2012 Oklahoma State University Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/10/2013

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. Our 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 TEAM activities is thus covered under one of the Planned Program areas. 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. Due to the second consecutive year of severe drought numerous planned programs were adjusted to address the issues resultant of these weather conditions. Some significant research and/or extension efforts and developments during 2012 are presented following.

Pasture Recovery Following Drought - Of the 8 million acres of introduced forages grown in Oklahoma, nearly all were negatively impacted through the excessive heat, prolonged drought, and heavy grazing pressure during the drought of 2010-2012. Even when growing conditions return to normal, lingering effects on pasture recovery related to drought will remain. Most notable of these will likely be reduced persistence, coupled with slower regrowth.

During 2012, a total of 11 **Pasture Recovery Following Drought** programs covering 13 counties were held to address specifics of pasture recovery due to extreme drought conditions using weed control, fertilization, and grazing deferment. Five hundred nineteen surveys were distributed with 193 completed (37% return rate). Conservative estimates suggest that forage managers of nearly 500,000 acres of introduced forage and pasture production in Oklahoma attended one of these programs. These acres represent approximately 5% of the total acreage devoted to the production and management of introduced pastures in Oklahoma.

Survey respondents assessed that 79% of the introduced pastures in Oklahoma suffered moderate to severe drought damage with an average forage production loss of $136 per acre. This resulted in estimated forage and pasture losses during 2011 at $26 million just for the 37% who completed the survey. Across Oklahoma, a conservative estimate of total forage losses during 2011 of **$1 billion** is possible. Based on drought damage and the uncertainty of pasture recovery, 99% of those who responded to the survey indicated plans to use information they learned at one of these meetings. Over 95% indicated plans to use some combination of weed control, fertilization, and grazing deferment as their primary tools for pasture recovery. Likewise, 95% of those who responded to the survey indicated that they planned to either maintain or decrease herd size during 2012. Forage producers valued this program at $90 per acre. Thus, the economic impact of this program was **valued at $17.7 million** by those attending one of the 11 county programs.

Wheat Variety Testing and Field Days - 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. 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. 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. This site received over 32,000 page views in 2012 and was reinforced with the @OSU_smallgrains Twitter feed. Hard copies of results were distributed to over 8,000 stakeholders in the state of Oklahoma via direct mailing and to over 600 producers via electronic copy. 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**.

Crop Diversification and Winter Canola- For many years the vast majority of Oklahoma cropland acres have been seeded to continuous winter wheat. Continuous cropping of annuals contributed to the buildup of yield-constraining weeds, diseases, and insects. Economic returns have been hampered by yield losses and by reductions in grain quality. For years, crop rotations had been recommended to mitigate these problems. However, crop rotations were not common in Oklahoma. Alternative winter small grain crops such as oats, barley, and rye were not economically competitive. In many cases, attempts to include summer crops such as corn, soybeans, and grain sorghum were not successful because they do not fit well in a rotation with winter wheat and do not perform well in dryland conditions in Oklahoma. Prior to 2004, winter canola was not produced in the state, there was no local market for canola, and Oklahoma producers did not have an economically viable alternative winter crop to rotate with winter wheat. OSU assembled a multidisciplinary DASNR team and initiated a comprehensive Canola research and extension program. The team developed best management practices for canola and determined that (a) wheat yields following canola were significantly greater than wheat yields experienced in continuous wheat and (b) expected net returns are greater for canola-wheat rotations than for continuous wheat. Producers respond to economic incentives. **Prior to 2004, winter canola was not produced in the state.** In 2009, for the first time, the Oklahoma Agricultural Statistics Service reported canola planted to 42,000 acres. By the 2011-12 season, well **over 150,000 acres of Canola** were reported in Oklahoma. This growth in canola acres is one result of the OSU Crop Management Team, as other results include: wheat producers have an economically viable alternative for managing weeds and diseases, several buyers are active in the State, Canola is processed in the state thus is a value-added crop for Oklahoma, and private companies are investing in variety development.

Applications Engineering / Manufacturing Consulting - Of the over 5,000 manufacturers in Oklahoma, approximately half are located in rural areas and are extremely important to their local economies. The loss or downsizing of even one of these wealth-generating small or mid-sized companies can have devastating consequences for the host and surrounding communities. These rural firms 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 rural manufacturers, the College of Engineering, Architecture and Technology and the Division of Agricultural Sciences and Natural Resources at Oklahoma State University work in partnership to provide technical assistance through the Applications Engineering program. Since 1997, Applications Engineers have been deployed in the state in as part of the Oklahoma Cooperative Extension Service to provide on-site engineering assistance. In order to receive engineering assistance the client must agree to a post-project impact assessment. This impact assessment is done using procedures developed by the National Institute for Standards and Technology for the Manufacturing Extension Partnership. 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. In 2012, the Applications Engineers client **projects resulted in increased sales of more than $48.0M, while retaining an additional $8.9M in sales that would have otherwise been lost.** Further, the expertise provided by our engineers created **cost savings of $5.6M**, and **avoided additional costs estimated at $5.4M**. With **163 new jobs created and 60 jobs retained**, our projects provided an additional $16.8M to the state's economy. Finally, assisted manufacturers invested over $7.5M in new plant facilities and equipment, for a **total economic impact of $92.3M**.

