and faculty
Professional/scientific societies
Key industries
The public

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 4

Patents listed

?Apparatus and method for biologic sample rapid collection and recovery device, and convenient storage. Patent No.: US 9423398 B2. 2016.

?Cold Plasma Devices for Wound Care and Decontamination?. OSU Invention Disclosure No. 2017-019.

?Cold Plasma Devices for Decontamination of Foodborne Human Pathogens?. PCT/US16/43899, OSU Disclosure 2015-17

?Production and Evaluation of Bacillus spp. as Probiotics with Multifunctional Benefits for Farm and Companion Animals?. OSU Invention Disclosure No. 216.50.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	20	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU faculty, students and staff affiliated with, or collaborating with NIMFFAB.

Year	Actual
2016	65

Output #2

Output Measure

- Number of outside-OSU researchers, agencies and entities sponsoring, collaborating with or benefiting from NIMFFAB activities.

Year	Actual
2016	93

Output #3

Output Measure

- Number of grant/contract proposals submitted in agricultural microbial forensics and biosecurity, and food safety.

Year	Actual
2016	23

Output #4

Output Measure

- Number of grants/contracts awarded in those areas.

Year	Actual
2016	18

Output #5

Output Measure

- Number of journal articles submitted with emphasis on agricultural microbial forensics and biosecurity.

Year	Actual
2016	21

Output #6

Output Measure

- Number of students taking classes or seminars developed as part of the OSU Agricultural Biosecurity initiative.

Year	Actual
2016	35

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of invitations to agricultural biosecurity team members for participation in initiatives, programs, presentations, and consultations related to agricultural biosecurity and microbial forensics
2	Number of team-associated individuals who a. Performed a project related internship b. Were hired into a professional position in the biosecurity or food safety field c. Served on agricultural biosecurity or food safety review committees or panels
3	Graduate students who will populate laboratories whose testing is related to the protection of human, animal, and plant health from infection by pathogenic organisms
4	Number of students enrolled in courses that contain a significant portion of material on agro-terrorism, bio-terrorism, or food safety
5	Foodborne illnesses associated with nut production
6	Capturing Global Biodiversity of Pathogens by Whole Genome Sequencing
7	Field Validation of New Microbial Forensics Technologies
8	Plant Biosecurity Program: E-probe Diagnostic Nucleic Acid Analysis (EDNA)

Outcome #1

1. **Outcome Measures**

   Number of invitations to agricultural biosecurity team members for participation in initiatives, programs, presentations, and consultations related to agricultural biosecurity and microbial forensics

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

   Number of team-associated individuals who a. Performed a project related internship b. Were hired into a professional position in the biosecurity or food safety field c. Served on agricultural biosecurity or food safety review committees or panels

   Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

   Graduate students who will populate laboratories whose testing is related to the protection of human, animal, and plant health from infection by pathogenic organisms

   Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

   Number of students enrolled in courses that contain a significant portion of material on agro-terrorism, bio-terrorism, or food safety

   Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

   Foodborne illnesses associated with nut production

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Currently there is a limited understanding of the natural occurrence and potential sources or contributing factors leading to tree nut contamination by human pathogens especially at orchard level. Furthermore, recently, in an effort to improve food safety, FDA, under the ?Food Safety Modernization Act?, has established a new produce safety rule that requires ?an adequate waiting period between animal
grazing and harvesting for covered produce?. However, it is not clear what ?an adequate waiting period? is for produce in general, and in particular, for cattle grazing which is a common practice for native pecan groves to increase diversity and profitability in Oklahoma.

What has been done
We are conducting a comprehensive microbiological survey in native pecan groves include grazed (cattle) and non-grazed 1) to determine the natural prevalence of pecan contamination with human pathogens; 2) to assess potential contamination routes of human pathogen to native pecan; and 3) to evaluate the impact of cattle withdrawal periods from the grove on human pathogen contamination of native pecan.

Results
Preliminary results have revealed the presence of two major foodborne human pathogens: Salmonella and Shiga toxin-producing Escherichia coli (STEC) in soil, cattle feces, and pecan samples. Further experiments will determine the impact of cattle grazing and withdraw periods on the prevalence of these pathogens at these orchards as well as the potential sources of such contaminations. Economic loss to farm families if grazed groves could not be harvested would range from $150 to $1,375 per acre depending on the site and grove management based on current price and yield typical for Oklahoma native groves with different management regimes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

Capturing Global Biodiversity of Pathogens by Whole Genome Sequencing

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The overall program objective and relevance was to build an infrastructure to use genomic information for microbial forensics applications.

What has been done
A consortium called µFORGE, a team consisting of collaborators from MRIGlobal, UTMB, OSU, and cBio, Inc., was established to meet the Whole Genome Approach to Microbial Forensics (WGAMF) program objective. A comprehensive survey of available genome sequences for targeted pathogens and their near neighbors was essential information for making an informed prioritization of these pathogens.

Results
From the conducted survey, the gaps in existing genome sequencing information were identified. OSU team coordinated the sequencing and the assembly to a high quality draft of 18 high consequence plant pathogens. Thus far, 16 of the genomes have been assembled to a high quality draft stage and submitted to NCBI; these are now publically available. This public database information allows for advancements in microbial forensics, diagnostics for high consequence plant pathogens and diseases, and a foundation to begin to better understand the biology of these crop biosecurity agents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Field Validation of New Microbial Forensics Technologies

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The objective and relevance were to test, for the first time, the application of new microbial forensics technologies, developed in previous OSU research, for forensic validity in an actual plant disease outbreak.

What has been done
A team of research cooperators in the U.S., Germany and Israel developed new technologies for pathogen detection and discrimination, assessment of the likelihood that a disease outbreak was intentionally incited, and evaluation of pathogen population biology and ecology, and applied these to an outbreak of salmon blotch of onion, a disease caused by the fungus Fusarium proliferatum, in southern Israel. Tools tested included a decision tool for assessing intentional introduction, pathogen identification via single sequence repeat analysis, and modeling of disease epidemiology.

Results
Each of the tested technologies provided information necessary for investigation of whether a field outbreak of salmon blotch of onion was intentionally incited, as well as providing evidence for the source of the pathogen. The research indicated that the specific F. proliferatum strains associated with the disease outbreak did not originate in the onion seeds used for onion set production, or in the sets themselves. Fungal strain matching indicated that fungal strains having the greatest similarity to the disease-associated strains were those isolated from soil and local vegetation in the region adjacent to the diseased field. This work represented the first field validation of technologies designed to assist law enforcement investigators to evaluate a potential crime scene involving a plant disease.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Plant Biosecurity Program: E-probe Diagnostic Nucleic Acid Analysis (EDNA)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
EDNA is a database-based process that efficiently tests sample-derived DNA sequences for the presence of signs of specific organisms. One of the project objectives was to adapt EDNA for detection, at a high level of sensitivity, all pathogens present in metagenomics data from a complex food matrix.

What has been done
EDNA has been adapted and validated for use in the detection of foodborne pathogens by analysis of metagenomic data acquired from alfalfa sprouts. The data support the use of EDNA as a highly specific and accurate detection method with the potential for the simultaneous detection of multiple foodborne pathogens present in a food sample by the development of e-probes for each pathogen. This new approach to analyze NGS data from metagenomic samples offers tremendous potential for improving the response to foodborne pathogen infections both in the initial detection as well as outbreak situations.

Results
The method was validated using NGS datasets created by sequencing the metagenome of alfalfa sprouts inoculated with 3, Escherichia coli O157:H7 strains. Non-specific hits in the negative control sample indicated the need for additional filtration of the e-probes to enhance specificity. There was no significant difference in the ability of an e-probe to detect the target pathogen

based upon the length of the probe set oligonucleotides. The results from the queries of the sample database using E. coli e-probe sets were significantly different than those using random decoy probe sets, and exhibited 100% precision. The manuscript, ?Adaptation and Validation of E-probe Diagnostic Nucleic Acid Analysis (EDNA) for Detection of Escherichia coli O157:H7 in Metagenomic Data of Complex Food Matrices? was published in 2016 (Blagden, T. 2016 J. Food Protection 79(4):574-581). This technology increases efficiency and specificity of surveilling food processing centers and food products for the extremely toxic E. coli O157:H7.

4. Associated Knowledge Areas

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

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
- Other (exotic pathogens, terrorism)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No data entered.

Key Items of Evaluation

No data entered.

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Farm and Agribusiness Systems Economics

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	25%	0%	60%	0%
602	Business Management, Finance, and Taxation	28%	0%	10%	0%
603	Market Economics	30%	0%	10%	0%
607	Consumer Economics	7%	0%	10%	0%
610	Domestic Policy Analysis	10%	0%	10%	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	7.0	0.0	4.0	0.0
Actual Paid	10.0	0.0	1.4	0.0
Actual Volunteer	0.1	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**
292834	0	56844	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
292834	0	56844	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1364332	0	318161	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Develop and communicate research based information that farm and agribusiness managers can use to improve decisions.
Develop decision aids developed that assist farm and agribusiness managers in improved decisions.
Conduct educational programs that improve the management skills of farm and agribusiness managers.
Develop and support innovative information delivery and education systems including Communities of Practice on eXtension, webinars and social media.

2. Brief description of the target audience

Managers, owners, and employees of farms and agribusinesses; policy makers; agency leadership, cooperative boards

3. How was eXtension used?

The cooperatives CoP was used extensively to develop and deliver information to cooperative managers. board of director members and producer members.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	8000	405000	700	4000

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	8	10	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of board members of farmer-owned cooperatives receiving credentialed director training for board goverence
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of software decision analysis aids developed

Year	Actual
2016	2

Output #3

Output Measure

- Number of manuscripts submitted to refereed journals

Year	Actual
2016	36

Output #4

Output Measure

- Number of farm income tax managment schools conducted

Year	Actual
2016	9

Output #5

Output Measure

- Number of participatory experiential learning workshops conducted

Year	Actual
2016	3

Output #6

Output Measure

- Number of extension fact sheets, current reports, department staff papers, newsletter articles and other reports developed.

Year	Actual

2016	94

Output #7

Output Measure

- Number of Extension educational meetings and workshops conducted

Year	Actual
2016	169

Output #8

Output Measure

- Number of website posts and other electronic media deliveries
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of tax preparers using information from OCES tax schools
2	Number of credentialed board members serving on agricultural cooperative boards (cumulative)
3	Number of beef producers applying some level of financial management decision skills learned through Master Cattleman certification
4	Number of producers and agribusiness managers using OSU developed decision aids
5	Number of producers gaining an improved understanding of risk management through participatory experiential learning experiences
6	Number of stakeholder downloads of information from websites and other electronic media
7	Managing Farm Family Business Transitions
8	How Do Measures of State Pride and Distance to Neighboring States Impact Consumers? Perceptions of State Brand Values
9	County Government Uniform Chart of Accounts
10	The Economic Effect of Lesser Prairie Chicken Protection in Oklahoma

Outcome #1

1. Outcome Measures

Number of tax preparers using information from OCES tax schools

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1435

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The mission of the Oklahoma State University Tax Schools is to provide a quality tax education experience for income tax preparers. The instructor team consists of veteran tax professionals, educators, and representatives of various agencies, including the Internal Revenue Service, the Oklahoma Tax Commission, and the Oklahoma Employment Security Commission.

What has been done
In 2016, 1,435 tax preparers attended the nine fall institutes conducted during November and December. High quality, professional instruction is provided to make continuing education credit available for Certified Public Accountants, Enrolled Agents, and Tax Attorneys as well as provide technical education for all tax return preparers. Most of the taxpreparers that attend are from Oklahoma however some come from Kansas, Texas, New Mexico, and Arkansas in order to maintain their Oklahoma accreditation. Many of our participants have indicated that the ability to speak with a representative from Internal Revenue Service and/or the Oklahoma Tax Commission as well as one-on-one with the instructors is a major reason they attend plus the ability to learn about agriculture tax issues. We have a few participants that have been attending the schools for more than 50 years.

Results
Participants in these schools have indicated on the evaluation form that they file approximately 280,000 Federal income tax returns which include about 52,000 Federal farm returns. This is roughly 65 percent of the total farm returns (Schedule F) filed in Oklahoma. Several participants at each location were asked to place a subjective value on the education received which they then use to assist their clients with tax planning advice to reduce Federal and Oklahoma income taxes, to increase return filing accuracy, to provide retirement planning assistance, and/or to educate their clients of important income tax and estate tax planning tools. The average value they provided was just slightly greater than $25.00 per return for 2016. These preparers indicated

that the education they received significantly reduced the amount of time needed to complete a return.

A large benefit of the OSU Tax Schools is the fact that this is the only school that has the participation of the Internal Revenue Service, Oklahoma Tax Commission, and the Oklahoma Employment Security Commission representatives. In addition we are the only school that covers agriculture tax issues. Thus the OSU Tax Schools are a major education component of taxpreparers in Oklahoma.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of credentialed board members serving on agricultural cooperative boards (cumulative)

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of beef producers applying some level of financial management decision skills learned through Master Cattleman certification

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	76

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beef production accounts for approximately one-third of Oklahoma's agricultural production in most years. Moreover, nearly seventy percent of the state's 80,000+ farms have some cattle and over fifty percent of the land area in Oklahoma is pasture or rangeland. Most of the cattle operations are small in size, with three-quarters of the beef cow inventory in herds of fifty head or

fewer. Costs of production are highly variable but smaller cattle operations often have higher cost of production and are less likely to incorporate best management practices.

What has been done

An interdisciplinary Beef Cattle Manual was first published in spring 2004, then updated and reprinted in fall 2005, fall 2008 and fall 2015. The manual now contains 45 chapters addressing various business, production, and natural resource topics. An interdisciplinary team effort has resulted in a variety of educational products and programs, including the Beef Cattle Manual, benchmarking of cow/calf and stocker producer practices, Master Cattleman programs delivered at the local level, periodic in-service training for Extension educators, biennial Master Cattleman Summits, journal articles and Extension publications, including a quarterly newsletter for graduates. To become a Master Cattleman, a producer completes twenty eight hours of instruction from the Beef Cattle Manual and associated quizzes. The program has enjoyed wide adoption in the state and continues to be a popular staple in educational programming. Approximately 1,327 students have enrolled in the Master Cattleman program since 2004 and 1045 have completed the program There were 76 graduates in 2016.

Results

In program evaluation surveys, graduates estimate annual improvement in their cattle operation's profitability at approximately $3,500. With an average of 87 producers graduating per year, the impact is approximately $305,000 each year for 12 years for a total impact of $3.66 million over the program's history if the increase is a one-time event. Arguably, the $3,500 impact per producer could be in perpetuity for the individual operation, resulting in a much bigger impact. On average, graduates indicate that they use the Beef Cattle Manual at least once monthly and that they have referred 5 additional people to the Beef Cattle Manual and three people to the Master Cattleman program.

Approximately 9,000 manuals have been distributed through local Extension offices, area, state and national meetings and from the Master Cattleman website. Beef manual requests have been filled to 37 states and 5 foreign countries. The manual has been used as a textbook in 8 universities and community colleges in 5 states.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #4

1. Outcome Measures

Number of producers and agribusiness managers using OSU developed decision aids

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

Number of producers gaining an improved understanding of risk management through participatory experiential learning experiences

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

Number of stakeholder downloads of information from websites and other electronic media

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Managing Farm Family Business Transitions

2. **Associated Institution Types**

- 1862 Extension

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

Year	Actual
2016	0

3c. **Qualitative Outcome or Impact Statement**

Issue (Who cares and Why)
Most family business owners and operators would likely say that they desire for someone to take over their business and ?continue the legacy? into the future. However, the success rate of transitioning these family businesses to the next generation is frighteningly low, with approximately 30% of farms and other small businesses successfully transitioning from the founding generation to a second generation, and suggestions from industry sources that success rates may be lower than that. Research demonstrates that family business owners and operators, and even more specifically farmers and ranchers, do not do a good job of planning for the transition, do not adequately consider the financial ramifications and needs, and do not do a

good job of preparing successors. Furthermore, research demonstrates that adequate planning and utilization of appropriate business transition models can help maintain the overall efficiency of the family business at a steady high level, as opposed to the business going through the typical family business efficiency life cycle involving significant peaks and valleys. Conversely, research suggests poor transition planning can lead to significant loss of farm assets as those assets are either sold or other assets must be mortgaged while family members purchase property from off-farm heirs.

What has been done

OSU Extension faculty in Agricultural Economics have developed and are delivering a comprehensive educational program to assist stakeholders in the agricultural industry, and other industries that are dominated by ?family based? businesses. Materials and presentations have been developed for comprehensive workshop series on this important topic. A Farm Transition Workbook is now available for free download along with over ten Extension fact sheets, and streaming online videos have been created to support the program. Popular press articles and other news stories have been issued as workshops and other events have been scheduled. In addition, shorter presentations on the topic have been frequently made at meetings hosted by local Extension or by industry participants. A farm transitions website is now available, with a digital version of the Farm Transition Workbook and with video presentations, decisions tools, and a multitude of supporting material to assist family business stakeholders in working though difficult transition issues. OSU faculty members are collaborating with colleagues from across the country in the development and delivery of this program.