Improved Wheat Variety Development and Adoption- In 2006 over half (54%) of all wheat acres were sown to the cultivar "Jagger" or the Jagger-by-Abilene cross Jagalene. 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. In 2012 acreage of Jagger and Jagalene had fallen to 8% and 2%, respectively. Acreage of the disease and Hessian fly resistant cultivar 'Duster' increased from 0.3% of acreage in 2007 to 22.2% in 2012 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.

Farm and Business Tax Institutes - Frequent changes in Federal and Oklahoma State Tax Laws create a need to keep tax preparers informed of the impact of the changes and how to best help their clients utilize the tax planning and management opportunities available in the current tax laws. These tax schools are designed to update tax preparers about new laws and regulations covering farm, non-farm business and individual taxpayer issues. This program has been conducted for the past 47 years. It has grown from a one-day seminar to its present form of two days per location for the fall Farm and Business Tax Institutes and the summer Tax Clinic. The combination of all the schools allows a preparer to get the full 40 hours of CPE/CLE as required by state. Topics covered range from presentation of new tax laws and their implications, agricultural issues, business issues, tax planning opportunities, professional ethics, retirement, and social security to name a few. Twelve two day sessions are conducted each year with two of these in the summer and ten in the fall and two one day special topics courses. Total 2012 attendance for the schools was approximately 2,100 tax preparers. Certified public accountants make up 46 percent of the attendance, 27 percent are tax preparers and bookkeepers, 10 percent are enrolled agents, 2 percent are attorneys, and the remaining 15 percent come from a variety of backgrounds. These tax preparers file roughly 80 percent of the farm returns for taxpayers in the state of Oklahoma.

High quality, professional instruction is provided to make continuing education credit available for Certified Public Accountants, Enrolled Agents, and Tax Attorneys. Participants **filed more than 37,645 Federal farm tax returns and 255,428 Federal non-farm tax returns** as reported by the participants in the most recent program evaluations. This is roughly 65 percent of the total farm returns filed in Oklahoma. A recently added question asked the participants 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 estate planning tools. The participants were asked specify a value per return they filed which averaged just slightly greater than $80.00 per return. Therefore using the number of participants willing to provide this information (roughly 25% of the participants) and the average number of returns completed by this group annually (250 returns) **the value of the tax schools is over $10,000,000 for 2012**.

Wind Energy Leasing Issues - Due to significant, rapid development of wind power leasing programs by a number of developers, stakeholders have been confronted with numerous issues related to wind energy leasing agreements. As of requests from such stakeholders, Oklahoma Cooperative Extension Service county extension educators and other agency personnel have requested programming regarding these concerns. Programs providing basic education with respect to wind power and renewable energy and guidelines for lease evaluation were devised and presented. Over 3,000 producers attended 40 workshops held at various locations in Oklahoma in 2012. As a result of the training the individuals are better able to understand and negotiate wind energy lease arrangements. To better understand the impact of this education, an example would be in order. A typical wind energy contract can provide in excess of $7,500 per year to the landowner with only one turbine. Some of the more wind-dense areas of Oklahoma can support up to four turbines per quarter-section (160 acres) of land and generate sufficient electricity to support annual payments of approximately $10,000. Thus, the successful negotiation of a wind energy lease can have significant economic impacts for landowners. At the $7,500 single-payment level, a 30 year lease agreement (typical for many Oklahoma leases) would have a total lifetime payout of $225,000 (NPV of $147,003 at 3% discount rate) and a $10,000, four-turbine parcel would have a total lifetime payout of $1.2 million (NPV of $784,018 at 3% discount rate).

Positive Youth Development - occurs when volunteers are properly oriented and equipped with appropriate tools to serve as positive role models. Volunteer adults and teens sever as positive role models and mentors and lead 4-H clubs, thus allow 4-H to reach more youth than could be achieved by paid staff alone.

There is a growing body of research showing that youth who feel safe, valued and connected to caring adults are more likely to be positive about life, engaged in school and emotionally healthy; they also are less likely to participate in destructive or delinquent behavior (Ferber et al. 2005). Additionally, in a recent study of Positive Youth Development by Tufts University, 4-H youth that participate in programs that incorporate the Five Cs: Competence, Confidence, Connection, Character, and Caring when compared to other youth were:

- Two times more likely to spend time exercising or being physically active;
- Two times less likely to engage in drug use;
- Two times less likely to use cigarettes or drink alcohol
- Nearly two times more likely to attend college (Lerner et al. R. 2012).