Results

?13 separate farm transition presentations were provided in 2016, ranging from 3 hour seminars to full day workshops attended by a cumulative audience of 614.
?Combined, these events generated 1,765 contact hours.
?Had the participants engaged accounting and legal professionals to obtain the same information provided through the one- and two-day events, the total cost for the equivalent number of contact hours would have been approximately $353,100.
?Assuming participants preserve even 1% more of their overall farm net worth as a result of the information presented and using the most recent (2015) Agricultural Resource Management Survey data for average farm net worth, this would result in overall wealth preservation increase of over $6.3 million.
?Agricultural producers across the nation are better prepared to understand and implement the complexities of a comprehensive transition plan for their family businesses as a result of this program.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

How Do Measures of State Pride and Distance to Neighboring States Impact Consumers? Perceptions of State Brand Values

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The ?Made in Oklahoma? (MIO) program is one example of a state branding program designed to draw attention to in-state food businesses and their products. The intent is that some level of state pride will convince Oklahomans to have higher intrinsic values (or at least greater awareness) for these products. Unfortunately, all surrounding states have similar programs with similar intents. The question for all of these state programs is: Do these brands have more, less, or indifferent values relative to the neighbors?

What has been done
Until this study, no research effort has examined consumer perceptions to determine if competing state brand programs result in a ?beggar-thy-neighbor? impact. An eight-state survey (Oklahoma, bordering states, and Louisiana) was conducted to determine the values consumers in each of these states place on the state brands from their own states and on those brands from the other seven states. A generic commodity (gallon of milk) was used as the product in these simulated market choices, with the only differences between products in the choices being the label (state brand) and/or the price. Additional questions related to measures of ?state pride? and the distance to borders of neighboring states were captured for all survey participants.

Almost 7,000 consumers participated from the eight-state region, with representative samples drawn from each state. The data has been, and continues to be, analyzed from the survey. To date, one manuscript from this study is in review with the American Journal of Agricultural Economics, and three presentations were made at professional meetings in 2016.

Results
The information obtained from the survey show that state pride and proximity of neighboring states impact the values consumers place on their own state?s brand and neighboring states?

brands. Preliminary results suggest that the differences in consumer values for state brands tend to be greater and more negative as the distance increases.
The information obtained from the survey show that state pride and proximity of neighboring states impact the values consumers place on their own state?s brand and neighboring states? brands. Preliminary results suggest that the differences in consumer values for state brands tend to be greater and more negative as the distance increases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
607	Consumer Economics

Outcome #9

1. Outcome Measures

County Government Uniform Chart of Accounts

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
County governments, in contrast with school districts, in Oklahoma do not have a uniform set of revenue and expense accounts. The uniform school district accounts allow better financial statements and more equitable allocation of state (and federal) funds among school districts. Lack of a uniform chart of accounts for county governments causes difficulties in auditing, in creation of annual financial reports, and in financial analysis for purposes of policy and management decisions. Many county governments are poorly equipped to create financial statements in keeping with accounting standards hence have difficulty in qualifying for federal funds and grants. The lack of a uniform set of accounts also makes auditing more difficult and expensive. Lastly, county governments and those assisting them (like Extension) have difficulty making comparisons, etc. In short, lack of a uniform chart of accounts has several costs and creation of a uniform chart of accounts would be a short-term cost (of change) with several long-term benefits.

What has been done

The State Auditor and Inspector contracted with Extension?s county training program (Lansford, PI) to create a uniform chart of accounts. A team consisting of members of the State Auditor?s staff, county clerks, county treasurers, several software vendors currently providing accounting software to counties, and three respected accounting firms providing services to county governments plus Extension staff created a uniform set of accounts. The project is 99% complete and pilot counties have been identified to begin use June 30, 2017.

Results

The uniform chart of accounts will allow counties to create financial statements by fund at the push of a button. The State Auditor?s staff will be able to more easily do their regular audits because fund names and the accompanying revenue and expenditures accounts will be uniformly defined. Lastly, research and analysis by the Legislature, citizens, county leaders, Extension, and others will be greatly aided because ?apples to apples? comparisons will be enabled. All of these will save many thousands of dollars, especially since the accounts will also become available electronically.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

The Economic Effect of Lesser Prairie Chicken Protection in Oklahoma

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The political and legal controversy surrounding the use of the Endangered Species Act (ESA) to protect imperiled species raises questions about the development restrictions and opportunity costs the ESA imposes on private landowners and industry. In Oklahoma the decision to list the lesser prairie chicken (LPC) in 2014 was controversial because the species' habitat lies in close proximity with agriculture and petroleum development.

What has been done
This research program has examined the economic ramifications of regulations to protect imperiled species and the effectiveness of conservation incentives to protect habitat.

Results
This research shows the economic effects of protecting the lesser prairie chicken have been small. There was little evidence showing that regulations affected land values. However, after looking for macro-level effects in employment data, the regulations did modestly reduce the number of jobs, although primarily in priority habitat areas. While some petroleum firms have participated in voluntary habitat offset programs to protect the species, many responded to the risk of regulatory penalties by avoiding the habitat area.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
610	Domestic Policy Analysis

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

none

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Integrated Bioenergy and BioBased Products 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
511	New and Improved Non-Food Products and Processes	100%	0%	100%	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	2.0	0.0	4.0	0.0
Actual Paid	1.0	0.0	4.2	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**
25077	0	177691	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
25077	0	177691	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
149846	0	994547	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Developing partnerships with universities, industry, and federal laboratories.
- Developing project proposals
- Preparing and presenting technical papers
- Submitting papers for journal articles
- Developing licenses and patents
- Taking new and/or improved products to pre-commercialization
- Developing educational materials
- Disseminate research findings through meetings and workshops

2. Brief description of the target audience

Other scientists, industry, agricultural producers, commercial developers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	2	30	32

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Technical papers and presentations

Year	Actual
2016	62

Output #2

Output Measure

- New processes or products developed

Year	Actual
2016	7

Output #3

Output Measure

- Technology demonstrations conducted

Year	Actual
2016	0

Output #4

Output Measure

- Educational Publications

Year	Actual
2016	1

Output #5

Output Measure

- Extension programs developed

Year	Actual
2016	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Release and commercialization of new feedstocks varieties
2	Best management practices identified for sustainable feedstock production
3	Fundamental knowledge of engineering or science gained in developing biobased products
4	Number of students graduated (masters and doctoral)
5	New processes or products developed
6	Products/processes taken to pre-commercialization

Outcome #1

1. Outcome Measures

Release and commercialization of new feedstocks varieties

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Best management practices identified for sustainable feedstock production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Environmental benefits of bioenergy crop production, such as carbon sequestration and recycling and water use efficiency, are vital for the long term sustainability of biofuels and biobased industries.

What has been done
Switchgrass a native species and sorghum, a naturally adapted species in Oklahoma, were compared for their environmental benefits during the 4th and 5th year after stand establishment. Net Ecosystem exchange of carbon dioxide (NEE) and ecosystem water use efficiency (EWUE) were measured for the two species using Eddy Flux systems at Chickasha, OK. Empirical models were developed to predict NEE and EWUE of these bioenergy species across OK.

Results
The switchgrass stand was a net carbon sink for four to five months (April/May?August), while sorghum appeared to be a net carbon sink for only three months (June?August). While both species showed similar water use patterns during the active growing period, seasonal cumulative ET was higher in switchgrass due to a longer growing season. Slightly larger EWUE in

switchgrass than sorghum shows that the switchgrass was more efficient than the sorghum on using water to gain carbon. The difference in carbon sink strength between the two species was driven mainly by the length of the growing season. Empirical models developed for estimating NEE and EWUE identified hot spots for bioenergy crop production in Oklahoma. Environmental benefits of the native and adapted bioenergy species were similar in the Southern Plains region. Species can be selected for a given location based on the rainfall pattern and water availability.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Fundamental knowledge of engineering or science gained in developing biobased products

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of students graduated (masters and doctoral)

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

New processes or products developed

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2016 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The development and production of fuels and chemicals from readily available renewable sources or waste materials is essential to supplement the petroleum-based economy with more environmentally sustainable biobased economy and improve the U.S energy security. Besides being an energy-producing state, Oklahoma is well-positioned to take a leading role in the biobased economy to meet part of the demand for renewable fuels and biobased chemicals to enhance rural farm economy and attract capital ventures.

Thermochemical, biochemical and hybrid conversion technologies are in early stages of development. These technologies can be employed in different parts of the U.S. and abroad, based on the type of feedstock used and availability of other resources to sustain the biorefinery. Currently, high capital costs and technological obstacles hinder the development of a viable biorefinery industry. As such, advancing the knowledge base in various aspects of the conversion processes to make this industry profitable is critical for sustainable biorefineries.

The hybrid conversion technology involves the conversion of syngas components (carbon monoxide, carbon dioxide and hydrogen) made from gasifying lignocellulosic biomass, municipal solid wastes and industrial wastes or from gas waste streams into fuels and chemicals. Mass transfer limitations, low cell productivity, enzyme inhibition, and the high cost of fermentation medium are major challenges for the hybrid conversion route. The biochemical conversion route involves pretreatment of biomass to make the cellulose and hemicellulose accessible to enzymes to break them down into simple sugars. Microorganisms then convert the sugars into fuels and chemicals. Challenges in the biochemical conversion route include high cost of pretreatment and enzymes and inefficient co-fermentation of C5 and C6 sugars. The research team is tackling these challenges through examining cell metabolism and process development of novel microorganisms, reactor design, scale-up and process modeling.

What has been done

Hybrid Conversion Technology

?Development of a feedback control of gas supply for ethanol production via syngas fermentation using pH as key control indicator. The syngas feed to Clostridium ragsdalei in a 3-L CSTR was continuously adjusted using a novel pH controller to keep fermentation pH at 4.8 for over 2000 h with about 25 g/L ethanol produced. This automatic control of syngas feed rate maintained constant pH, increased stability, ethanol selectivity and concentration. This method is described in US Patent Application Publication, US 2016/0281114 A1, Publication date: 9/29/2016.

?Continued to refine tools to facilitate designing and control of large-scale bioreactors to increase alcohol productivity and selectivity and gas utilization. Models are used to construct process control methods that ensure high conservation of energy, product specificity and alcohol yield. This was described in a US Patent Application Publication. US 2016/0215303 A1. Publication date: 7/28/2016.

?Development of inexpensive production media for syngas conversion to ethanol. Results showed that over 50% more ethanol was produced in the new medium compared to typical expensive media.

?Continued the development of a direct monitoring and control of CO/H2 in bioreactors. The selection and overall design of the real-time CO sensor and real-time CO/H2 monitoring system were finalized. Ranges for gas measurements and data acquisition module to perform tests of the developed system were established. One invention discourse is filed with OSU-TDC in 2016.

Results

Hybrid Conversion Technology

Research efforts will impact conversion efficiency, cost of production, reactor design, and process development of the hybrid conversion technology for implementation in sustainable biorefineries in Oklahoma, the nation, and the world. The developed tools represent a break-through characterization of the production mechanisms that underline the commercially deployed fermentation process, and can be implemented in industrial control systems for process operation. These tools can be used on an industrial scale to maintain high conversion of syngas components to alcohols, which also requires moderately skilled operators and potentially reduces capital and operating costs. My team has four patent applications on the developed tools. These inventions are expected to contribute in building IP portfolio that will benefit the university and the state by creating wealth from IP rights. OSU-TDC is negotiating licensing agreements with interested industrial partners to move this technology to commercial scale.

There are opportunities to apply the hybrid conversion technology in different regions of the country to meet our increasing energy needs. Upon its full development, this hybrid technology can provide 35% more ethanol from the same amount of biomass as compared to the biochemical conversion technology. Also, this technology can produce fuels from natural gas and industrial waste gases that contains carbon monoxide and hydrogen, and from gasified petroleum wastes. If fuel producers adopt this hybrid technology to produce 25% of the mandated 16 billion GPY renewable transportation fuels such as ethanol (i.e., 4 billion GPY), my research suggests a projected annual savings of over $650 million due to the use of 13.1 million tons less biomass with the hybrid technology.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Products/processes taken to pre-commercialization

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is an increasing demand for low cost, small-scale (50-100 kWe), portable electricity generation units that utilize diverse carbonaceous wastes. These units could be deployed in remote and/or energy deficit regions domestically and internationally. Utilizing municipal solid waste (MSW), small municipalities could supplement power needs while simultaneously reducing landfills. Areas devastated by natural disasters could use these units as stand-alone or supplemental electricity sources. Unlike conventional diesel/gasoline generators, which require fuel to be transported in at fully-burdened costs, often ranging from over 10 times local service station costs, these units would be indefinitely fueled by locally available biobased resources.

What has been done
The Gasifier Team completed the design, fabrication, and initial testing of the scaled-up gasifier unit (approximately 50 kWe) for syngas production from biomass-based resources. This unit serves as a proof-of-concept and an integral component to a proposed mobile electricity generation unit having a 50-100 kWe nameplate output. The scaled-up unit is based on OSU?s patented downdraft gasifier design, which has a unique pyrolysis and tar cracking conversion zone. In addition to the unique reactor design, the gasifier is capable of utilizing low bulk density carbonaceous materials, which can be problematic to any gasification system. In August 2015, the Gasifier Team demonstrated the consistent operation of the scaled-up unit. Attendees of this demonstration included representatives of military, congressional staffers, OSU administration and potential investors in the mobile electricity generation technology. Due to the inability of the original interest group in providing the necessary investment capital to move this technology to market, other potential investors were sought, demonstrations provided and initial negotiations were conducted in 2016. In the meantime, additional research and development of the gasifier and associated components have been pursued.

Results
The Gasifier Team is working with the OSU Technology Development Center and the OSU Research Foundation to secure a company to develop a beta version of the mobile electricity generation system that could utilize a wide range of feedstocks, including municipal solid wastes (MSW). Ultimately, a power generation unit will be marketed for dispatchable, distributed electricity generation that is grid-tied via net metering. OSU?s patented downdraft gasifier has been scaled-up. We are seeking investors to develop a beta version of a mobile 50-100 kWe electricity generation unit. Ultimately, our desire is to have an Oklahoma-based company market this technology around the world.

4. Associated Knowledge Areas

KA Code	Knowledge Area

511 New and Improved Non-Food Products and Processes

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

none

Key Items of Evaluation

None

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Childhood Obesity - Hunger / Health / Risky Behaviors / Resilience Issue Teams

☑ 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
134	Outdoor Recreation	12%	0%	0%	0%
703	Nutrition Education and Behavior	40%	0%	0%	0%
724	Healthy Lifestyle	18%	0%	0%	0%
802	Human Development and Family Well-Being	19%	0%	0%	0%
806	Youth Development	11%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	33.0	0.0	0.0	0.0
Actual Paid	19.0	0.0	0.0	0.0
Actual Volunteer	6.8	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**
410950	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
410950	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3100247	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Establish advisory board of FCS educators, youth, and relevant stakeholders and partners
- Collaboratively conduct 4-H projects and activities
- Conduct research that addresses chronic issues in Oklahoma
- Evaluate programs to determine effectiveness and impacts
- Leverage resources via grant writing and development activities
- Student internships and service learning
- Mentoring program
- Community service projects

2. Brief description of the target audience

Youth, children; parents; teachers; adult volunteers; middle to low income families; race and ethnicity will also be recognized as an identifier of audiences; caretakers, agencies & service providers, schools, policy makers.

3. How was eXtension used?

eXtension is provided as an educator resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	164057	2639075	68132	1600000

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	2	13	15

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU Facts published

Year	Actual
2016	11

Output #2

Output Measure

- Number of other publications including but not limited to Bulletins, Technical Manuals, Reports as well as PowerPoint presentations and curricula, and core competency modules distributed for use by others.

Year	Actual
2016	37

Output #3

Output Measure

- Number of in-service training sessions

Year	Actual
2016	26

Output #4

Output Measure

- Number of certification training sessions

Year	Actual
2016	2

Output #5

Output Measure

- Number of other training sessions, workshops, etc. conducted

Year	Actual
2016	4

Output #6

Output Measure

- Number of presentations at Extension organized meetings

Year	Actual
2016	19

Output #7

Output Measure

- Number of presentations at other meetings and events (professional meetings, invitations to speak to community groups, stakeholder groups, etc.)

Year	Actual
2016	30

Output #8

Output Measure

- Number of workshops, conferences, etc. organized

Year	Actual
2016	6

Output #9

Output Measure

- Number of posters, displays, exhibits, or models

Year	Actual
2016	10

Output #10

Output Measure

- Number of demonstrations

Year	Actual
2016	0

Output #11

Output Measure

- Number of newsletters

Year	Actual

2016	2

Output #12

Output Measure

- Number of web pages created or updated

Year	Actual
2016	0

Output #13

Output Measure

- Number of radio and television presentations

Year	Actual
2016	1

Output #14

Output Measure

- Number of newspaper, and magazine articles written

Year	Actual
2016	63

Output #15

Output Measure

- Average number of phone calls and/or email requests responded to on a weekly basis

Year	Actual
2016	0

Output #16

Output Measure

- Number of webcasts or guest appearances on webinars
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of OSU Fact Sheets revised
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of participants increasing consumption of fruits
2	Percentage of participants increasing consumption of vegetables
3	Percentage of participants increasing consumption of whole grains
4	Percentage of participants increasing consumption of low-fat dairy and other calcium-rich foods
5	Percentage of participants decreasing consumption of foods high in fat, sugar and salt
6	Percentage of participants decreasing consumption of sugar-sweetened beverages
7	Percentage of participants increasing physical activity
8	Percentage of participants increasing safe food handling practices
9	Percentage of participants increasing positive parenting skills
10	Percentage of participants increasing positive youth peer involvement
11	Percentage of participants increasing parenting competence
12	Percentage of participants increasing child competent behaviors
13	Percentage of participants with increased access to affordable, healthy foods
14	Percentage of participants decreasing child problematic behaviors
15	Percentage of participants decreasing disengaged or hostile parenting

Outcome #1

1. Outcome Measures

Percentage of participants increasing consumption of fruits

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Seventeen percent of Oklahoma youth are considered obese and the state has poor fruit and vegetable consumption. For adults, Oklahoma ranks as the 8th most obese state in the nation. This ranking reflects the state's high density of fast food establishments and low fruit consumption. Half of all the state?s adults and 44% of Oklahoma youth reported consuming fruits and vegetables less than one time daily. 31% of the state?s adults report engaging in no leisure-time physical activity and 69% report having access to places for physical activity.

What has been done
Oklahoma Cooperative Extension Service programs are committed to the physical, mental and emotional health of our nation's youth so they may lead healthy and productive lives into and throughout adulthood. In order to advance the socio-economic development of the state, and have an impact on issues that address childhood obesity, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life related to the critical areas of food, nutrition, and health.

Results
In 2016, Family and Consumer Sciences programs were presented to 12,157 Oklahoma youth through 15 different curricula and 11,815 adult participants through 22 different curricula. Programs presented include:

?OrganWise Guys program. Based on 2,264 pre-post tests, improvements were reported among participating Oklahoma youth in the areas of increasing servings of fruit and vegetables, skim milk, hand-washing before eating, and physical activity. Youth also reported increased consumption of healthy snacks, which can play a role in reducing overweight and risk of related

chronic diseases.

?Growing Strong Bodies and Minds aims to promote the development of healthful food preferences, physically active lifestyles and literacy skills in young children. Specific goals include: use of pre-reading and reading strategies to teach nutrition and health messages; promote consumption of whole grains, fruits, vegetables, low-fat dairy foods, and increase time spent in active play; and support parents of young children in offering economical, nutrient dense foods to their children and increasing time spent in active play. 1,197 youth across the state participated in this program. In addition to increasing their knowledge of healthy foods, the students are trying new foods.

?The Farm to You exhibit traveled to 19 counties in Oklahoma, often serving more than one school district within each county. It was featured at summer camps, county fairs, and community events. Approximately 10,355 students experienced the Farm to You exhibit and approximately 665 community volunteers donated time in support of the educational program.

?Live Well, Eat, Well, be Active with Diabetes (LEAD) is a four week education program which helps people with diabetes and their family members learn helpful ways to control diabetes, physical activity that can improve glucose levels, and how to follow a low carbohydrate diet. 314 adults participated in this program.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Percentage of participants increasing consumption of vegetables

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Percentage of participants increasing consumption of whole grains

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Percentage of participants increasing consumption of low-fat dairy and other calcium-rich foods

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

Percentage of participants decreasing consumption of foods high in fat, sugar and salt

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

Percentage of participants decreasing consumption of sugar-sweetened beverages

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Percentage of participants increasing physical activity

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Seventeen percent of Oklahoma youth are considered obese and for adults, Oklahoma ranks as the 8th most obese state in the nation. 31% of the state?s adults report engaging in no leisure-time physical activity and 69% report having access to places for physical activity.

What has been done

Oklahoma Cooperative Extension Service programs are committed to the physical, mental and emotional health of our nation's youth so they may lead healthy and productive lives into and throughout adulthood. In order to advance the socio-economic development of the state, and have an impact on issues that address childhood obesity, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life related to the critical areas of food, nutrition, and health.

Results

In 2016, Family and Consumer Sciences programs focused on physical activity were presented to 9,336 Oklahoma youth and 2,409 adult participants. Programs presented include:

?OrganWise Guys program. Based on 2,264 pre-post tests, improvements were reported among participating Oklahoma youth in the areas of increasing servings of fruit and vegetables, skim milk, hand-washing before eating, and physical activity. Youth also reported increased consumption of healthy snacks, which can play a role in reducing overweight and risk of related chronic diseases.

?1,437 Oklahomans participated in Tai Chi for Better Balance, the purpose of which is to reduce risk of fall among older adults. Participants perform a series of eight exercises, beginning with simple weight shifting and sequentially building towards more complex forms. The program is taught in a community setting over period of eight weeks. The program is proven to improve functional balance and physical performance among participants.

?The Arthritis Foundation Exercise Program (AFEP) had 935 participants in 2016. Its purpose is to reduce symptoms of arthritis and arthritis-related diseases among participants. The program features a variety of exercises, gradually increasing in intensity over the duration of the program. The program is taught in a community setting over a period of time, ranging from eight weeks to an ongoing basis. The program is proven to reduce pain and stiffness and improve physical performance among participants.

?6,472 Oklahoma youth participated in 4-H Yoga for Kids in 2016. The purpose of this program is to increase fitness, decrease stress, and improve mental focus in noncompetitive manner.

4. Associated Knowledge Areas

KA Code	Knowledge Area
134	Outdoor Recreation
724	Healthy Lifestyle

Outcome #8

1. Outcome Measures

Percentage of participants increasing safe food handling practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is critical to address not only the prevention of childhood obesity but also the social and emotional impacts obesity can have on youth who are already obese.

While obese teens engage in high-risk behaviors at the same rate as their healthy weight peers, they do so in more dangerous ways, such as earlier onset of smoking, and engaging in sexual activity while under the influence of drugs or alcohol before the age of 13. Obese girls are also at increased risk of earlier onset of sex, having more sexual partners, and less consistent use of contraception. In 2016 there were 4,802 births to Oklahoma 15-19 year old teens, 17,000 12-17 year olds reported using marijuana at least once during a 30 day period in 2014, and 19,000 12-17 year olds reported binge drinking at least once during a 30 day period in 2014.

While all teens are vulnerable during adolescence, obese teens are more likely to drop out of school due to health problems, bullying, and social withdrawal related to poor body image, and poor self-esteem. In Oklahoma, 7.8% youth statewide dropped out of high school in 2015. Oklahoma ranks among the top 5 in all states for number of divorces. Divorce has negative impacts on parents and youth and increases the risk of negative outcomes in youth. Youth whose parents divorce have a 25-30% increased risk of suffering a mental health condition.

What has been done

Oklahoma Cooperative Extension Service programs are committed to the physical, mental and emotional health of our nation's youth so they may lead healthy and productive lives into and throughout adulthood. In order to advance the socio-economic development of the state, and have an impact on issues that address the critical areas of risky behaviors of youth and family resilience, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results

?311 Oklahoma parents participated in resilience programs including curricula such as Active Parenting Now/Active Parenting Now in 3, Active Parenting for Teens, and Conscious Discipline. These curricula are part of the parenting skills and parent-child relationship program for Oklahoma families. Outcomes improved by these programs include: parental attitudes and beliefs, parent-child relationship problems, and positive and negative child behaviors.

?Programs such as Character Critters and Character Counts provided lessons on topics such as respect, fairness, and responsibility to 3,163 Oklahoma youth

?Approximately 88 Latino families were involved in the Juntos program

?Oklahoma Cooperative Extension conducted the award-winning Co-Parenting

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Percentage of participants increasing positive parenting skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is critical to address not only the prevention of childhood obesity but also the social and emotional impacts obesity can have on youth who are already obese.
While obese teens engage in high-risk behaviors at the same rate as their healthy weight peers, they do so in more dangerous ways, such as earlier onset of smoking, and engaging in sexual activity while under the influence of drugs or alcohol before the age of 13. Obese girls are also at increased risk of earlier onset of sex, having more sexual partners, and less consistent use of contraception. In 2016 there were 4,802 births to Oklahoma 15-19 year old teens, 17,000 12-17 year olds reported using marijuana at least once during a 30 day period in 2014, and 19,000 12-17 year olds reported binge drinking at least once during a 30 day period in 2014.

While all teens are vulnerable during adolescence, obese teens are more likely to drop out of school due to health problems, bullying, and social withdrawal related to poor body image, and poor self-esteem. In Oklahoma, 7.8% youth statewide dropped out of high school in 2015. Oklahoma ranks among the top 5 in all states for number of divorces. Divorce has negative impacts on parents and youth and increases the risk of negative outcomes in youth. Youth whose parents divorce have a 25-30% increased risk of suffering a mental health condition.

What has been done

Oklahoma Cooperative Extension Service programs are committed to the physical, mental and emotional health of our nation's youth so they may lead healthy and productive lives into and throughout adulthood. In order to advance the socio-economic development of the state, and have an impact on issues that address the critical areas of risky behaviors of youth and family resilience, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results

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?Approximately 88 Latino families were involved in the Juntos program

?Oklahoma Cooperative Extension conducted the award-winning Co-Parenting

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Percentage of participants increasing positive youth peer involvement

Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

Percentage of participants increasing parenting competence

Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

Percentage of participants increasing child competent behaviors

Not Reporting on this Outcome Measure

Outcome #13

1. **Outcome Measures**

Percentage of participants with increased access to affordable, healthy foods

Not Reporting on this Outcome Measure

Outcome #14

1. **Outcome Measures**

Percentage of participants decreasing child problematic behaviors

Not Reporting on this Outcome Measure

Outcome #15

1. **Outcome Measures**

Percentage of participants decreasing disengaged or hostile parenting

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Issue team evaluation items for the above outcomes include:

54 youth respondents to health issue team evaluations reported the following planned behavior changes after participating in the program:

- 116% increase in planning to eat a serving of fruit 2 or more times each day
- 166% increase in planning to eat a serving of vegetables 3 or more times each day
- 29% increase in planning to eat a whole grain food 3 or more times each day
- 53% increase in planning to eat or drink a serving of calcium-rich food 2 or 3 times each day
- 58% decrease in planning to eat snack foods (chips, cookies, candy, etc.) 1 or more times a day
- 58% decrease in planning to drink 1 or more sugar-sweetened drinks each day
- 15% increase in planning to be physically active at least 60 minutes throughout the day

417 adult respondents to health issue team evaluations reported the following planned behavior changes after participating in the program:

- 90% increase in planning to eat a serving of fruit 2 or more times each day
- 79% increase in planning to eat a serving of vegetables 3 or more times each day
- 70% increase in planning to eat a whole grain food 3 or more times each day
- 69% increase in planning to eat or drink a serving of calcium-rich food 2 or 3 times each day
- 36% decrease in planning to eat snack foods (chips, cookies, candy, etc.) 1 or more times a day
- 35% decrease in planning to drink 1 or more sugar-sweetened drinks each day
- 64% increase in planning to be physically active at least 30 minutes throughout the day

54 adult respondents to family resilience issue team evaluations reported the following changes after participating in the programs:

- 91% increase in belief that children need encouragement as much as they need discipline
- 32% increase in belief that parents should monitor their children's activities
- 117% increase in disagreement with the belief that sometimes yelling at children is the only way to get them to do what you want
- 120% increase in disagreement with the belief that parents should control their children
- 71% increase in child's sharing readily with other children, for example toys, treats, pencils
- 14% increase in child having at least one good friend
- 100% increase in knowing they are doing a good job as a mother/father
- 133% increase in persistence in trying to solve problems between their child and themselves
- 86% increase in child being considerate of other people's feelings
- 88% decrease in child stealing from home, school or elsewhere

- 75% increase in those who search for the positive in their child's other parent and actively point it out to their child
- 50% increase in those who avoid asking questions of their child that might make them feel like spy
- 70% increase in those who can honestly say they treat their child's other parent like a valued member of a team

Based on 2,264 pre-post tests for the OrganWise Guys program, the following improvements were reported among participating Oklahoma youth:

- 80% improved 1 or more knowledge or skill(s) necessary to choose foods (including fruits, vegetables, dairy, and healthy snacks) consistent with Federal Dietary Guideline recommendations
- 54% improved 2 or more knowledge or skill(s) necessary to choose foods (including fruits, vegetables, dairy, and healthy snacks) consistent with Federal Dietary Guideline recommendations
- 32% improved 1 or more knowledge, skill(s), or behaviors necessary to improve their physical activity practices

Key Items of Evaluation

In 2016, Issue Team-specific Evaluation Questionnaires were collected after planned program curriculum delivery. These questions utilized a retrospective approach. Evaluation participation was completely voluntary and does not include all program participants.

V(A). Planned Program (Summary)

Program # 15

1. Name of the Planned Program

Structure and Function of Macromolecules

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	5%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	5%	0%
206	Basic Plant Biology	0%	0%	20%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	0%	0%	5%	0%
212	Pathogens and Nematodes Affecting Plants	0%	0%	5%	0%
304	Animal Genome	0%	0%	5%	0%
305	Animal Physiological Processes	0%	0%	45%	0%
311	Animal Diseases	0%	0%	5%	0%
312	External Parasites and Pests of Animals	0%	0%	5%	0%
	Total	0%	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	0.0	0.0	9.0	0.0
Actual Paid	0.0	0.0	7.1	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**
0	0	300643	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	300643	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1682716	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Basic research will be conducted that will make fundamental discoveries which will enhance our understanding of molecular mechanisms involved in the regulation of physiological processes in plant and animal systems.

New faculty and staff will be recruited to build, foster and maintain a cohesive critical mass of research faculty with a diverse set of expertise that focuses on the study of structural biology.

Grant proposals will be written to acquire and maintain state of the art equipment to enhance the research capabilities relating to protein structure/ function/ interactions on the OSU campus.

Funds will be solicited from national, state and university sources to acquire, and maintain support for "Core" facilities that are critical to the research mission of DASNR and Oklahoma State University.

Design and conduct basic research to fill critical gaps in scientific knowledge that will address needs, issues and problems that ultimately can be translated into an improvement in plant and animal health.

Develop new research methods and procedures.

Train undergraduate and graduate students, and postdoctoral associates.

Publish scientific articles.

Write and submit grant proposals.

Attend and present scientific findings at professional conferences.

File patents for protection of intellectual property and negotiate licensing agreements for technology transfer.

Interact with other researchers both on and off the OSU campus.

2. Brief description of the target audience

Departments and department heads
OSU administrators
Other faculty and other scientific researchers in DASNR, at OSU & the scientific community
Students and post-docs
Federal, state, and private funding agencies
Scientific journal editors, readers & the scientific community
Candidates for open faculty and staff positions.
Patent officers
Agricultural, environmental, life, and human science industries
General public and elected officials

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	30	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Research discoveries, procedural and technological advances, and dissemination of results of research efforts.

Year	Actual
2016	0

Output #2

Output Measure

- Filing patents for protection of intellectual property and negotiation of licensing agreements for technology transfer.

Year	Actual
2016	0

Output #3

Output Measure

- Training of students and post-docs.

Year	Actual
2016	25

Output #4

Output Measure

- Research discoveries, procedural and technological advances, and solicitation of support for research efforts.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of manuscripts published from research efforts.
2	Number of licensing agreements negotiated for transfer patented technology to industry.
3	Numbers of graduate students graduated and postdoctoral associates mentored with training in structural biology and placed/hired into appropriate professional level positions.
4	Number of new extramural grants funded.
5	Number of invitations that faculty members received to present research findings at universities and colleges, and to national and international meetings.
6	Number of trainees attending workshops designed to train individuals in aspects of structural biology, proteomics, and bioinformatics.
7	Number of Instrumentation Grants Funded

Outcome #1

1. Outcome Measures

Number of manuscripts published from research efforts.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	46

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #2

1. Outcome Measures

Number of licensing agreements negotiated for transfer patented technology to industry.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Numbers of graduate students graduated and postdoctoral associates mentored with training in structural biology and placed/hired into appropriate professional level positions.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Graduate students who are being taught a scientific discipline often have difficulty relaying the importance of their work to professional and lay audiences. The Department of Biochemistry and Molecular Biology has developed a course to teach graduates student how to clearly communicate scientific information to an array of audiences. In the future, these students? ability to clearly communicate scientific information will enhance their careers as scientists, and will help de-mystify scientific developments to the general public.

What has been done
The BMB curriculum committee approved the development of two courses that were implemented in the spring semester of 2016: ?Articulation of Scientific Logic?, and the ?Biochemistry and Molecular Biology Graduate Student Colloquium?. These courses were developed to teach graduate students how to clearly communicate the workings of the scientific method to lay audiences, and to effectively present their laboratory work and finding to professional audiences of their peers.

Results
New graduate students were taught principles behind how to clearly communicate scientific material to audiences of their peers that will further their careers in science, having an impact on: timely publication of their research findings; their success at grantsmanship; and their future employment and promotion. Their ability to clearly communicate with lay audiences will help the general population to better understand the impact of science on everyday life, and de-mystify the scientific process, thus accelerating the acceptance of agricultural breakthroughs by society.

4. Associated Knowledge Areas

KA Code	Knowledge Area

201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #4

1. Outcome Measures

Number of new extramural grants funded.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #5

1. Outcome Measures

Number of invitations that faculty members received to present research findings at universities and colleges, and to national and international meetings.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	54

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #6

1. Outcome Measures

Number of trainees attending workshops designed to train individuals in aspects of structural biology, proteomics, and bioinformatics.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Promising answers to agricultural challenges can be found in the biomolecules and biochemical processes of life. To leverage this promise, the Center offers advanced instrumentation, technical expertise, and turn-key biochemical analyses that are typically not readily available to individual investigators. In 2016, the Center analyzed more than 500,000 biomolecules, supporting 115 individual research projects, representing 63 principal investigators from 17 departments spread among 5 OSU colleges.

What has been done
The Center provided training, supervision, training, and oversight for a pod of essential instruments to ensure that all investigators in the Division of Agricultural Sciences and Natural Resources have access to essential research capabilities. This includes instrumentation for end-point and quantitative polymerase chain reaction; ultraviolet and visible spectroscopy in high-throughput plate readers, traditional spectrophotometers, and nano-scale spectrophotometers; visible, fluorescence, and chemiluminescence imaging of biomolecules; nano-calorimetry; micro-bore high performance chromatograpy; and other shared instrument capabilities.