It is almost certain that most 4-H Volunteers and 4-H Educators consider Positive Youth Development as their top priority for 4-H clubs and groups. However, many 4-H Volunteers have not received in depth training on what elements are needed to foster positive youth development or the skills needed to ensure they provide those elements. County, district and state staff recruit, orient, train, utilize and manage adult volunteers who provide leadership to local, county, district and state programming. Extension professionals work in partnership with volunteers to develop the human, social and political capital of young citizens.

County Extension educators reported well over 23,000 contacts where youth and adults were involved in citizenship activities or projects. 4-H Youth Development addressed the broader developmental assets which all children and youth need - such as safe places (880 4-H clubs and 227 project clubs) and activities (1000+ 4-H events); opportunities for developing good physical and mental health (24,382 youth); marketable skills (43,000 youth); and opportunities for service and civic participation

(133,521 volunteer hours of service). Valued at $17.49 per hour for their time that is a $2.3M contribution.

Childhood Obesity - Over the past decade, the percentage of those overweight has steadily increased in Oklahoma. As many as one in five Oklahoma children are at-risk of being overweight or obese; and two-thirds of adults are overweight or obese. Among children and adolescents, overweight increases the risk of type 2 diabetes, high blood pressure, and cardiovascular disease. The health of Oklahoma youth can be improved by increasing knowledge, skills, attitudes and behaviors related to food and physical activity. Overweight, obesity and associated health problems have a significant economic impact. The estimated annual cost of overweight and obesity in the United States is $147 billion. Just a 10% sustained weight loss has been estimated to reduce an overweight person's lifetime medical costs by $2,200 to $5,300. **OrganWise Guys** comprehensive school wellness program teaches healthy eating and physical activity habits to Pre-K through 5th grade students in low-income schools as designated by the Oklahoma State Department of Education Child Nutrition Program. The program promotes four basic preventative health habits: (1) maintaining a low-fat diet (2) consuming high fiber foods (3) drinking plenty of water and (4) engaging in regular physical activity. **Farm to You Exhibit**

OCES programs targeting youth populations joined efforts with State agencies and agricultural commodity organizations to offer an interactive educational exhibit linking agriculture as the source of nutrient dense foods and role of these foods to health. Exhibit messages are research based and consistent with United States Department of Agriculture (USDA) Dietary Guidelines for Americans 2005 and MyPyramid. **Food & Fun for Everyone** nutrition education program consists of a series of approximately 6 lessons taught to youth in third and fourth grades in low-income school districts. The interactive learning experiences teach the concepts of MyPyramid food guidance system, the importance of hand washing and eating breakfast every day, as well as appropriate and healthy snacking.

The cumulative total **served by The OrganWise Guys in 2012 was 6,594 youth in approximately 271 classrooms** throughout Oklahoma. Based on 2,054 pre-post tests, improvements were reported in the areas of increasing servings of fruit, skim milk and physical activity. Youth also reported decreased consumption of sweets, fat eaten and less screen time. In 2012 the Farm to You exhibit traveled to 31 counties in Oklahoma, serving multiple school districts within each county. It has also been featured at summer camps, county fairs and community events. **During 2012, 22,796 youth experienced the Farm to You exhibit and 1,120 community volunteers supported the educational program.** Important improvements in food, nutrition and physical activity behaviors, which can have a role in reducing overweight and risk of related chronic diseases, were observed among Oklahoma youth participating in the Farm to You exhibit. **The statistically significant observed improvements for 2012 include:**

- 46% increase in eating whole grain breads and cereals
- 35% increase in drinking milk or eating cheese or yogurt
- 31% increase in eating low-fat meats
- 26% increase in time spent in physical activity
- 33% increase in eating foods from 2 or 3 MyPyramid food groups for breakfast
- 24% increase in snacking only when hungry
- 47% increase in using nutrition facts labels to make food and beverage choices

In 2012 more than**3,464 Oklahoma youth participated in the Food & Fun for Everyone** lesson series, with 2,846 complete evaluations. Sixteen-percent of youth increased their ability to select low-cost, nutritious foods.