Results
The Center performed quantitative analysis of 524 protein mixtures (?proteomes?), generating approximately 500,000 ?shotgun? identifications and quantifications of individual proteins. These analyses supported 115 individual research projects, representing 63 researchers from 17 departments spread among 5 OSU colleges.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #7

1. Outcome Measures

Number of Instrumentation Grants Funded

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To replace the obsolete Roche sequencing instrument and provide inexpensive and high-capacity sequencing, Dr. Peter R. Hoyt wrote a successful NSF Major Research Infrastructure (MRI) grant to purchase an Illumina NextSeq500 genome sequencer. To support the expected throughput of the sequencer, a Core Facility Infrastructure Proposal was funded to purchase an Agilent BRAVO liquid handling robot, tapestation, and thermocycler to prepare libraries for the sequencer. These developments support the ?Genomics? effort of the Genomics and Proteomics Center.

What has been done
The sequencer is located in the Genomics and Proteomics center (GPC: formerly the Bioinformatics Core Resource Facility) of the Henry Bellmon Research Center; an established core facility (12 years). The NextSeq has a high level of exposure in the GPC, and is available to the greater research community through the existing non-profit "store" infrastructure of the GPC. The NextSeq500 can produce up to 120-billion base pairs of data in a single 28-hour run; enough to sequence a human genome 40-fold over, or sequence 500 bacterial genomes at 50-fold coverage. The large capacity of the instrument enables multiplexing, i.e. the simultaneous sequencing of multiple samples that are indexed and can be separated after a sequencing run is complete. The BRAVO robot is capable of preparing 96 libraries with individual indexing and with greater accuracy than a human.

Results
The sequencer was obtained after polling of the research community revealed that over 11,000 samples were planned for sequencing over the next three years, ALL of which would be out-sourced. The instrument will serve 43 faculty, 36 postdoctoral or staff, 81 graduate students, and 87 undergraduate students. Users come from four colleges (ten departments) at OSU in Stillwater and Tulsa, 2 PUIs, 1 HBCU, and 2 government laboratories that work with OSU on research projects. Because the GPC is an experienced non-profit store, the services offered will be less

expensive than outsourcing, while simultaneously providing faster turnaround. Cost savings to OSU researchers is estimated at $15,000 annually, while also supporting the GPC?s future service contracts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes
311	Animal Diseases

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

1. We will evaluate percentage increases in number of manuscripts published as stated in Outcome #1. 119%
2. We will evaluate percentage increases in number of licensing agreements negotiated for transfer-patented technology to industry as stated in Outcome #2. No Change-0
3. We will evaluate percentage increases in numbers of graduate students graduated and postdoctoral associates mentored with training in structural biology and placed/ hired into appropriate professional level positions as stated in Outcome #3. 129%
4. We will evaluate percentage increases in numbers of new extramural grants funded as stated in Outcome #4. 280%
5. We will evaluate percentage increases in numbers of instrumentation proposals funded and new instruments obtained as stated in Outcome #5. 1 (2016) vs 1 (2015)
6. We will evaluate percentage increases in numbers of invitations that faculty members received to present research findings at universities and colleges, and to national and international meetings as stated in Outcome #6. 123%
7. We will evaluate the percentage increases in workshop attendance as stated in Outcome #7. 72%

Key Items of Evaluation

Shrinking appropriations and increased competition for research funding is now impacting the ability of team members to obtain grant funds. Team members increased the numbers of grants they received in 2016, but the number of faculty members on the Structure and Function of Macromolecules Team has decreased and faculty lines to replace them have not been approved due to state budgetary cuts. However, team members have increased their productivity as measured by the number of manuscripts published.

V(A). Planned Program (Summary)

Program # 16

1. Name of the Planned Program

Environmental Family and Youth Issues

☑ 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
403	Waste Disposal, Recycling, and Reuse	50%	0%	0%	0%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	50%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	2.5	0.0	0.0	0.0
Actual Paid	2.0	0.0	0.0	0.0
Actual Volunteer	0.4	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**
149437	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
149437	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
134626	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Develop, test and use evaluation tools to determine effectiveness and impacts
- Establish appropriate partnerships with other youth serving agencies and commodity groups
- Leverage resources via grant writing and development activities
- Collaboratively conduct 4-H projects and activities

2. Brief description of the target audience

Homeowners, youth, adults, families, community leaders

3. How was eXtension used?

eXtension is provided as an educator resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2517	520	200	400

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	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU Fact s published

Year	Actual

2016	0

Output #2

Output Measure

- Number of other publications including but not limited to Bulletins, Technical Manuals, Reports as well as digital resources such as PowerPoint presentations, curricula, and core competency modules distributed for use by others

Year	Actual
2016	0

Output #3

Output Measure

- Number of in-service training sessions

Year	Actual
2016	3

Output #4

Output Measure

- Number of certification Training sessions

Year	Actual
2016	0

Output #5

Output Measure

- Number of other training sessions, workshops, etc. conducted

Year	Actual
2016	0

Output #6

Output Measure

- Number of presentations at Extension organized meetings

Year	Actual
2016	4

Output #7

Output Measure

- Number of presentations at other meetings and events (professional metings, invitations to speak to community groups and stakeholder groups, etc.)

Year	Actual
2016	1

Output #8

Output Measure

- Number of workshops, conferences, etc. organized

Year	Actual
2016	2

Output #9

Output Measure

- Number of demonstrations

Year	Actual
2016	0

Output #10

Output Measure

- Number of posters or displays, exhibits, and models

Year	Actual
2016	0

Output #11

Output Measure

- Number of newsletters

Year	Actual
2016	0

Output #12

Output Measure

- Number of radio and television presentations

Year	Actual

2016	0

Output #13

Output Measure

- Number of newspaper, and magazine articles written

Year	Actual
2016	0

Output #14

Output Measure

- Number of OSU Fact Sheets revised
  Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of webpages created or updated
  Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Average number of phone calls and/or email requests responded to on a weekly basis
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of webcasts or guest appearances on webinars
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of participants increasing composting, donation of goods for others to use, repurposing, and recycling items
2	Percentage of participants increasing energy efficiency
3	Percentage of participants increasing maintenance, conservation, and protection of natural resources (air, land, water)

Outcome #1

1. Outcome Measures

Percentage of participants increasing composting, donation of goods for others to use, repurposing, and recycling items

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma ranks 10th in the nation in total energy consumption per capita. The typical family spends about $1,900 annually on utility bills. The average American produces 4.4 pounds of garbage every day. 40% of municipal garbage is made up of kitchen and garden waste. Two-thirds of Oklahomans have access to drop-off or curbside recycling. About half of Oklahomans' utility bills are spent on heating and cooling; a large portion of that energy is wasted. In 2016, residents of 63 counties were potentially exposed to water with a health-related violation.

What has been done
Abuse of the state?s natural resources can have far-reaching and long-lasting consequences for Oklahoma?s economy and the well-being of its citizens. In order to advance the socio-economic development of the state, educational programs have been created and implemented to educate Oklahomans on how to be better stewards of the environment.

Results
In 2016, 257 individuals attended educational programs which taught them how to repurpose and upcycle items such as books, china and glassware, and textiles.

4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Percentage of participants increasing energy efficiency

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Percentage of participants increasing maintenance, conservation, and protection of natural resources (air, land, water)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2016, residents of 63 counties were potentially exposed to water with a health-related violation.

What has been done
Abuse of the state?s natural resources can have far-reaching and long-lasting consequences for Oklahoma?s economy and the well-being of its citizens. In order to advance the socio-economic development of the state, educational programs have been created and implemented to educate Oklahomans on how to be better stewards of the environment.

Results
In 2016 1,132 individuals attended programming on water conservation practices

53 individuals attended Does Climate Change your Plate

4. Associated Knowledge Areas

KA Code	Knowledge Area

403	Waste Disposal, Recycling, and Reuse
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

While no Oklahoma Family and Consumer Sciences educators chose Environment as a primary issue team for their county, and therefore did not participate in issue team evaluation, some educators still conducted environment activities.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 17

1. Name of the Planned Program

Family and Youth Environmental and Safety Issues

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%	0%	0%	0%
111	Conservation and Efficient Use of Water	6%	0%	0%	0%
121	Management of Range Resources	13%	0%	0%	0%
133	Pollution Prevention and Mitigation	13%	0%	0%	0%
134	Outdoor Recreation	18%	0%	0%	0%
141	Air Resource Protection and Management	5%	0%	0%	0%
723	Hazards to Human Health and Safety	25%	0%	0%	0%
805	Community Institutions, Health, and Social Services	15%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	5.5	0.0	0.0	0.0
Actual Paid	5.0	0.0	0.0	0.0
Actual Volunteer	0.6	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**
224155	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
224155	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
336119	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research that addresses chronic issues in Oklahoma
- Evaluate programs to determine effectiveness and impacts
- Leverage resources via grant writing and development activities
- Develop relevant partnerships
- Collaboratively conduct 4-H projects and activities

2. Brief description of the target audience

Youth, homeowners, families, children, teachers, communities, community leaders

3. How was eXtension used?

eXtension is provided as an educator resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2628	30100	800	0

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	0	6	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU Fact s published

Year	Actual
2016	0

Output #2

Output Measure

- Number of other publications including but not limited to Bulletins, Technical Manuals, Reports as well as digital resources such as PowerPoint presentations, curricula, and core competency modules distributed for use by others

Year	Actual
2016	3

Output #3

Output Measure

- Number of in-service training sessions

Year	Actual
2016	27

Output #4

Output Measure

- Number of certification training sessions

Year	Actual
2016	0

Output #5

Output Measure

- Number of other training sessions, workshops, etc. conducted

Year	Actual
2016	4

Output #6

Output Measure

- Number of presentations at Extension organized meetings

Year	Actual
2016	19

Output #7

Output Measure

- Number of presentations at other meetings and events (professional meetings, invitations to speak to community and stakeholder groups, etc.)

Year	Actual
2016	13

Output #8

Output Measure

- Number of workshops, conferences, etc. organized

Year	Actual
2016	1

Output #9

Output Measure

- Number of demonstrations

Year	Actual
2016	1

Output #10

Output Measure

- Number of displays, exhibits, and models

Year	Actual

2016	0

Output #11

Output Measure

- Number of newsletters

Year	Actual
2016	0

Output #12

Output Measure

- Number of radio and television presentations

Year	Actual
2016	1

Output #13

Output Measure

- Number of newspaper, and magazine articles written

Year	Actual
2016	10

Output #14

Output Measure

- Number of OSU Fact Sheets revised
  Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of webpages created or updated
  Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Average number of phone calls and/or email requests responded to on a weekly basis
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Number of webcasts or guest appearances on webinars

Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of participants increasing selection and home preservation of home, locally and regionally produced foods
2	Percentage of participants increasing composting, donation of goods for others to use, repurposing, and recycling of items
3	Percentage of participants increasing maintenance, conservation, and protection of natural resources (air, land, water)
4	Number of participants who are prepared for emergencies
5	Percentage of participants increasing proper home thermostat management
6	Percentage of participants managing safety hazards in the home
7	Number of participants who are using assistive technology as necessary
8	Number of participants using available assistance for injury/disability

Outcome #1

1. **Outcome Measures**

Percentage of participants increasing selection and home preservation of home, locally and regionally produced foods

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Percentage of participants increasing composting, donation of goods for others to use, repurposing, and recycling of items

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Percentage of participants increasing maintenance, conservation, and protection of natural resources (air, land, water)

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Number of participants who are prepared for emergencies

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
907 magnitude 3+ earthquakes occurred in Oklahoma in 2015, up from 585 in 2014 and 109 in 2013. In addition, Oklahoma is vulnerable to many natural disasters each year such as tornadoes, ice storms, floods and wildfires. These disasters can cause significant financial loss by destroying homes and businesses. Many Oklahomans lack information about how to maintain their health, well being, and safety as it relates to their homes and the near environment. In Oklahoma, falls, fires/burns, and poisonings account for the majority of unintentional home injury deaths among all age groups.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address safety, educational programs have been created and implemented to educate Oklahomans on how to improve their quality of life.

Results
A total of 327 individuals were reached through emergency preparedness programs such as EDEN Grab and Go Emergency Preparedness and Build an Emergency Preparedness Kit on a Budget. As of 2016, 384 Oklahomans pledged to create emergency kits and 163 had fulfilled this pledge.

A total of 1,738 youth attended Progressive Ag Safety Day across Oklahoma and learned how to keep safe at home, at play, and during severe weather.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety
805	Community Institutions, Health, and Social Services

Outcome #5

1. Outcome Measures

Percentage of participants increasing proper home thermostat management

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Percentage of participants managing safety hazards in the home

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Number of participants who are using assistive technology as necessary

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Number of participants using available assistance for injury/disability

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Even though no Oklahoma Family and Consumer Sciences educators chose Environment as an issue team and therefore did not participate in issue team evaluation, some educators still completed environment activities.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 18

1. Name of the Planned Program

Food Safety - Hunger, Health and Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	30%	0%	0%	0%
723	Hazards to Human Health and Safety	40%	0%	0%	0%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	5%	0%	0%	0%
805	Community Institutions, Health, and Social Services	25%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	19.0	0.0	0.0	0.0
Actual Paid	15.0	0.0	0.0	0.0
Actual Volunteer	4.1	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**
373591	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
373591	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1998321	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Establish appropriate partnerships
- Collaboratively conduct 4-H projects and activities.
- Evaluate programs to determine effectiveness and impacts.
- Conduct research that addresses chronic issues in Oklahoma.
- Leverage resources via grant writing and development activities
- Student internships and service learning

2. Brief description of the target audience

Families, youth, resturant employees, food handlers, children, communities, community leaders

3. How was eXtension used?

eXtension is provided as an educator resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	90776	2348682	6500	250000

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	1	0	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU Fact Sheets Newly Developed

Year	Actual
2016	1

Output #2

Output Measure

- Number of other publications including but not limited to Bulletins, Technical Manuals, Reports as well as digital resources such as PowerPoint presentations, curricula, core competency modules, etc. distributed for use by others

Year	Actual
2016	5

Output #3

Output Measure

- Number of in-service training sessions

Year	Actual
2016	5

Output #4

Output Measure

- Number of certification Training sessions

Year	Actual
2016	0

Output #5

Output Measure

- Number of other training sessions, workshops, etc. conducted

Year	Actual
2016	2

Output #6

Output Measure

- Number of presentations at Extension organized meetings

Year	Actual
2016	12

Output #7

Output Measure

- Number of presentations at other meetings and events (professional meetings, invitations to speak to community groups, stakeholder groups, etc.)

Year	Actual
2016	0

Output #8

Output Measure

- Number of workshops, conferences, etc. organized

Year	Actual
2016	0

Output #9

Output Measure

- Number of posters or displays, exhibits, and models

Year	Actual
2016	0

Output #10

Output Measure

- Number of other demonstrations

Year	Actual
2016	2

Output #11

Output Measure

- Number of newsletters

Year	Actual
2016	0

Output #12

Output Measure

- Number of radio and television presentations

Year	Actual
2016	18

Output #13

Output Measure

- Number of newspaper, and magazine articles written

Year	Actual
2016	35

Output #14

Output Measure

- Number of OSU Fact Sheets revised
  Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of webpages created or updated
  Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Number of website hits
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Average number of phone calls and/or email requests responded to on a weekly basis
  Not reporting on this Output for this Annual Report

Output #18

Output Measure

- Number of webcasts or guest appearances on webinars
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of participants increasing meal preparation at home
2	Percentage of participants increasing food cooking skills
3	Percentage of participants increasing safe food handling practices
4	Percentage participants increasing safe and effective food preservation practices
5	Percentage of participants increasing practice of safety and injury/secondary injury prevention

Outcome #1

1. Outcome Measures

Percentage of participants increasing meal preparation at home

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nine percent of Oklahomans have limited access to healthy food. In the United States, food waste is estimated at between 30-40 percent of the food supply.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address maintaining or improving health through safe food choices, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 1,171 youth and adult participants across Oklahomans learned safe food handling and food preparation practices through programs such as Food Safety Basics, Home Food Preservation, and Put It Up! Food Preservation for Youth.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #2

1. Outcome Measures

Percentage of participants increasing food cooking skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Total annual health-related costs of food borne illness in the United States, including medical expenses, lost productivity, and even death, totals exceeds $15 billion.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address maintaining or improving health through safe food choices, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 1,171 youth and adult participants across Oklahomans learned safe food handling and food preparation practices through programs such as Food Safety Basics, Home Food Preservation, and Put It Up! Food Preservation for Youth.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #3

1. Outcome Measures

Percentage of participants increasing safe food handling practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Total annual health-related costs of food borne illness in the United States, including medical expenses, lost productivity, and even death, totals exceeds $15 billion.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address maintaining or improving health through safe food choices, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 1,171 youth and adult participants across Oklahomans learned safe food handling and food preparation practices through programs such as Food Safety Basics, Home Food Preservation, and Put It Up! Food Preservation for Youth. Audiences included youth about to age out of the state?s Foster Care system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Percentage participants increasing safe and effective food preservation practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Total annual health-related costs of food borne illness in the United States, including medical expenses, lost productivity, and even death, totals exceeds $15 billion. Food waste in the United States is estimated at between 30-40 percent of the food supply.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address maintaining or improving health through safe food choices, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 1,171 youth and adult participants across Oklahomans learned safe food handling and food preparation practices through programs such as Food Safety Basics, Home Food Preservation, and Put It Up! Food Preservation for Youth.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety

Outcome #5

1. Outcome Measures

Percentage of participants increasing practice of safety and injury/secondary injury prevention

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Oklahoma, 16,636 deaths resulted from injury (88 per 100,000 residents) in 2016.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address reducing risks that could harm health, well-being, and safety in homes and communities, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 3,691 adults and youth participated in programs that taught them how to avoid hazards and stay safe in their homes. An additional 2,409 Oklahoma adults participated in the Walk with Ease, Arthritis Foundation Land Exercise, and Tai Chi: Moving for Better Balance programs which are a series of low-impact exercises to increase balance and mobility.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Issue team evaluation items for the above outcomes include:

145 adult respondents to hunger issue team evaluations and 417 adult respondents to health issue team evaluations reported the following planned behavior changes after participating in the program:

- 34% increase in planning to cook meals at home
- 61% increase in planning to use simple recipes to cook foods
- 37% increase in planning to use safe food handling practices
- 26% increase in planning to use safe food storage practices

124 adult respondents to home food preservation evaluations reported the following planned behavior changes after participating in the program:

- 146% increase in planning on using safe and effective food preservation practices
- 164% increase in planning to use recipes from recent, reliable sources
- 104% increase in planning to carefully follow recipe instructions
- 115% increase in planning to use jars or containers made for the type of preservation being done
- 137% increase in planning to process all canned foods in either a boiling water or pressure canner

54 youth respondents to health issue team evaluations reported the following planned behavior changes after participating in the program:

- 80% increase in youth planning on using safe food preservation practices

149 adult respondents to safety issue team evaluation questions reported the following planned behavior changes after participating in safety programs:

- 75% increase in planning to manage safety hazards in or near their home
- 45% increase in confidence in ability to be safe
- 325% increase in ability to move without the risk of injury despite their current health condition

- 166% increase in ability to perform common activities of daily living with minimal difficulty

Key Items of Evaluation

In 2016, Issue Team-specific evaluation questionnaires were collected after planned program curriculum delivery. These questions utilized a retrospective approach. Evaluation participation was completely voluntary and does not include all program participants.

V(A). Planned Program (Summary)

Program # 19

1. Name of the Planned Program

Global Food Security and Hunger - Families and 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
604	Marketing and Distribution Practices	5%	0%	0%	0%
607	Consumer Economics	17%	0%	0%	0%
608	Community Resource Planning and Development	3%	0%	0%	0%
703	Nutrition Education and Behavior	20%	0%	0%	0%
704	Nutrition and Hunger in the Population	10%	0%	0%	0%
724	Healthy Lifestyle	10%	0%	0%	0%
801	Individual and Family Resource Management	8%	0%	0%	0%
802	Human Development and Family Well-Being	7%	0%	0%	0%
805	Community Institutions, Health, and Social Services	10%	0%	0%	0%
806	Youth Development	10%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	0.0	0.0	0.0
Actual Paid	22.0	0.0	0.0	0.0
Actual Volunteer	7.8	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**
410950	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
410950	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3185247	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research that addresses chronic issues in Oklahoma
- Leverage resources via grant writing and development activities
- Student internships and service learning
- Establish appropriate partnerships with other youth serving agencies and commodity groups
- Develop, test and use evaluation tools to determine effectiveness and impacts
- Collaboratively conduct 4-H projects and activities
- Establish community and school gardens

2. Brief description of the target audience

Families, communities, youth, children, parents, community leaders, teachers, job seakers, businesses

3. How was eXtension used?

eXtension is provided as an educator resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	113465	3710000	10500	200000

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	1	4	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU Fact sheets revised

Year	Actual
2016	4

Output #2

Output Measure

- Number of other publications including but not limited to Bulletins, Technical Manuals, Reports as well as digital resources such as PowerPoint presentations, curricula, core competency modules, etc. distributed for use by others

Year	Actual
2016	6

Output #3

Output Measure

- Number of in-service training sessions

Year	Actual
2016	14

Output #4

Output Measure

- Number of certification training sessions

Year	Actual
2016	3

Output #5

Output Measure

- Number of other training sessions, workshops, etc. conducted

Year	Actual
2016	7

Output #6

Output Measure

- Number of presentations at Extension organized meetings

Year	Actual
2016	6

Output #7

Output Measure

- Number of presentations at other meetings and events (professional meetings, invitations to speak to community groups, stakeholder groups, etc.)

Year	Actual
2016	6

Output #8

Output Measure

- Number of workshops, conferences, etc. organized

Year	Actual
2016	5

Output #9

Output Measure

- Number of posters or displays, exhibits, and models

Year	Actual
2016	3

Output #10

Output Measure

- Number of other demonstrations

Year	Actual

2016	16

Output #11

Output Measure

- Number of newsletters

Year	Actual
2016	1

Output #12

Output Measure

- Number of radio and television presentations

Year	Actual
2016	0

Output #13

Output Measure

- Number of newspaper, and magazine articles written

Year	Actual
2016	16

Output #14

Output Measure

- Number of OSU Fact Sheets newly developed

Year	Actual
2016	4

Output #15

Output Measure

- Number of webpages created or updated
  Not reporting on this Output for this Annual Report

Output #16

Output Measure

- Number of webcasts or guest appearances on webinars
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Average number of phone calls and/or email requests responded to on a weekly basis
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of participants increasing money saving meal planning or food shopping practices
2	Percentage of participants increasing food money management practices
3	Percentage of participants increasing growth, production, hunting, or fishing for some food
4	Percentage of participants decreasing likelihood of using high-risk negative financial practices such as overusing credit, failing to save money or planning for the future
5	Percentage of participants decreasing risk of default on loans, credit card debt, unpaid bills, mortgage foreclosure, and identity theft
6	Percentage of participants increasing financial planning practices across the life cycle and skills to manage financial risk
7	Percentage of participants increasing readiness for employment opportunities
8	Percentage of participants increasing readiness for life changes
9	Percentage of participants increasing life skills for personal competence
10	Percentage of participants increasing ability to manage personal and family finances
11	Percentage of participants increasing child competent behaviors
12	Percentage of participants decreasing child problematic behaviors

Outcome #1

1. Outcome Measures

Percentage of participants increasing money saving meal planning or food shopping practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2016, 17% of Oklahomans did not have access to a reliable source of food and 9% had limited access to healthy food. The Regional Food Bank of Oklahoma feeds more than 126.000 Oklahomans every week, 37% of which are children. The Community Food Bank of Eastern Oklahoma provides more than 339,000 meals to Oklahomans each week.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address food insecurity & hunger, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 4,173 Oklahomans participated in educational programs including Eat Right When Money is Tight, Stretching Your Food Dollars, and MyPlate for My Family that focused on reducing hunger and helped family provide nutritious meals on a budget.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
704	Nutrition and Hunger in the Population
801	Individual and Family Resource Management

Outcome #2

1. **Outcome Measures**

   Percentage of participants increasing food money management practices

   Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

   Percentage of participants increasing growth, production, hunting, or fishing for some food

   Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

   Percentage of participants decreasing likelihood of using high-risk negative financial practices such as overusing credit, failing to save money or planning for the future

2. **Associated Institution Types**

   - 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2016 the statewide unemployment rate was 5.1% and the median household income in Oklahoma was $47,524. Four percent of all homes with mortgages in the state were foreclosed. Seventeen percent of Oklahomans, including 22% of Oklahoma children, live below the poverty level. Twenty-five percent of Oklahoma adults and 11% of children do not have health insurance. In 2015, 7.8% of high school students dropped out of school.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address financial management and planning skills, jobs and employment, and families,

educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, programs using various curricula were presented to 1,581 individuals across Oklahoma. Programs presented include:

?Making Sense of Money Management classes are offered as an alternative to having bogus check charges filed in district court.
?Money Habitudes cards are a fun, easy tool for participants to talk about money and understand their money personality type. Money Habitudes help individuals understand their money personality and spending habits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
801	Individual and Family Resource Management
806	Youth Development

Outcome #5

1. Outcome Measures

Percentage of participants decreasing risk of default on loans, credit card debt, unpaid bills, mortgage foreclosure, and identity theft

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Percentage of participants increasing financial planning practices across the life cycle and skills to manage financial risk

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Percentage of participants increasing readiness for employment opportunities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2016 the statewide unemployment rate was 5.1% and the median household income in Oklahoma was $47,524. Four percent of all homes with mortgages in the state were foreclosed. Seventeen percent of Oklahomans, including 22% of Oklahoma children, live below the poverty level. Twenty-five percent of Oklahoma adults and 11% of children do not have health insurance. In 2015, 7.8% of high school students dropped out of school.

What has been done
In order to advance the socio-economic development of the state, and have an impact on issues that address financial management and planning skills, jobs and employment, and families, educational programs have been created and implemented to educate Oklahomans on how to attain a better quality of life.

Results
In 2016, 1696 participants attended programs such as:

?Overcoming Obstacles which teaches important life skills such as communication, decision making and goal setting. 256 high school students participating in the program also focus on planning of continuing education and career readiness, as well how to excel on the job and develop financial responsibility.

?PRIDE (Producing Resourceful Informed Dedicated Employees) is a customer service program designed to enhance rural and community development. 71 frontline employees learn quality customer service techniques and helps employees learn about highlights and tourist attractions in their community, county, region and state.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
806	Youth Development

Outcome #8

1. **Outcome Measures**

Percentage of participants increasing readiness for life changes

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

Percentage of participants increasing life skills for personal competence

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

Percentage of participants increasing ability to manage personal and family finances

Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

Percentage of participants increasing child competent behaviors

Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

Percentage of participants decreasing child problematic behaviors

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Issue team evaluation items for the above outcomes include:

145 adult respondents to hunger issue team evaluations reported the following planned behavior changes after participating in the program:

- 162% increase in planning to use money saving meal planning or food shopping practices
- 75% increase in planning to grow, produce, hunt or fish for some of their own food

241 adult respondents to finance issue team evaluations reported the following planned behavior changes after participating in the program:

- 18% decrease in planning to use a payday loan company for small loans
- 24% decrease in planning to not pay off credit card balance each month
- 54% decrease in not planning to take steps to prevent identity theft
- 64% decrease in not planning to order a copy of their credit report on a regular basis
- 116% increase in planning to establish or update estate plans
- 163% increase in planning to regularly write down financial goals
- 102% increase in planning to regularly make a written spending plan
- 61% increase in planning to regularly track income and spending

Key Items of Evaluation

In 2016, Issue Team-specific Evaluation Questionnaires were collected after planned program curriculum delivery. These questions utilized a retrospective approach. Evaluation participation was completely voluntary and does not include all program participants.

V(A). Planned Program (Summary)

Program # 20

1. Name of the Planned Program

Enhanced Goat Production in the South - Central United States (Langston University)

☑ 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
302	Nutrient Utilization in Animals	0%	30%	0%	30%
307	Animal Management Systems	0%	30%	0%	30%
313	Internal Parasites in Animals	0%	20%	0%	20%
502	New and Improved Food Products	0%	20%	0%	20%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	2.0	0.0	3.0
Actual Paid	0.0	0.6	0.0	1.7
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**
0	15261	0	54893
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	26360
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	163177

V(D). Planned Program (Activity)

1. Brief description of the Activity

We will publish scientific articles, present research papers at scientific meetings, write newsletters and present workshops and demonstrations.

2. Brief description of the target audience

All present/potential goat producers in Oklahoma and surrounding states.

3. How was eXtension used?

eXtension was not used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	200	100	175	25

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	0	3	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research projects completed on Enhanced Goat Products

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers learning new goat production techniques.
2	Number of goat producers using new goat production techniques.
3	Goat producers who have improved production efficiency by using the learned control techniques.

Outcome #1

1. Outcome Measures

Number of goat producers learning new goat production techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Goat enterprises are important components of many farms and farming systems in the United States; particularly among small and resource-poor units. There is a growing number of farms where sales of goats or goat products provide the majority of their income. Many large operations have diversified by adding goats to more conventional production systems to benefit from the unique feeding habits of goats. Therefore, this project can lead to improvements in goat management practices, production systems, and use of goat products for increased levels and efficiencies of goat productivity and economic returns. This program is important to a large number of goat industry producers and consumers in Oklahoma, other parts of the United States and numerous countries worldwide. Goat production is very important to food security and economic security in many developing countries.

What has been done
A number of experiments were conducted in 2016. Principal outputs of the project have been disseminated via abstracts, associated poster presentations at scientific meetings. Scientific manuscripts (3) and abstracts (3) were published. Information gained has been disseminated through the website of the American Institute for Goat Research and Extension activities such as the Annual Goat Field Day and various workshops held throughout the year.

Results
The resources employed and activities undertaken by this project are contributing to a better understanding of goat production, management and utilization of goat products. Both small and large diversified farming operations that utilize goats have been able to use the technology and information resulting from this project to increase their goat production levels, reduce losses in

their herds and increase production efficiency. These changes in knowledge and improvements in production methods have helped producers increase their economic returns in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #2

1. Outcome Measures

Number of goat producers using new goat production techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Goat enterprises are important components of many farms and farming systems in the United States; particularly among small and resource-poor units. There is a growing number of farms where sales of goats or goat products provide the majority of their income. Many large operations have diversified by adding goats to more conventional production systems to benefit from the unique feeding habits of goats. Therefore, this project can lead to improvements in goat management practices, production systems, and use of goat products for increased levels and efficiencies of goat productivity and economic returns. This program is important to a large number of goat industry producers and consumers in Oklahoma, other parts of the United States and numerous countries worldwide. Goat production is very important to food security and economic security in many developing countries.

What has been done

A number of experiments were conducted in 2016. Principal outputs of the project have been disseminated via abstracts, associated poster presentations at scientific meetings. Scientific

manuscripts (3) and abstracts (3) were published. Information gained has been disseminated through the website of the American Institute for Goat Research and Extension activities such as the Annual Goat Field Day and various workshops held throughout the year.

Results

The resources employed and activities undertaken by this project are contributing to a better understanding of goat production, management and utilization of goat products. Both small and large diversified farming operations that utilize goats have been able to use the technology and information resulting from this project to increase their goat production levels, reduce losses in their herds and increase production efficiency. These changes in knowledge and improvements in production methods have helped producers increase their economic returns in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
313	Internal Parasites in Animals

Outcome #3

1. Outcome Measures

Goat producers who have improved production efficiency by using the learned control techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Goat enterprises are important components of many farms and farming systems in the United States; particularly among small and resource-poor units. There is a growing number of farms where sales of goats or goat products provide the majority of their income. Many large operations have diversified by adding goats to more conventional production systems to benefit from the unique feeding habits of goats. Therefore, this project can lead to improvements in goat management practices, production systems, and use of goat products for increased levels and efficiencies of goat productivity and economic returns. This program is important to a large number of goat industry producers and consumers in Oklahoma, other parts of the United States and numerous countries worldwide. Goat production is very important to food security and

economic security in many developing countries.

What has been done

A number of experiments were conducted in 2016. Principal outputs of the project have been disseminated via abstracts, associated poster presentations at scientific meetings. Scientific manuscripts (3) and abstracts (3) were published. Information gained has been disseminated through the website of the American Institute for Goat Research and Extension activities such as the Annual Goat Field Day and various workshops held throughout the year.

Results

The resources employed and activities undertaken by this project are contributing to a better understanding of goat production, management and utilization of goat products. Both small and large diversified farming operations that utilize goats have been able to use the technology and information resulting from this project to increase their goat production levels, reduce losses in their herds and increase production efficiency. These changes in knowledge and improvements in production methods have helped producers increase their economic returns in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Other ((Disease))

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

An advisory council evaluated the scientific merit and usefulness of this project. It was deemed acceptable and on-track in its efforts.

Key Items of Evaluation

The project was examined for its scientific merit and to establish if it could produce useable results.

V(A). Planned Program (Summary)

Program # 21

1. Name of the Planned Program

4-H Clubs (Langston University)

☑ 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
806	Youth Development	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	2.0	0.0	0.0
Actual Paid	0.0	1.1	0.0	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**
0	40377	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	121921	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The 4-H program will conduct meetings, training sessions, classes and use other learning vehicles to help youth develop life skills.

2. Brief description of the target audience

Youth in Oklahoma who qualify for the program.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	50	2000	200

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of of Research Projects completed in the 4-H Club Program.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth learning new information from the 4-H Club Program.
2	Number of youth using information learned in the 4-H Club program.
3	Youth who develop life skill.

Outcome #1

1. Outcome Measures

Number of youth learning new information from the 4-H Club Program.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The need for 4-H Clubs in Oklahoma counties was identified as an issue by concerned parents and community leaders. Most Oklahoma communities offer limited youth education programs for young people (especially in the areas of science, mathematics and technology). Consequently, there is an unacceptably high number of students who are more susceptible to the lure and negative effects of drugs, alcohol, teen pregnancy, peer pressure, gang violence and school dropout. Inactivity among youth has also led to another health challenge for youth in the form of obesity.

What has been done

Langston University Cooperative Extension staff worked with 4-H volunteer leaders in order to help them maintain their volunteer certification. The staff visited each leader and provided training that included 4-H orientation, steps in starting new 4-H community clubs and serving as effective project leaders. The staff also provided information and materials to leaders in order to help them implement specific projects and events. Clubs conducted meetings during 2016 and presented tailored curriculum to youth. Club members worked on 4-H projects including gardening,

woodworking, goats, fabrics and fashion, computer graphics, photography, visual arts, aquaponics, entrepreneurship, money management, public speaking, science, natural resources, biotechnology and robotics. Activities were also conducted to get youth to move and exercise.

Results
During 2016 over 2000 youth were reached through Langston University 4-H Club efforts. Many, if not all, of these youth improved their skills in leadership, public speaking and proper human interaction. Youth were challenged to increase their science IQs in hopes of developing a population of future scientists and engineers. Materials were presented and sessions conducted that will potentially result in more youth choosing to stay away from gangs and drug involvement, become high school graduates and pursue science or technology as a college major.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Number of youth using information learned in the 4-H Club program.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need for 4-H Clubs in Oklahoma counties was identified as an issue by concerned parents and community leaders. Most Oklahoma communities offer limited youth education programs for young people (especially in the areas of science, mathematics and technology). Consequently, there is an unacceptably high number of students who are more susceptible to the lure and negative effects of drugs, alcohol, teen pregnancy, peer pressure, gang violence and school dropout. Inactivity among youth has also led to another health challenge for youth in the form of obesity.