Oklahoma Integrated Pest management (IPM) Helps Ranchers Control Horn Fly - Oklahoma beef cattle production is worth annually $2 billion. Horn flies can cause an estimated $8.5 million loss of production each year. Horn flies are managed primarily by the use of ear tags that are impregnated with an insecticide. In recent years, Horn flies have developed resistance to several of the commonly used

insecticides used in ear tags. OSU researchers and extension personnel conducted a result demonstration over 2 years evaluating the combination of patch-burn grazing and rotation of insecticide active ingredients in ear tags for management of horn flies. Ear tags were deployed only after the economic threshold of 200 flies per animal had been reached. OSU researchers demonstrated that the combination of patch-burn grazing, combined with rotation of insecticide in ear tags can delay buildup of horn fly populations from reaching the economic threshold of 200 horn flies per animal. This strategy allows producers to deploy ear tags at a later time using less chemical inputs. Research has shown a net savings of $5.03/head is likely from this system. It seems reasonable that this system is applicable and feasible for use on operations representing approximately at least 25% of the 1.7 million head of cattle in Oklahoma. The benefits from this system thus could be over $2.1 million per year to Oklahoma producers and a diminished use of chemical inputs.

Air Quality Improvement Research - Nut harvesting can be a major source of particulate matter emissions. In some areas, nut harvesting has been identified as the primary source of particulate matter emissions. Nut industries and regulatory agencies in several states are looking to implement new management practices or abatement technologies to reduce the particulate matter emissions produced during harvest. Picking nuts off the ground requires stirring leaves, debris, and soil - all of which can add particulates to the atmosphere. Oklahoma State University faculty in Biosystems Engineering teaming with researchers from the USDA-ARS Cotton Ginning Research Laboratory in Mesilla Park, NM; New Mexico State University; and Flory Industries of Salida, CA are working on an abatement device that can be used with existing machines to reduce particulate emissions. Initial tests have shown that the devise can remove 77 to 105 pounds of material per minute from the air stream.

Oklahoma Master Gardener Volunteer Program - 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. 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.

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.The service from the 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 Master Gardener Program now has 22 counties participating in the program during 2012. The following data was provided by 14 of the 22 counties. Approximately 232 new Master Gardeners were trained during the 2012 training season. Close to 1,000 active Master Gardeners volunteered their time, contributing approximately **47,263 volunteer hours resulting in over 4,324,786 educational interventions with Oklahomans and as many as 1,234+ educational and community programs** and activities being conducted in their communities in 2012. This translates to over **$826,630.00 in service that was donated by volunteers** (wage rate of $17.49/hour was used, which includes a 12% estimate of fringe benefits. This hourly rate is the assigned wage for nonagricultural workers in 2010 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.

Two New and Outstanding turf-type bermudagrasses Enter the Sod Production Trade - Since its invention, Tifway hybrid bermudagrass has provided an outstanding lawn and sports field surface in the southern US. Few grasses could rival its visual appeal and functional value. However, Tifway lacks appropriate winter hardiness, so its use across the transition zone (the merger area between subtropical and temperate climate zones) has been limited due to potential of winter kill. A cold hardy hybrid bermudagrass having both the visual and functional characteristics of Tifway yet having superior cold hardiness, has been sought by turfgrass managers for decades. Until recently, only OSU's Patriot hybrid bermudagrass offered quality approaching that of Tifway while having superior cold hardiness.

The Oklahoma State University Bermudagrass Breeding and Development Team has been working since 1986 on development of both seeded and vegetatively propagated bermudagrasses having outstanding winter hardiness and improved visual and functional quality. During that time superior cultivars in the form of Yukon, Riviera, and Patriot were developed and released to the turfgrass industry. In 2003 a round of super high quality OSU experimental hybrid bermudagrass lines entered a 9 year trial at Stillwater, OK, going head to head with the industry standard, Tifway. Winter tolerance, quality, color, texture density, sod strength, divot injury and traffic tolerance were assessed during this trial. Two superior lines, OKC1119 and OKC1134 emerged as elite performers against Tifway under Oklahoma conditions and were selected in 2007 for competing in the final stage 5- year long National Turfgrass Evaluation Program bermudagrass test. The OSU cultivars Latitude 36 (OKC1119) and Northbridge (OKC11134) emerged as top performers in the 2007-2012 multi-state NTEP bermudagrass trial. These lines were licensed to Sod Solutions, LLC who has since licensed nine sod producers of the OSU products during the 2011 and 2012 time period. In 2012 two sod producers in Oklahoma began production of the two new OSU hybrid bermudagrasses having both visual and functional quality equaling or exceeding Tifway and winter tolerance exceeding Tifway.

As licensed sod producers of Latitude 36 and Northbridge bermudagrass expand their acreage in production, consumers will at last be able to purchase bermudagrass that truly has the traditional visual and functional appeal of Tifway but having cold tolerance exceeding that of Tifway and on par with OSU's Patriot bermudagrass. Transition zone turfgrass managers won't have to play visual appeal against winter hardiness since these characterizes are wrapped into a single package by the name of Latitude 36 and Northbridge bermudagrasses from Oklahoma State University.