What has been done

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Results

During 2016 over 2000 youth were reached through Langston University 4-H Club efforts. Many, if not all, of these youth improved their skills in leadership, public speaking and proper human interaction. Youth were challenged to increase their science IQs in hopes of developing a population of future scientists and engineers. Materials were presented and sessions conducted that will potentially result in more youth choosing to stay away from gangs and drug involvement, become high school graduates and pursue science or technology as a college major.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Youth who develop life skill.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The need for 4-H Clubs in Oklahoma counties was identified as an issue by concerned parents and community leaders. Most Oklahoma communities offer limited youth education programs for young people (especially in the areas of science, mathematics and technology). Consequently, there is an unacceptably high number of students who are more susceptible to the lure and

negative effects of drugs, alcohol, teen pregnancy, peer pressure, gang violence and school dropout. Inactivity among youth has also led to another health challenge for youth in the form of obesity.

What has been done

Langston University Cooperative Extension staff worked with 4-H volunteer leaders in order to help them maintain their volunteer certification. The staff visited each leader and provided training that included 4-H orientation, steps in starting new 4-H community clubs and serving as effective project leaders. The staff also provided information and materials to leaders in order to help them implement specific projects and events. Clubs conducted meetings during 2016 and presented tailored curriculum to youth. Club members worked on 4-H projects including gardening, woodworking, goats, fabrics and fashion, computer graphics, photography, visual arts, aquaponics, entrepreneurship, money management, public speaking, science, natural resources, biotechnology and robotics. Activities were also conducted to get youth to move and exercise.

Results

During 2016 over 2000 youth were reached through Langston University 4-H Club efforts. Many, if not all, of these youth improved their skills in leadership, public speaking and proper human interaction. Youth were challenged to increase their science IQs in hopes of developing a population of future scientists and engineers. Materials were presented and sessions conducted that will potentially result in more youth choosing to stay away from gangs and drug involvement, become high school graduates and pursue science or technology as a college major.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Competing Public priorities

Brief Explanation

External factors did nor affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Pre and post evaluations of activities showed them to be effective.

Key Items of Evaluation

- Build self-confidence
- Improved math skills
- Improved reading skill

V(A). Planned Program (Summary)

Program # 22

1. Name of the Planned Program

Extended Education (Langston University)

☑ 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
806	Youth Development	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	1.2	0.0	0.0
Actual Paid	0.0	2.0	0.0	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**
0	86501	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	121921	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension personnel will conduct classes and mini camps in reading, math and science for youth in Oklahoma.

2. Brief description of the target audience

Youth in Oklahoma

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	90	40	664	200

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects competed on Extended Education.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth taught extended education techniques.
2	Number of youth grasping and using extended education techniques.
3	Number of youth who improve their academic performance and catch up in the classroom.

Outcome #1

1. Outcome Measures

Number of youth taught extended education techniques.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need for a summer literacy program in Logan County was identified as an issue by concerned parents and community leaders. Logan County offers limited youth education programs for young people after school and during the summer months. Consequently, there is an unacceptably high number of latchkey students. Students who do not participate in skills building and recreation programs during their summer vacation are more likely to experience a diminishment in their reading and math capabilities and health and physical fitness over the summer. Students who do not have something constructive to do are more susceptible to becoming engaged in destructive activities. There is a national effort through 4-H to increase the number of youth involved in programs in science, engineering and technology (SET). We addressed that challenge in 2016 through our summer literacy program, a 4-H SET Saturday Academy and a 4-H SET Summer Camp.

What has been done
Langston University Cooperative Extension staff planned and conducted an annual Literacy in Action Summer Reading Program designed to help Oklahoma Logan County youth (grades pre-kindergarten through fifth) learn developmental concepts that help to maintain their academic capabilities and strengthen their overall well-being. A setting was created that motivated life skill development during the months of June through July. Seventy-six students received group and individualized instructions and hands-on practice in math, reading and writing. They participated in nutrition education workshops and performed physical fitness exercises daily. With the child obesity epidemic presently facing our country, physical fitness and proper nutrition were essential daily components of the program. During 2016, we also taught a curriculum that was age-specific in science, engineering and technology (SET). This was part of a program launched during the summer and fall of 2008. The 4-H SET Curriculum was taught during the summer, on weekends and during a summer camp. College support students, volunteers and university faculty and staff helped deliver this program. Participants built and launched rockets, engaged in SAT prep

vocabulary training, learned about distracted driving via fatal goggles simulations, received reptile, amphibian and ichthyology education and engaged in science-related field trips.

Results

The seventy-six students who participated in our 4-H Literacy Program received reinforcement over the summer to help maintain or strengthen their skills in reading and mathematics. Post testing showed the success of the reading and mathematics components of this program. At the conclusion of the program 100% of youth participants demonstrated improvement in reading comprehension. One hundred percent showed improvement in understanding mathematical concepts. Instructors at a school in Logan County stated that students who participated in this summer program were more school-ready in the fall. Students who participated in the 4-H SET Summer Program received age-specific training in food science, computer technology, rocketry, aquaculture, robotics and other areas to create within them a thirst for science, engineering and technology. Three (3) of our former 4-H SET Program students have graduated from high school and enrolled in universities in Oklahoma and majoring in science- related fields.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Number of youth grasping and using extended education techniques.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The need for a summer literacy program in Logan County was identified as an issue by concerned parents and community leaders. Logan County offers limited youth education programs for young people after school and during the summer months. Consequently, there is an unacceptably high number of latchkey students. Students who do not participate in skills building and recreation programs during their summer vacation are more likely to experience a diminishment in their reading and math capabilities and health and physical fitness over the

summer. Students who do not have something constructive to do are more susceptible to becoming engaged in destructive activities. There is a national effort through 4-H to increase the number of youth involved in programs in science, engineering and technology (SET). We addressed that challenge in 2016 through our summer literacy program, a 4-H SET Saturday Academy and a 4-H SET Summer Camp.

What has been done

Langston University Cooperative Extension staff planned and conducted an annual Literacy in Action Summer Reading Program designed to help Oklahoma Logan County youth (grades pre-kindergarten through fifth) learn developmental concepts that help to maintain their academic capabilities and strengthen their overall well-being. A setting was created that motivated life skill development during the months of June through July. Seventy-six students received group and individualized instructions and hands-on practice in math, reading and writing. They participated in nutrition education workshops and performed physical fitness exercises daily. With the child obesity epidemic presently facing our country, physical fitness and proper nutrition were essential daily components of the program. During 2016, we also taught a curriculum that was age-specific in science, engineering and technology (SET). This was part of a program launched during the summer and fall of 2008. The 4-H SET Curriculum was taught during the summer, on weekends and during a summer camp. College support students, volunteers and university faculty and staff helped deliver this program. Participants built and launched rockets, engaged in SAT prep vocabulary training, learned about distracted driving via fatal goggles simulations, received reptile, amphibian and ichthyology education and engaged in science-related field trips.

Results

The seventy-six students who participated in our 4-H Literacy Program received reinforcement over the summer to help maintain or strengthen their skills in reading and mathematics. Post testing showed the success of the reading and mathematics components of this program. At the conclusion of the program 100% of youth participants demonstrated improvement in reading comprehension. One hundred percent showed improvement in understanding mathematical concepts. Instructors at a school in Logan County stated that students who participated in this summer program were more school-ready in the fall. Students who participated in the 4-H SET Summer Program received age-specific training in food science, computer technology, rocketry, aquaculture, robotics and other areas to create within them a thirst for science, engineering and technology. Three (3) of our former 4-H SET Program students have graduated from high school and enrolled in universities in Oklahoma and majoring in science- related fields.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Number of youth who improve their academic performance and catch up in the classroom.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need for a summer literacy program in Logan County was identified as an issue by concerned parents and community leaders. Logan County offers limited youth education programs for young people after school and during the summer months. Consequently, there is an unacceptably high number of latchkey students. Students who do not participate in skills building and recreation programs during their summer vacation are more likely to experience a diminishment in their reading and math capabilities and health and physical fitness over the summer. Students who do not have something constructive to do are more susceptible to becoming engaged in destructive activities. There is a national effort through 4-H to increase the number of youth involved in programs in science, engineering and technology (SET). We addressed that challenge in 2016 through our summer literacy program, a 4-H SET Saturday Academy and a 4-H SET Summer Camp.

What has been done
Langston University Cooperative Extension staff planned and conducted an annual Literacy in Action Summer Reading Program designed to help Oklahoma Logan County youth (grades pre-kindergarten through fifth) learn developmental concepts that help to maintain their academic capabilities and strengthen their overall well-being. A setting was created that motivated life skill development during the months of June through July. Seventy-six students received group and individualized instructions and hands-on practice in math, reading and writing. They participated in nutrition education workshops and performed physical fitness exercises daily. With the child obesity epidemic presently facing our country, physical fitness and proper nutrition were essential daily components of the program. During 2016, we also taught a curriculum that was age-specific in science, engineering and technology (SET). This was part of a program launched during the summer and fall of 2008. The 4-H SET Curriculum was taught during the summer, on weekends and during a summer camp. College support students, volunteers and university faculty and staff helped deliver this program. Participants built and launched rockets, engaged in SAT prep vocabulary training, learned about distracted driving via fatal goggles simulations, received reptile, amphibian and ichthyology education and engaged in science-related field trips.

Results
The seventy-six students who participated in our 4-H Literacy Program received reinforcement over the summer to help maintain or strengthen their skills in reading and mathematics. Post testing showed the success of the reading and mathematics components of this program. At the conclusion of the program 100% of youth participants demonstrated improvement in reading comprehension. One hundred percent showed improvement in understanding mathematical

concepts. Instructors at a school in Logan County stated that students who participated in this summer program were more school-ready in the fall. Students who participated in the 4-H SET Summer Program received age-specific training in food science, computer technology, rocketry, aquaculture, robotics and other areas to create within them a thirst for science, engineering and technology. Three (3) of our former 4-H SET Program students have graduated from high school and enrolled in universities in Oklahoma and majoring in science- related fields.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Public priorities

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The seventy-six students who participated in our 4-H Literacy program received reinforcement over the summer to help maintain or strengthen their skills in reading and mathematics. Post testing showed the success of the reading and mathematics component of this program. At the conclusion of the program 100% of youth participants demonstrated improvement in reading comprehension and 100% showed improvement in understanding mathematical concepts.

Key Items of Evaluation

- Build self-confidence
- Improved math skills
- Improved reading skill

V(A). Planned Program (Summary)

Program # 23

1. Name of the Planned Program

Family and Consumer Sciences (Langston University)

☑ 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
801	Individual and Family Resource Management	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.5	0.0	0.0
Actual Paid	0.0	0.3	0.0	0.0
Actual Volunteer	0.0	0.3	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**
0	23708	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	121921	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension personnel will conduct classes, seminars, workshops and forums to share Family and Consumer Sciences resources.

2. Brief description of the target audience

Citizens of Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	200	100	300	200

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Family and Consumer Sciences

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants who learned about Family and Consumer Sciences.
2	Number of participants who used Family and Consumer Sciences resources.
3	Number of families that improved their quality of life at least in part from this program.

Outcome #1

1. Outcome Measures

Number of participants who learned about Family and Consumer Sciences.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	400

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public officials continue to sound the alarm about America's mounting obesity epidemic; which is no respecter of age, gender, race, or socioeconomic status. Over half a million people in Oklahoma live in households that are food insecure. With the continued sluggishness of the economy, many Americans are facing issues in stretching food, housing and medical dollars. The Family and Consumer Sciences Program at Langston University assists clientele in combating these challenges.

What has been done
During 2016 meetings were conducted and demonstrations carried out on healthy food selection, good nutrition, My Plate and tailoring diets. Exercise type and intensity were taught during demonstrations. Sessions were conducted on food and nutrition principles (including food safety selection and storage), childhood development and money management. Targeted audiences were primarily in Logan, Oklahoma and Tulsa Counties.

Results
Program participants reported that they were more selective in their food choices; choosing more healthy foods. Some participants introduced more fruits and vegetables into their meals. These adopted changes in food choices have resulted in weight lost and put some participants on the road to healthy living at least in part because of their diets. Program participants also stated that they have experienced reductions in food costs. This is very important to many families that live from paycheck to paycheck.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #2

1. Outcome Measures

Number of participants who used Family and Consumer Sciences resources.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public officials continue to sound the alarm about America's mounting obesity epidemic; which is no respecter of age, gender, race, or socioeconomic status. Over half a million people in Oklahoma live in households that are food insecure. With the continued sluggishness of the economy, many Americans are facing issues in stretching food, housing and medical dollars. The Family and Consumer Sciences Program at Langston University assists clientele in combating these challenges.

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Results
Program participants reported that they were more selective in their food choices; choosing more healthy foods. Some participants introduced more fruits and vegetables into their meals. These adopted changes in food choices have resulted in weight lost and put some participants on the road to healthy living at least in part because of their diets. Program participants also stated that they have experienced reductions in food costs. This is very important to many families that live from paycheck to paycheck

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #3

1. Outcome Measures

Number of families that improved their quality of life at least in part from this program.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public officials continue to sound the alarm about America's mounting obesity epidemic; which is no respecter of age, gender, race, or socioeconomic status. Over half a million people in Oklahoma live in households that are food insecure. With the continued sluggishness of the economy, many Americans are facing issues in stretching food, housing and medical dollars. The Family and Consumer Sciences Program at Langston University assists clientele in combating these challenges.

What has been done
During 2016 meetings were conducted and demonstrations carried out on healthy food selection, good nutrition, My Plate and tailoring diets. Exercise type and intensity were taught during demonstrations. Sessions were conducted on food and nutrition principles (including food safety selection and storage), childhood development and money management. Targeted audiences were primarily in Logan, Oklahoma and Tulsa Counties.

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Program participants reported that they were more selective in their food choices; choosing more healthy foods. Some participants introduced more fruits and vegetables into their meals. These adopted changes in food choices have resulted in weight lost and put some participants on the road to healthy living at least in part because of their diets. Program participants also stated that they have experienced reductions in food costs. This is very important to many families that live from paycheck to paycheck

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Public priorities

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

- Improved food selection
- Improved food preparation and storage skills.

Key Items of Evaluation

- Obesity
- Food security
- Nutrition principles
- Childhood

V(A). Planned Program (Summary)

Program # 24

1. Name of the Planned Program

Food and Nutrition (Langston University)

☑ 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
504	Home and Commercial Food Service	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.5	0.0	0.0
Actual Paid	0.0	0.3	0.0	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**
0	21007	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	121921	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension personnel will conduct classes, seminars, workshops and hold community forums to teach healthy food and nutrition concepts.

2. Brief description of the target audience

Primarily limited resource families, youth and the elderly.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects competed on Food and Nutrition.
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants who learned about food and nutrition.
2	Number of participants who used knowledge/guidelines presented during food and nutrition sessions.
3	Number of participants who improve their lifestyles by following food and nutrition guidelines.

Outcome #1

1. Outcome Measures

Number of participants who learned about food and nutrition.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food and nutrition practices play a key role in the health of a nation. Many common diseases or conditions leading to diseases such as diabetes, hypertension and heart disease are linked to poor food and nutrition choices. This is especially true within minority populations. Oklahoma, and especially rural Oklahoma, ranks high among the states when it comes to overweight and obesity.

What has been done
No activity occurred this year.

Results
No activity occurred this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service

Outcome #2

1. Outcome Measures

Number of participants who used knowledge/guidelines presented during food and nutrition sessions.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food and nutrition practices play a key role in the health of a nation. Many common diseases or conditions leading to diseases such as diabetes, hypertension and heart disease are linked to poor food and nutrition choices. This is especially true within minority populations. Oklahoma, and especially rural Oklahoma, ranks high among the states when it comes to overweight and obesity.

What has been done
No activity occurred this year.

Results
No activity occurred this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service

Outcome #3

1. Outcome Measures

Number of participants who improve their lifestyles by following food and nutrition guidelines.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food and nutrition practices play a key role in the health of a nation. Many common diseases or conditions leading to diseases such as diabetes, hypertension and heart disease are linked to poor food and nutrition choices. This is especially true within minority populations. Oklahoma, and especially rural Oklahoma, ranks high among the states when it comes to overweight and obesity.

What has been done
No activity occurred this year.

Results
No activity occurred this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Government Regulations
- Competing Public priorities

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Participants indicated that they are making better decisions and choices related to food, nutrition, budgeting and balanced diets.

Key Items of Evaluation

- Improvement in food selection, preparation and storage skills
- Development of better budgeting skills

V(A). Planned Program (Summary)

Program # 25

1. Name of the Planned Program

Biotechnology (Langston University)

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.2	0.0	1.1
Actual Paid	0.0	0.0	0.0	0.5
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
0	0	0	14664
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	26360
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	153019

V(D). Planned Program (Activity)

1. Brief description of the Activity

Researchers will develop a local peanut nucleotide database and build a bioinformatics pipeline for peanut gene discovery.

2. Brief description of the target audience

All peanut producers in Oklahoma

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	100	50	50	50

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Biotechnology.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers learning about the peanut nucelotide database.
2	Number of farmers using the peanut nucleotide database.
3	Farmers who use the peanut nucleotide database or new peanut gene discoveries to improve their peanut production system.

Outcome #1

1. Outcome Measures

Number of farmers learning about the peanut nucelotide database.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need for developing improved peanut genotypes that are higher yielding and more disease and insect resistant. Improved nutritional varieties would include higher protein levels and alleviation of plant DNA that causes allergens. The peanut is relatively easily accessible and a less-expensive source of vegetable protein. Its improvement will significantly help in the global war against hunger and poverty. The pace for developing these improved genotypes will be accelerated through the use of modern techniques such as those used in the Biotechnology Program at Langston University.