Numerous programs have been implemented to **reach Native American and Latino youth**. This has been particularly true of mentoring, STEM, and natural resource related programs. Special educators targeting Native American, urban, and Latino youth are functioning in strategic geographic locations. Partnerships have been developed with the Native American tribes as well as Latino community centers.

The Wheat Improvement Team saved Oklahoma wheat growers more than $1.73 million from Hessian fly damage - by screening winter wheat varieties for resistance to Hessian fly. Five new wheat varieties that contained partial or full resistance to Hessian fly were released and are currently being adopted by Oklahoma wheat producers. Oklahoma wheat producers planted nearly1.3 million acres to "Duster" and "Billings" in 2012. Duster has been rapidly adopted by Oklahoma wheat growers, changing from 0.3% of acres planted in 2008 to more than 22% of acres planted in 2012, becoming the most planted variety in Oklahoma. Billings was planted in 1.7% of Oklahoma wheat acres in 2012. Of that, a minimum of 5% or 65,000 acres were planted in areas where Hessian fly was documented to be a serious problem in the 2 years previous to 2012 resulting in an estimated $1.73 million in yield savings. In 2011-12, researchers were able to begin to characterize emergence patterns for Hessian fly in Oklahoma. Research is continuing to monitor emergence patterns for Hessian fly for development of new pest management strategies.

The Oklahoma Quality Beef Network (OQBN) integrates research and extension activities with the goal of enhancing value added opportunities for Oklahoma's beef industry. This collaborative project reaches across research and extension as well as across disciplinary lines, involving Agricultural Economics faculty, Animal Science research and extension faculty, and Vet Med faculty. In both 2011 and 2012 marketing years, severe drought conditions across much of the state altered the calf marketing choices made by producers as, for many, the resources necessary for retaining calves beyond weaning were scarce at best. Those marketing choices impacted participation numbers for calves marketed through the Oklahoma Quality Beef Network's value added health management program.

Approximately 3,000 OQBN certified calves were marketed through six OQBN sales in Fall 2012. This is similar to the approximately 3,750 calves marketed in 2011 and down from the 2010 OQBN numbers (prior to drought) of 10,000 calves. Lower numbers did not necessarily mean lower premiums. Producers who did certify and sell calves through OQBN received, on average, a weighted average premium of $9.23/cwt over calves that had not been preconditioned, indicating that buyers valued these calves over non-preconditioned calves. Preliminary analysis suggests that the program added approximately $100,000 in value to Oklahoma calves, based on premiums alone. That figure does not include the value of the additional weight gained by the calf between weaning and marketing. Research conducted on sale data increases our knowledge base about the value of various cattle characteristics and also informs future extension programming in educating producers on the benefits of preconditioning calves before marketing.

Plant Biological Technologies - A team of scientists from the OSU National Institute for Microbial Forensics and Agricultural Biosecurity (NIMFFAB) have developed a bioinformatic pipeline for pathogen screening, created sample sequence datasets and used the database for pathogen typing to support forensic microbiological discrimination and attribution. Using data from massively parallel sequencing, the pipeline was validated with sequencing data sets containing nucleic acid from multiple pathogen groups (viruses, bacteria and fungi) for detection in a metagenomic sample containing mixed microbial and plant sequences. Procedures to test the statistical significance of the data were evaluated and optimal parameters for searching sequence databases were established. Electronic probes (e-probes) were designed and validated for each pathogen, and all pathogens were detected, even in low abundance. EDNA finds nucleic acid signatures of microbes of interest without assembly and GenBank BLAST steps. The procedure was both sensitive and specific in the detection of RNA and DNA viruses, prokaryotic and eukaryotic organisms. Through a strong educational component, the team also addresses a critical emerging national need for scientists trained and experienced in both traditional and modern areas of plant pathology, and knowledgeable and appreciative of new National initiatives in agricultural biosecurity and forensic capability.

Food safety research - includes investigation of human pathogens on plants and how they are disseminated, how well they survive, and mechanisms of virulence to multiple hosts. OSU researchers recently documented survival and replication of human pathogen E. coli O157:H7 on spinach surfaces after regurgitation by flies. Fly movement of pathogens to edible plants is not well substantiated, but results suggest that pathogens survive in regurgitant on leaf surfaces.

Spinach breakage has been correlated with increased incidence of human pathogen contamination in bagged spinach. Research has shown that spinach grown under summer conditions grows faster, resulting in 30 to 50% thinner leaves than spinach grown under cooler spring conditions. Summer grown spinach is weaker, up to 25%, than spring spinach, suggesting that excessive weight in bins after harvest may contribute to the breakage phenomenon.