What has been done
During 2016 biotechnology studies were conducted on the peanut. Gene re-isolation and library construction were carried out; as well as other protocols. High school and college students were trained in biotechnology protocol and instrumentation.

Results
Activities in 2016 resulted in students increasing their interest in research and their skills in laboratory procedures. Five students selected genetics as a major when they applied to Graduate School.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

Outcome #2

1. Outcome Measures

Number of farmers using the peanut nucleotide database.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need for developing improved peanut genotypes that are higher yielding and more disease and insect resistant. Improved nutritional varieties would include higher protein levels and alleviation of plant DNA that causes allergens. The peanut is relatively easily accessible and a less-expensive source of vegetable protein. Its improvement will significantly help in the global war against hunger and poverty. The pace for developing these improved genotypes will be accelerated through the use of modern techniques such as those used in the Biotechnology Program at Langston University.

What has been done
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Results
Activities in 2016 resulted in students increasing their interest in research and their skills in laboratory procedures. Five students selected genetics as a major when they applied to Graduate School.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

Outcome #3

1. Outcome Measures

Farmers who use the peanut nucleotide database or new peanut gene discoveries to improve their peanut production system.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need for developing improved peanut genotypes that are higher yielding and more disease and insect resistant. Improved nutritional varieties would include higher protein levels and alleviation of plant DNA that causes allergens. The peanut is relatively easily accessible and a less-expensive source of vegetable protein. Its improvement will significantly help in the global war against hunger and poverty. The pace for developing these improved genotypes will be accelerated through the use of modern techniques such as those used in the Biotechnology Program at Langston University.

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Results
Activities in 2016 resulted in students increasing their interest in research and their skills in laboratory procedures. Five students selected genetics as a major when they applied to Graduate School.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Public priorities

Brief Explanation

- Time series (multiple points before and after program).

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Annual progress with mapping pathways and developing DNA libraries for improving test species.

Key Items of Evaluation

- Developing DNA libraries.

V(A). Planned Program (Summary)

Program # 26

1. Name of the Planned Program

Water Gardens (Aquaculture) (Langston University)

☑ 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
401	Structures, Facilities, and General Purpose Farm Supplies	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	1.0	0.0	0.6
Actual Paid	0.0	0.0	0.0	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**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	26360
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	154046

V(D). Planned Program (Activity)

1. Brief description of the Activity

Studies were conducted on water garden filtration utilizing native submergent aquatic vegetation and on biological filter design for koi ponds.

2. Brief description of the target audience

All aquaculture farmers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Water Gardens

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers learning water garden techniques.
2	Number of farmers using water garden techniques.
3	Farmers who improve the water quality of their water gardens and reduce operational costs.

Outcome #1

1. Outcome Measures

Number of farmers learning water garden techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Development of the Oklahoma water garden industry is dependent on producing high quality Koi fish. Also, aesthetically pleasing and efficient production systems are needed. Filtration systems for ornamental ponds are derived from technologies developed for municipal waste treatment and/or swimming pools. While treatment cost is secondary for municipalities, both capital and operating costs are primary concerns for owners of private ornamental ponds. Costs can be reduced by using systems that rely on low pressure, high volume pumps. The cost reduction can be enhanced by combining technologies to maximize performance for solids removal and biotransformation of organic waste materials.

What has been done
There are no results to report this year.

Results
There are no results to report this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies

Outcome #2

1. Outcome Measures

Number of farmers using water garden techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Development of the Oklahoma water garden industry is dependent on producing high quality Koi fish. Also, aesthetically pleasing and efficient production systems are needed. Filtration systems for ornamental ponds are derived from technologies developed for municipal waste treatment and/or swimming pools. While treatment cost is secondary for municipalities, both capital and operating costs are primary concerns for owners of private ornamental ponds. Costs can be reduced by using systems that rely on low pressure, high volume pumps. The cost reduction can be enhanced by combining technologies to maximize performance for solids removal and biotransformation of organic waste materials.

What has been done
There are no results to report this year.

Results
There are no results to report this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies

Outcome #3

1. Outcome Measures

Farmers who improve the water quality of their water gardens and reduce operational costs.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Development of the Oklahoma water garden industry is dependent on producing high quality Koi fish. Also, aesthetically pleasing and efficient production systems are needed. Filtration systems for ornamental ponds are derived from technologies developed for municipal waste treatment and/or swimming pools. While treatment cost is secondary for municipalities, both capital and operating costs are primary concerns for owners of private ornamental ponds. Costs can be reduced by using systems that rely on low pressure, high volume pumps. The cost reduction can be enhanced by combining technologies to maximize performance for solids removal and biotransformation of organic waste materials.

What has been done
There are no results to report this year.

Results
There are no results to report this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Development of best management practices for the water garden industry.

Key Items of Evaluation

Sharing best management practices with clientele.

V(A). Planned Program (Summary)

Program # 27

1. Name of the Planned Program

Alternative Species (Aquaculture) (Langston University)

☑ 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
307	Animal Management Systems	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.4	0.0	0.2
Actual Paid	0.0	0.6	0.0	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**
0	24559	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Buffalo fish species will be tested for sustainability and profitability in Oklahoma.

2. Brief description of the target audience

All aquaculture farmers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Alternative Species.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers learning alternative fish species techniques.
2	Number of farmers using alternative fish species techniques.
3	Farmers who improved their yearly income by using alternative fish species.

Outcome #1

1. Outcome Measures

Number of farmers learning alternative fish species techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pushed by years of limited and diminishing freshwater supplies, some Oklahoma fish farmers are now learning to operate completely closed recirculating systems to bolster and stabilize their enterprises. Many Oklahoma consumers are becoming more concerned with the quality and environmental friendliness of their foods. They are eager to learn more about food from aquaponics production. 4-H leaders are learning to use the LU aquaponics facility to widen their club's agricultural experiences.

What has been done
There are no results to report this year.

Results
There are no results to report this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #2

1. Outcome Measures

Number of farmers using alternative fish species techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pushed by years of limited and diminishing freshwater supplies, some Oklahoma fish farmers are now learning to operate completely closed recirculating systems to bolster and stabilize their enterprises. Many Oklahoma consumers are becoming more concerned with the quality and environmental friendliness of their foods. They are eager to learn more about food from aquaponics production. 4-H leaders are learning to use the LU aquaponics facility to widen their club's agricultural experiences.

What has been done
There are no results to report this year.

Results
There are no results to report this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #3

1. Outcome Measures

Farmers who improved their yearly income by using alternative fish species.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pushed by years of limited and diminishing freshwater supplies, some Oklahoma fish farmers are now learning to operate completely closed recirculating systems to bolster and stabilize their enterprises. Many Oklahoma consumers are becoming more concerned with the quality and environmental friendliness of their foods. They are eager to learn more about food from aquaponics production. 4-H leaders are learning to use the LU aquaponics facility to widen their club's agricultural experiences.

What has been done
There are no results to report this year.

Results
There are no results to report this year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

Droughts can hinder research efforts.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Cost analysis will be used to determine if use of alternative fish species resulted in increased income for producers.

Key Items of Evaluation

Producers who improved their fish production practices.

V(A). Planned Program (Summary)

Program # 28

1. Name of the Planned Program

Fishery Management (Aquaculture) (Langston University)

☑ 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
307	Animal Management Systems	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.4	0.0	0.3
Actual Paid	0.0	0.0	0.0	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**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Work will be performed in fishery management under such conditions as drought, aquatic vegetation infestation and pond leaks.

2. Brief description of the target audience

All aquaculture farmers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Fishery Management.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers learning new fishery management techniques.
2	Number of farmers using new fishery management techniques.
3	Farmers who have improved their production efficiency and raised their profits with the new fishery management techniques.

Outcome #1

1. Outcome Measures

Number of farmers learning new fishery management techniques.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No activity occurred during 2016.

What has been done
No activity occurred during 2016.

Results
No activity occurred during 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #2

1. Outcome Measures

Number of farmers using new fishery management techniques.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No activity occurred during 2016.

What has been done
No activity occurred during 2016.

Results
No activity occurred during 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #3

1. Outcome Measures

Farmers who have improved their production efficiency and raised their profits with the new fishery management techniques.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No activity occurred during 2016.

What has been done
No activity occurred during 2016.

Results
No activity occurred during 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors affected outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Overall improvement in urban pond water quality at specific sites and consequently improvement in the quality of some watershed streams.

Key Items of Evaluation

Increase in water quality for specific residential ponds.

V(A). Planned Program (Summary)

Program # 29

1. Name of the Planned Program

Sustainable Internal Parasite Control for Small Ruminants (Langston University)

☑ 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
313	Internal Parasites in Animals	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.3	0.0	0.1
Actual Paid	0.0	0.2	0.0	0.1
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**
0	11733	0	733
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	26360
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	163177

V(D). Planned Program (Activity)

1. Brief description of the Activity

Internal parasites are the most important health issue in small ruminants; causing greater morbidity, mortality and lost production than the next three most important diseases. The problems with internal parasites include lack of knowledge on biology and management practices to control them, internet

misinformation and dewormer resistance.

2. Brief description of the target audience

All goat producers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	194	40	8	8

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on sustainable internal parasite control.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers learning internal parasite control techniques.
2	Number of goat producers using internal parasite control techniques.
3	Goat producers who have gotten internal parasites under control by using the learned control techniques.

Outcome #1

1. Outcome Measures

Number of goat producers learning internal parasite control techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Internal parasites (Gastrointestinal Nematodes) are the most important health issue in sheep and goats; causing greater morbidity, mortality and lost production than the next three most important diseases. The problems with internal parasites include lack of knowledge on biology and management practices to control them, internet misinformation and dewormer resistance. All goat producers in this region of the country have internal parasite challenges with their herds and significant to severe dewormer resistance. Therefore, both goat and sheep producers are interested in practices to better control internal parasites in their animals.

What has been done
During 2016, four parasite workshops were presented in Oklahoma with a total of 53 people in attendance. At a breakout session during our annual meat goat field day, 63 producers participated. A parasite workshop was conducted at a Meat Goat Boot Camp to 48 producers. Two, one-on-one workshops were conducted for producers with serious goat herd parasite problems. Also, two exchange students and two producers were taught how to do fecal egg counts.

Results
2016 Field Day surveys indicated that most of the 63 participants planned to make changes based upon information presented. Earlier results from this program reported that fifteen out of the twenty-two producers experienced a reduction in the number of required dewormings (68%). Thirteen producers (59%) indicated a cost saving of $75 to $400 by reducing the number of herd dewormings. Also, seven out of the twenty-two producers (32%) reported a reduction in animal losses that was a saving of $300-$2,500.

4. Associated Knowledge Areas

KA Code	Knowledge Area
313	Internal Parasites in Animals

Outcome #2

1. Outcome Measures

Number of goat producers using internal parasite control techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Internal parasites (Gastrointestinal Nematodes) are the most important health issue in sheep and goats; causing greater morbidity, mortality and lost production than the next three most important diseases. The problems with internal parasites include lack of knowledge on biology and management practices to control them, internet misinformation and dewormer resistance. All goat producers in this region of the country have internal parasite challenges with their herds and significant to severe dewormer resistance. Therefore, both goat and sheep producers are interested in practices to better control internal parasites in their animals.

What has been done
During 2016, four parasite workshops were presented in Oklahoma with a total of 53 people in attendance. At a breakout session during our annual meat goat field day, 63 producers participated. A parasite workshop was conducted at a Meat Goat Boot Camp to 48 producers. Two, one-on-one workshops were conducted for producers with serious goat herd parasite problems. Also, two exchange students and two producers were taught how to do fecal egg counts.

Results
2016 Field Day surveys indicated that most of the 63 participants planned to make changes based upon information presented. Earlier results from this program reported that fifteen out of the twenty-two producers experienced a reduction in the number of required dewormings (68%). Thirteen producers (59%) indicated a cost saving of $75 to $400 by reducing the number of herd dewormings. Also, seven out of the twenty-two producers (32%) reported a reduction in animal

losses that was a saving of $300-$2,500.

4. Associated Knowledge Areas

KA Code	Knowledge Area
313	Internal Parasites in Animals

Outcome #3

1. Outcome Measures

Goat producers who have gotten internal parasites under control by using the learned control techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Internal parasites (Gastrointestinal Nematodes) are the most important health issue in sheep and goats; causing greater morbidity, mortality and lost production than the next three most important diseases. The problems with internal parasites include lack of knowledge on biology and management practices to control them, internet misinformation and dewormer resistance. All goat producers in this region of the country have internal parasite challenges with their herds and significant to severe dewormer resistance. Therefore, both goat and sheep producers are interested in practices to better control internal parasites in their animals.

What has been done
During 2016, four parasite workshops were presented in Oklahoma with a total of 53 people in attendance. At a breakout session during our annual meat goat field day, 63 producers participated. A parasite workshop was conducted at a Meat Goat Boot Camp to 48 producers. Two, one-on-one workshops were conducted for producers with serious goat herd parasite problems. Also, two exchange students and two producers were taught how to do fecal egg counts.

Results

2016 Field Day surveys indicated that most of the 63 participants planned to make changes based upon information presented. Earlier results from this program reported that fifteen out of the twenty-two producers experienced a reduction in the number of required dewormings (68%). Thirteen producers (59%) indicated a cost saving of $75 to $400 by reducing the number of herd dewormings. Also, seven out of the twenty-two producers (32%) reported a reduction in animal losses that was a saving of $300-$2,500.

4. Associated Knowledge Areas

KA Code	Knowledge Area
313	Internal Parasites in Animals

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

Drought

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Eagerness of goat producers to adopt alternative parasite control methods.

Key Items of Evaluation

Goat producers adopt practices and experience improvements in their herds' health.

V(A). Planned Program (Summary)

Program # 30

1. Name of the Planned Program

Goat Internet Website (Langston University)

☑ 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
903	Communication, Education, and Information Delivery	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.2	0.0	0.1
Actual Paid	0.0	0.3	0.0	0.1
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
0	6614	0	1771
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	26360
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	163177

V(D). Planned Program (Activity)

1. Brief description of the Activity

Meat goat production is one of the fastest growing sectors of the livestock industry in the United States. New producers, as well as some established ones, have an expressed need for current, correct

information on how to raise goats and produce safe, wholesome products in demand by the public. As the meat goat industry grows and evolves, a quality assurance (QA) program is essential. Such a QA program ensures the production of a wholesome product that satisfies consumes and increases profits for the meat goat industry.

2. Brief description of the target audience

The target audience is primarily goat producers interested in becoming certified in meat goat production.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	58970	40000	5800	200

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Goat Internet Website.

Year	Actual

2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers learning about information found on the goat internet website.
2	Number of goat producers using the goat internet website.
3	Goat producers who improved their operations with information from the goat internet website.

Outcome #1

1. Outcome Measures

Number of goat producers learning about information found on the goat internet website.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Meat goat production is one of the fastest growing sectors of the livestock industry in the United States. New producers, as well as some established ones, have an expressed need for current, correct information on how to raise goats and produce safe, wholesome products in demand by the public. Many producers obtain goat production information from the World Wide Web. While scientifically-based information does exist on the internet, producers with little to no livestock experience may not be able to distinguish between good and bad information. As the meat goat industry grows and evolves, a quality assurance (QA) program is essential. Such a QA program ensures the production of a wholesome product that satisfies consumers and increases profit for the meat goat industry.

What has been done
Langston University was awarded funding by the Food Safety and Inspection Service of USDA to develop training and certification for meat goat producers. Langston University organized and led a consortium of 1890 universities and producer associations in this project. The consortium identified the subject topics most pertinent and pressing for the instructional modules. The consortium then identified experts on the selected subject topics and pursued these experts as module authors. These authors represent the most qualified persons in their field in academia as well as in the industry. Langston University translated the 22 instructional modules into web pages with accompanying images, and pre- and post-tests for those producers wishing to pursue certification. This program is known as the Quality Producer (QP) Online Certification. All modules are also available in pdf for easy printing and the introductory module is available as a podchapter for downloading and listening on your favorite mp3 player. The web-site (http://www2.luresext.edu/goats/training/qa.html) was well received by the goat community. In 2015 to better understand internet user's preferences, a tracking code for Goggle Analytics was again embedded in each web page.

Results
More than two thousand seven hundred (2,700) goat producers have enrolled in the online certification program and 371 goat producers have been certified via the site to date. Twenty-five producers were certified in 2016. Knowledge gained by producers for more efficient and effective goat production will potentially result in increased profits for many of these 371 producers. Based upon Goggle Analytics data, there were 28,095 visits to the online site in 2016 and 9,214 people visited the nutrient requirement site. These visits represented 192 countries or territories, all 50 U.S. States and the District of Columbia.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Number of goat producers using the goat internet website.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Meat goat production is one of the fastest growing sectors of the livestock industry in the United States. New producers, as well as some established ones, have an expressed need for current, correct information on how to raise goats and produce safe, wholesome products in demand by the public. Many producers obtain goat production information from the World Wide Web. While scientifically-based information does exist on the internet, producers with little to no livestock experience may not be able to distinguish between good and bad information. As the meat goat industry grows and evolves, a quality assurance (QA) program is essential. Such a QA program ensures the production of a wholesome product that satisfies consumers and increases profit for the meat goat industry.