Wind power - is expanding throughout the world, including here in Oklahoma. Wind power has great potential for reducing our carbon footprint and providing rural landowners revenue, but a key problem is

that it cannot provide baseline power. In other words, wind power production is not tied to power demand, so if more power is needed at certain times, you cannot increase power production by making the wind blow more. Also, if demand is reduced, you can't shut off the wind. In order to stabilize the peaks and valleys due to wind power's variability, a type of energy storage system is necessary to store energy when it is produced at a faster rate than it is consumed. A group of students and faculty at OSU have proposed using excess wind energy to generate hydrogen using water electrolysis. Then, anaerobic bacteria would consume the hydrogen and carbon dioxide from and industrial source and produce ethanol. The team has named the process BioWinol.

Clostridium carboxidivorans has been identified as a bacterium that can effectively produce ethanol from carbon dioxide and hydrogen. Also, a nutrient media was developed for the process. We have successfully used a hollow fiber membrane to diffuse gas into our medium. The membrane has been shown by others to increase mass transfer rates by 20 fold over traditional stirred tank reactors. Also, we used a pH control to boost cell production. We successfully produced ethanol, n-butanol and n-hexanol from carbon dioxide and hydrogen.

The BioWinol process can effectively store wind energy while sequestering carbon dioxide. We envision industrial sources of carbon dioxide using this process to sequester carbon dioxide while producing valuable fuels and chemicals. This scenario would greatly benefit from any cap and trade system that might be implemented.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	245.0	0.0	87.0	0.0
Actual	254.0	0.0	87.0	0.0

II. Merit Review Process

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

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

2. Brief Explanation

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 state program leader (when appropriate). 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 the appropriate assistant director/state program leader.

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. 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, etc. 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.

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.

Every County CES 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, individuals, and, 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)

Brief explanation.

Following are some examples of stakeholder input - 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 (three times per year)

Canola Advisory Board (twice per year)

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

Health Rocks Advisory Team

Oklahoma Farm Bureau

4-H Centennial Gardens Committee (twice per year)

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

Oklahoma State Water Plan

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.

Input was used in decisions as to filling vacant positions in a difficult budget time. These decisions resulted in approval for filling the following positions two Area Animal Science Specialists, two Area Agronomy Specialists, a 4-H District Specialist, a weed science State Specialist, and an Entomologist and Pesticide Coordinator State Specialist.

We continued to receive much input related to drought. 2012 was our second severe drought in a row. We continued to target programming and educational materials to include drought related programs, forage options, feeding alternatives, forage nitrate testing, cattle selection and culling, alternative crops, crop insurance, tax implication education, etc. Drought issues brought forward by PAC attendees included:

- Rebuilding cowherds will be expensive
- Pasture Renovation/weed control options following drought
- Alternative crops
- No-till cropping systems
- Discovery/utilization of more drought tolerant forage base
- Crop insurance programs and decisions
- Proper stocking rates for post-drought recovery of pastures
- Stocker programs for traditional cow-calf operations
- Increased feed/hay cost
- Methods to extend hay supply
- Use of CRP land
- Risk management

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.

Many also had concerns about passage of the next Farm Bill, the commodity programs and risk management programs that would be contained in the Farm Bill. FCS and 4-H revisited the goals and objectives that came out of their extensive community input gathering from the previous year and these were reaffirmed by PACs around the state.

Brief Explanation of what you learned from your Stakeholders

New Farm Bill passage with continued risk management opportunites available. Severe drought conditions continue to plague cattle and crop production.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
5512628	0	4001676	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	6215276	0	4001676	0
Actual Matching	6215276	0	4001676	0
Actual All Other	25469595	0	22024835	0
Total Actual Expended	37900147	0	30028187	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	6215276	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger - 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	15%		15%	
302	Nutrient Utilization in Animals	12%		20%	
303	Genetic Improvement of Animals	8%		10%	
304	Animal Genome	0%		10%	
305	Animal Physiological Processes	0%		10%	
306	Environmental Stress in Animals	12%		10%	
307	Animal Management Systems	30%		10%	
308	Improved Animal Products (Before Harvest)	8%		5%	
311	Animal Diseases	6%		5%	
315	Animal Welfare/Well-Being and Protection	9%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	4.0	0.0
Actual Paid Professional	20.0	0.0	16.0	0.0
Actual Volunteer	3.4	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**
555000	0	656554	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
555000	0	656554	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2000000	0	3631747	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Develop research-based information and disseminate through peer reviewed journal articles, scientific reviews, and abstracts.

Develop decision aids and management programs that assist cattle and forage managers in making better informed decisions.

Conduct educational programs to improve the management skills, profitability and other success factors of people managing cattle and forages. Outputs for these activities will include fact sheets, books, and other extension publications, conference proceedings, web sites and conferences, and cattle enrolled in value-enhancement programs.