What has been done

Langston University was awarded funding by the Food Safety and Inspection Service of USDA to develop training and certification for meat goat producers. Langston University organized and led a consortium of 1890 universities and producer associations in this project. The consortium identified the subject topics most pertinent and pressing for the instructional modules. The consortium then identified experts on the selected subject topics and pursued these experts as module authors. These authors represent the most qualified persons in their field in academia as well as in the industry. Langston University translated the 22 instructional modules into web pages with accompanying images, and pre- and post-tests for those producers wishing to pursue certification. This program is known as the Quality Producer (QP) Online Certification. All modules are also available in pdf for easy printing and the introductory module is available as a podchapter for downloading and listening on your favorite mp3 player. The web-site (http://www2.luresext.edu/goats/training/qa.html) was well received by the goat community. In 2015 to better understand internet user's preferences, a tracking code for Goggle Analytics was again embedded in each web page.

Results

More than two thousand seven hundred (2,700) goat producers have enrolled in the online certification program and 371 goat producers have been certified via the site to date. Twenty-five producers were certified in 2016. Knowledge gained by producers for more efficient and effective goat production will potentially result in increased profits for many of these 371 producers. Based upon Goggle Analytics data, there were 28,095 visits to the online site in 2016 and 9,214 people visited the nutrient requirement site. These visits represented 192 countries or territories, all 50 U.S. States and the District of Columbia.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Goat producers who improved their operations with information from the goat internet website.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2016 200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Meat goat production is one of the fastest growing sectors of the livestock industry in the United States. New producers, as well as some established ones, have an expressed need for current, correct information on how to raise goats and produce safe, wholesome products in demand by the public. Many producers obtain goat production information from the World Wide Web. While scientifically-based information does exist on the internet, producers with little to no livestock experience may not be able to distinguish between good and bad information. As the meat goat industry grows and evolves, a quality assurance (QA) program is essential. Such a QA program ensures the production of a wholesome product that satisfies consumers and increases profit for the meat goat industry.

What has been done

Langston University was awarded funding by the Food Safety and Inspection Service of USDA to develop training and certification for meat goat producers. Langston University organized and led a consortium of 1890 universities and producer associations in this project. The consortium identified the subject topics most pertinent and pressing for the instructional modules. The consortium then identified experts on the selected subject topics and pursued these experts as module authors. These authors represent the most qualified persons in their field in academia as well as in the industry. Langston University translated the 22 instructional modules into web pages with accompanying images, and pre- and post-tests for those producers wishing to pursue certification. This program is known as the Quality Producer (QP) Online Certification. All modules are also available in pdf for easy printing and the introductory module is available as a podchapter for downloading and listening on your favorite mp3 player. The web-site (http://www2.luresext.edu/goats/training/qa.html) was well received by the goat community. In 2015 to better understand internet user's preferences, a tracking code for Goggle Analytics was again embedded in each web page.

Results

More than two thousand seven hundred (2,700) goat producers have enrolled in the online certification program and 371 goat producers have been certified via the site to date. Twenty-five producers were certified in 2016. Knowledge gained by producers for more efficient and effective goat production will potentially result in increased profits for many of these 371 producers. Based upon Goggle Analytics data, there were 28,095 visits to the online site in 2016 and 9,214 people visited the nutrient requirement site. These visits represented 192 countries or territories, all 50 U.S. States and the District of Columbia.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Eagerness of goat producers to register for and complete the goat producer certification module.

Key Items of Evaluation

Certified goat producers who improved their goat production practices.

V(A). Planned Program (Summary)

Program # 31

1. Name of the Planned Program

Development of New Dairy Goat Products (Langston University)

☑ 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
502	New and Improved Food Products	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.3	0.0	0.3
Actual Paid	0.0	0.0	0.0	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**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

No activity to report this year.

2. Brief description of the target audience

All goat producers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research projects completed on Development of New Dairy Goat Products

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers learning about techniques for developing new dairy goat products.
2	Number of goat producers using techniques for developing new dairy goat products.
3	Goat producers developing increasing yearly income from new dairy goat products.

Outcome #1

1. Outcome Measures

Number of goat producers learning about techniques for developing new dairy goat products.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No activity occurred during 2016.

What has been done
No activity occurred during 2016.

Results
No activity occurred during 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #2

1. Outcome Measures

Number of goat producers using techniques for developing new dairy goat products.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No activity occurred during 2016.

What has been done
No activity occurred during 2016.

Results
No activity occurred during 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #3

1. Outcome Measures

Goat producers developing increasing yearly income from new dairy goat products.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No activity occurred during 2016.

What has been done
No activity occurred during 2016.

Results
No activity occurred during 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

No activity occurred during 2016.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No activity occurred during 2016.

Key Items of Evaluation

No activity occurred during 2016.

V(A). Planned Program (Summary)

Program # 32

1. Name of the Planned Program

Demonstration Clinic: Artificial Insemination for Goats (Langston University)

☑ 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
301	Reproductive Performance of Animals	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.1	0.0	0.0
Actual Paid	0.0	0.1	0.0	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**
0	4634	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Hands-on artifical insemination (AI) workshops will be conducted to teach AI techniques to goat producers. These AI skills will allow goat producers to gain access to genetically superior sires for

herd improvement.

2. Brief description of the target audience

All goat producers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	17	50	2	20

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research projects completed on Demonstration Clinic: Artificial Insemination for Goats

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers learning about artificial insemination techniques.
2	Number of goat producers using artificial insemination techniques.
3	Goat producers who improved their herds by using artificial insemination techniques.

Outcome #1

1. Outcome Measures

Number of goat producers learning about artificial insemination techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The use of superior sires is imperative for improving the genetic composition of breeding stock. Artificial insemination (AI) has long been used in the dairy cattle industry and is a simple technology that goat producers can acquire. However, opportunities for goat producers to acquire the necessary skills via formal and practical instruction are not widespread. Langston University has instituted a practical workshop for instruction in artificial insemination in goats. Producers are instructed in the anatomy and physiology of the female goat, estrus detection and handling and storage of semen. Producers participate in a hands-on insemination exercise. An understanding of the anatomy and physiology enable the producer to devise seasonal breeding plans and to troubleshoot problem breeders. Acquiring goat artificial insemination skills also allows producers to save money by conducting the inseminations themselves, rather than hiring an inseminator.

What has been done
In 2016 AI workshops were held on 10/08/16 on the Langston University Campus (Langston, Oklahoma). Seventeen (17) participants enrolled and received AI training.

Results
Two workshops were conducted in AI for goats. Goat producers are under-served in this area of herd improvement because traditional AI courses are geared toward cattle and the AI techniques differ drastically between the species. Goat producers participating in the workshops saved money by being able to conduct their own herd artificial inseminations. They can also potentially improve their herds with access to genetic material from superior sires.

4. Associated Knowledge Areas

KA Code	Knowledge Area

301 Reproductive Performance of Animals

Outcome #2

1. Outcome Measures

Number of goat producers using artificial insemination techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The use of superior sires is imperative for improving the genetic composition of breeding stock. Artificial insemination (AI) has long been used in the dairy cattle industry and is a simple technology that goat producers can acquire. However, opportunities for goat producers to acquire the necessary skills via formal and practical instruction are not widespread. Langston University has instituted a practical workshop for instruction in artificial insemination in goats. Producers are instructed in the anatomy and physiology of the female goat, estrus detection and handling and storage of semen. Producers participate in a hands-on insemination exercise. An understanding of the anatomy and physiology enable the producer to devise seasonal breeding plans and to troubleshoot problem breeders. Acquiring goat artificial insemination skills also allows producers to save money by conducting the inseminations themselves, rather than hiring an inseminator.

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Results
Two workshops were conducted in AI for goats. Goat producers are under-served in this area of herd improvement because traditional AI courses are geared toward cattle and the AI techniques differ drastically between the species. Goat producers participating in the workshops saved money by being able to conduct their own herd artificial inseminations. They can also potentially improve their herds with access to genetic material from superior sires.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals

Outcome #3

1. Outcome Measures

Goat producers who improved their herds by using artificial insemination techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The use of superior sires is imperative for improving the genetic composition of breeding stock. Artificial insemination (AI) has long been used in the dairy cattle industry and is a simple technology that goat producers can acquire. However, opportunities for goat producers to acquire the necessary skills via formal and practical instruction are not widespread. Langston University has instituted a practical workshop for instruction in artificial insemination in goats. Producers are instructed in the anatomy and physiology of the female goat, estrus detection and handling and storage of semen. Producers participate in a hands-on insemination exercise. An understanding of the anatomy and physiology enable the producer to devise seasonal breeding plans and to troubleshoot problem breeders. Acquiring goat artificial insemination skills also allows producers to save money by conducting the inseminations themselves, rather than hiring an inseminator.

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Results
Two workshops were conducted in AI for goats. Goat producers are under-served in this area of herd improvement because traditional AI courses are geared toward cattle and the AI techniques differ drastically between the species. Goat producers participating in the workshops saved money by being able to conduct their own herd artificial inseminations. They can also potentially

improve their herds with access to genetic material from superior sires.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Goat producers acquiring artificial insemination skills.

Key Items of Evaluation

- Goat producers saving money by performing artificial insemination on their own herds.
- Goat producers improving their herds via genetic material from superior sires.

V(A). Planned Program (Summary)

Program # 33

1. Name of the Planned Program

Fish Marketing (Aquaculture) (Langston University)

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.4	0.0	0.2
Actual Paid	0.0	0.0	0.0	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**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Methods of marketing alternative fish species will be explored to increase fish producers' profits.

2. Brief description of the target audience

All aquaculture producers in Oklahoma

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Fish Marketing.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers learning new fish marketing techniques.
2	Number of farmers using new fish marketing techniques.
3	Farmers who use new fish marketing techniques to increase their profits.

Outcome #1

1. Outcome Measures

Number of farmers learning new fish marketing techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Aquaculture producers need additional sale venues to withstand economic uncertainties. Competition from a state agency is an ongoing obstacle to sales. Aquaculture production of buffalo fishes and grass carp can meet consumer desires and provide additional income opportunities for channel catfish producers, but more buyers must be found for buffalo and grass carp.

What has been done
No activity occurred in 2016.

Results
No activity occurred in 2016.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of farmers using new fish marketing techniques.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Aquaculture producers need additional sale venues to withstand economic uncertainties. Competition from a state agency is an ongoing obstacle to sales. Aquaculture production of buffalo fishes and grass carp can meet consumer desires and provide additional income opportunities for channel catfish producers, but more buyers must be found for buffalo and grass carp.

What has been done
No activity occurred in 2016.

Results
No activity occurred in 2016.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Farmers who use new fish marketing techniques to increase their profits.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Aquaculture producers need additional sale venues to withstand economic uncertainties. Competition from a state agency is an ongoing obstacle to sales. Aquaculture production of buffalo fishes and grass carp can meet consumer desires and provide additional income opportunities for channel catfish producers, but more buyers must be found for buffalo and grass carp.

What has been done
No activity occurred in 2016.

Results
No activity occurred in 2016.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors affected outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Development of new markets or marketing methods for fish producers.

Key Items of Evaluation

Fish producers improving their income via direct marketing of fish.

V(A). Planned Program (Summary)

Program # 34

1. Name of the Planned Program

Meat Buck Performance Test (Langston University)

☑ 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
303	Genetic Improvement of Animals	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.2	0.0	0.1
Actual Paid	0.0	0.0	0.0	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**
0	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension personnel will conduct the annual meat goat performance test for young, growing meat bucks to evaluate growth and feed efficiency.

2. Brief description of the target audience

All goat producers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Meat Buck Performance Test.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers learning about the meat buck performance test.
2	Number of goat producers using the meat goat performance test.
3	Goat producers who improve their herds via the meat buck performance test.

Outcome #1

1. Outcome Measures

Number of goat producers learning about the meat buck performance test.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An influential aspect of meat goat production is the growth rate and/or efficiency of kids. Objective performance records are needed when making informed genetic selections to improve average daily gain, feed efficiency and/or residual feed intake. In order to compare animals from different ranches or environments, a central performance meat buck testing is conducted. In 1997, Langston University established a meat buck performance test to promote the identification and increased utilization of genetically superior sires.

What has been done
No activity occurred in 2016.

Results
No activity occurred in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals

Outcome #2

1. Outcome Measures

Number of goat producers using the meat goat performance test.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An influential aspect of meat goat production is the growth rate and/or efficiency of kids. Objective performance records are needed when making informed genetic selections to improve average daily gain, feed efficiency and/or residual feed intake. In order to compare animals from different ranches or environments, a central performance meat buck testing is conducted. In 1997, Langston University established a meat buck performance test to promote the identification and increased utilization of genetically superior sires.

What has been done
No activity occurred in 2016.

Results
No activity occurred in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals

Outcome #3

1. Outcome Measures

Goat producers who improve their herds via the meat buck performance test.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An influential aspect of meat goat production is the growth rate and/or efficiency of kids. Objective performance records are needed when making informed genetic selections to improve average daily gain, feed efficiency and/or residual feed intake. In order to compare animals from different ranches or environments, a central performance meat buck testing is conducted. In 1997, Langston University established a meat buck performance test to promote the identification and increased utilization of genetically superior sires.

What has been done
No activity occurred in 2016.

Results
No activity occurred in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Meat buck performance tests give producers an accurate assessment of the market value of their animals.

Key Items of Evaluation

- Some meat goat producers are able to demand higher market values for their animals because of an accurate buck performance test.

V(A). Planned Program (Summary)

Program # 35

1. Name of the Planned Program

Goat Dairy Herd Improvement (DHI) Laboratory (Langston University)

☑ 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
308	Improved Animal Products (Before Harvest)	0%	100%	0%	100%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.2	0.0	1.1
Actual Paid	0.0	0.1	0.0	1.0
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**
0	6269	0	22944
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	26360	0	26360
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	97418	0	163177

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension personnel will conduct goat milk quality tests in the Langston University Goat Dairy Herd Improvement Laboratory.

2. Brief description of the target audience

All goat producers in Oklahoma.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	150	100	500	100

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	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects completed on Goat Dairy Herd Improvement (DHI) Laboratory.

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of goat producers who learned about the Goat Dairy Herd Improvement Laboratory.
2	Number of goat producers who are using the Goat Dairy Herd Improvement Laboratory.
3	Goat producers who have increased their production profits by utilizing the Goat Dairy Herd Improvement Laboratory.

Outcome #1

1. Outcome Measures

Number of goat producers who learned about the Goat Dairy Herd Improvement Laboratory.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	35

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dairy Herd Improvement Association (DHIA) has been serving cow producers for decades. However, for many years dairy goat producers had to deal with records written in cow language. This meant that they could not get accurate information in goat terms and that all the reports reflected cows, bulls and calves rather than does, bucks and kids. The records produced by our DHI lab are used to identify high producing does. These records are useful for the exportation of does to foreign countries and accurate data could enhance the resale value of does and offspring for the producers domestically as well. DHI programs are playing a significant role in increasing goat milk production and quality. Langston University operates a certified laboratory that operates under the supervision of the National Dairy Herd Improvement Association.

What has been done
During 2016, we used a program developed in cooperation with other institutions to utilize goat language for accurate data measurements and recordings. Accurate records were produced on dairy goat breeds along with correct gender identification and expected delivery dates for pregnant does. Workshops and one-on-one demonstrations were conducted on the benefits of DHIA records and how to collect raw data and milk samples for DHI laboratory processing. Numerous tours and demonstrations were conducted for goat producers, high school and college students. Updates made in 2015 allowed the DHI laboratory to produce more precise data at a faster rate.

Results
Goat producers are now able to get records for their animals that reflect accurate information with the correct language. These records not only reflect higher fat and protein values for a doe, but also are easier to understand when used for genetic evaluation and for herd management. Currently, we are serving over 140 goat producers in 34 states. Information provided by the

Langston University DHI Laboratory has allowed goat producers to demand higher prices for their animals during sales. Of the 140 plus participating producers, information from this program can help them increase their profits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)

Outcome #2

1. Outcome Measures

Number of goat producers who are using the Goat Dairy Herd Improvement Laboratory.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dairy Herd Improvement Association (DHIA) has been serving cow producers for decades. However, for many years dairy goat producers had to deal with records written in cow language. This meant that they could not get accurate information in goat terms and that all the reports reflected cows, bulls and calves rather than does, bucks and kids. The records produced by our DHI lab are used to identify high producing does. These records are useful for the exportation of does to foreign countries and accurate data could enhance the resale value of does and offspring for the producers domestically as well. DHI programs are playing a significant role in increasing goat milk production and quality. Langston University operates a certified laboratory that operates under the supervision of the National Dairy Herd Improvement Association.

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students. Updates made in 2015 allowed the DHI laboratory to produce more precise data at a faster rate.

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Goat producers are now able to get records for their animals that reflect accurate information with the correct language. These records not only reflect higher fat and protein values for a doe, but also are easier to understand when used for genetic evaluation and for herd management. Currently, we are serving over 140 goat producers in 34 states. Information provided by the Langston University DHI Laboratory has allowed goat producers to demand higher prices for their animals during sales. Of the 140 plus participating producers, information from this program can help them increase their profits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)

Outcome #3

1. Outcome Measures

Goat producers who have increased their production profits by utilizing the Goat Dairy Herd Improvement Laboratory.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dairy Herd Improvement Association (DHIA) has been serving cow producers for decades. However, for many years dairy goat producers had to deal with records written in cow language. This meant that they could not get accurate information in goat terms and that all the reports reflected cows, bulls and calves rather than does, bucks and kids. The records produced by our DHI lab are used to identify high producing does. These records are useful for the exportation of does to foreign countries and accurate data could enhance the resale value of does and offspring for the producers domestically as well. DHI programs are playing a significant role in increasing goat milk production and quality. Langston University operates a certified laboratory that operates

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4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

External factors did not affect outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Goat producers are able to get accurate milk fat and protein records for their dairy goats.

Key Items of Evaluation

• Goat producers are able to get accurate milk fat and protein values to use in marketing their does and improving their herds.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
6450	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
1	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
30000	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)	
16	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
83	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.