In animals exposed to BVDV, BRD, or both, identify biological links that exist between the bacteria and/or virus, reduced animal performance, and meat quality.

Provide meat goat workshops, boot camps, and keep meat goat manual up to date.

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, and the general public.

3. How was eXtension used?

Active participation in the Horse CoP.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	101902	8085628	4010	700000

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

Patent Applications Submitted

Year: 2012

Actual: 1

Patents listed

Methods of feeding ruminants.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	9	12	21

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conferences, symposiums, and meetings

Year	Actual
2012	405

Output #2

Output Measure

- Peered reviewed journal articles

Year	Actual
2012	12

Output #3

Output Measure

- Extension publications: fact sheets, proceedings, books, manuals, bulletins

Year	Actual
2012	166

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Total number of producers certified as Master Cattlemen
2	Number of producers implementing improved management, grazing systems and beef production systems resulting in improved sustainability.
3	Number of producers implementing management programs to decrease the incidence and economic impact of BVDV and BRD
4	Number of producers certified in the Beef Quality Assurance program
5	Number of cattle enrolled in value enhancement programs
6	Oklahoma Animal Genetics Initiative
7	2012 Cow/Calf Boot Camp
8	2012 Meat Goat Boot Camp
9	Psture recovery following drought

Outcome #1

1. Outcome Measures

Total number of producers certified as Master Cattlemen

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	75

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, seventy percent of the state's 86,000 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 seventy-eight percent of the beef cow inventory in herds of fifty head or less. Smaller cattle operations have higher cost of production and are less likely to incorporate best management practices.

What has been done
The Master Cattleman Program is conducted by an interdisciplinary team resulting 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 and in-service training for Extension educators. An interdisciplinary Beef Cattle Manual was updated and published. The manual contains 41 chapters addressing various business, production, and natural resource topics. Approximately 462 manuals were distributed in 2012 and a total of about 9,400 have been distributed since program inception through local Extension offices, area and state meetings and from the Master Cattleman website. Requests have been filled to 25 states and 5 foreign countries. The manual is being used as a textbook in 8 universities and community colleges.

Results
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 it continues to be a popular staple in educational programming. Approximately 730 students have graduated with 75 having graduated during 2012. Currently, 133 students are enrolled from 17 Oklahoma Counties. Graduates average response to their estimate of annual improvement in their cattle operation's profitability is $3,500 for a total annual impact of $2.5 million. 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.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of producers implementing improved management, grazing systems and beef production systems resulting in improved sustainability.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Hay ranks as the second largest crop grown and harvested in Oklahoma. Tremendous effort and expense goes into growing, cutting, baling, storing, transporting, and feeding hay in cow/calf enterprises across the state. In fact, recent data surveying 729 Oklahoma producers (Vestal et al., 2007) indicates that only 10% of cow/calf operations have a hay feeding season of 60 days or less. Most rely on harvested forages as the primary source of dietary nutrients for the majority of the winter (90 to 150 days).

What has been done
Our group had previously discovered that 16% less hay would be needed for beef cow operations if a better hay feeder were used. In a follow-up experiment, we discovered that hay needed for

wintering cows could be reduced by 18% by combining three technologies: using a better hay feeder, feeding a specific feed additive in the supplement and limiting access to hay on a daily basis. The amazing thing about this 18% savings in hay is that there was NO DIFFERENCE in performance of the cows regardless if they received the standard management program or the "three technology" program.

Results
With extreme cost of hay in 2012 due to the continued drought, the economic impact to the state is estimated to be $3.5 million dollars per year. This assumes that only 5% of the 86,000 beef cattle operations adopt the use of one or more of these three technologies.

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

Outcome #3

1. Outcome Measures

Number of producers implementing management programs to decrease the incidence and economic impact of BVDV and BRD

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	125

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Bovine respiratory disease (BRD) is the most significant production problem for the feedlot industry, accounting for the majority of morbidity, mortality, and decreased production in feedlots

with estimated annual economic losses in excess of $1 billion. The standard protocol when treating for BRD or undifferentiated fever in feedlot cattle is to administer some class of injectable antimicrobial. However, it is also common to provide additional treatment, or ancillary therapy, along with the antimicrobial. The goal of ancillary therapy is to improve the response to a BRD challenge in calves treated with antimicrobials, not to replace antimicrobial treatment. This can be accomplished by relieving the harmful effects of inflammation, blocking histamine activity, or boosting immune system function to aid in the defense of infectious pathogens. In 1999, USDA NAHMS surveyed feedlots in the top 12 cattle feeding states and noted that only 12.8% of these feedlots used a single antimicrobial for the treatment of BRD (USDA APHIS, 2001). A more recent survey reported that 48% of veterinarians recommended some form of ancillary therapy for the treatment of BRD. The most common forms of ancillary therapy listed in the surveys included: vitamin C, non-steroidal-anti-inflammatory drugs (NSAID), antihistamines, direct-fed microbials (DFM), B vitamins, viral vaccines, and corticosteroids.

What has been done
While surveys provide evidence as to the scope of ancillary therapy use, there is limited published research on the efficacy of these ancillary therapies. Animal enterprises evaluated the effects of 3 ancillary therapies utilized in combination with an antimicrobial on performance and health variables of newly received high-risk calves treated for BRD.

Results
Calves receiving an intranasal viral vaccine tended to be treated a second time for BRD less frequently, and calves receiving NSAID or vitamin C tended to require a third BRD treatment less often when compared to calves receiving no ancillary therapy. Although the responses observed to the 3 ancillary therapies used were largely negligible, increased days on feed, lower final body weight and lower carcass value results in an $11.36 loss in income for every time an animal gets treated for BRD. Decreasing the average number of times an animal is treated for BRD by one treatment would result in a nearly $9 million savings to Oklahoma feedlot cattle producers.

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 #4

1. Outcome Measures

Number of producers certified in the Beef Quality Assurance program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	300

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cattle sickness costs the industry millions of dollars each year. These losses negatively impact producer profitability and they impact each and every level of the beef production chain.

What has been done
In order to facilitate the adoption of best management practices that should result in reduced sickness and associated adverse effects, the Oklahoma Quality Beef Network (OQBN) was initially developed in 2001. The objective is to add value to Oklahoma's calf crop and empower cattle producers to capture at least part of the added value.

Results
In 2012, 85 Oklahoma beef producers enrolled 3,496 calves in the OQBN program. Nine regional OQBN Vac-45 calf sales were conducted in six livestock markets. OQBN cattle received a premium of $9.23/cwt, based on the weighted average price of all lots, over non-preconditioned cattle. The average price premium is an additional $55.38 per head, while the added value of weight gain during the preconditioning period averaged $76.50 per head for a gross increase in revenue of $131.88 per calf. Average cost to participate in the program was about $80 per head, resulting in a net increase in income of about $52 per head or total net increase in income of $182,000 for the calves enrolled in the program in 2012. The extreme drought has reduced cow numbers drastically in the state and forced producers to sell calves early and directly off of the cow. We expect participation in this program and ones like it to climb dramatically again once forage production returns to normal. However, the educational program and example given by the OQBN is stimulating growth in adoption of these management, certification and marketing practices throughout the state. Therefore, the impact is much higher than can be measured by direct participation in the program.

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 #5

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
2012	3496

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
See qualitative outcome for Oklahoma Beef Quality Network.

What has been done

Results
Involvement in this program was again reduced in 2012 due to the drought.

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 #6

1. Outcome Measures

Oklahoma Animal Genetics Initiative

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Improper management of genetic resources and failure to use appropriate mating systems negatively impact beef cattle operations by reducing profit. Failure to follow basic guidelines regarding genetics and mating systems can impact all levels of the production chain by negatively impacting overall beef demand due to failure to provide a product that is acceptable from a consumer standpoint. Appropriate use of mating systems allows the selection of animals that fit the production environment and increase cowherd efficiency while still producing a product that is acceptable for beef consumers. Research studies, many of which stem from long-term research conducted at the US Meat Animal Research Center, have consistently highlighted the production advantages achieved from using appropriate crossbreeding systems to capitalize on maternal heterosis. Dramatic improvements in longevity, fertility, and lifetime productivity have been well documented in crossbred beef females. Other genetic tools such as EPDs and genomics can also be used to manage production levels to fit the environment while using terminal crosses to produce high-output animals with good carcass traits.

What has been done
The Oklahoma Animal Genetics Initiative began with the launching of a new web portal focused towards producer education on genetics and genomics topics (www.beefextension.com/genetics). This web portal is the gateway to integration of a variety of educational tools, programs, and topics that are of interest to Oklahoma cattlemen. The site is designed to be continually evolving and adding new materials and tools. It has been focused more towards beef cattle to date, but can also be expanded to other species as materials become available. This website is also serving as the primary informational delivery system for the upcoming Beef Improvement Federation Research Symposium and Annual Meeting. The schedule, registration links, and hotel information have all been posted and linked both from our site and the Beef Improvement Federation website.

Results
The genetics webpage has been completely re-designed and five previously authored fact sheets have been included within their appropriate sections. New content in 2012 consists of 1 fact sheet concerning use of genomics, an across-breed EPD calculator, a video episode of SUNUP TV that talks about the bovine genome, links to pertinent news articles, and links to outside websites and sources of genetics and genomics information. Additional web content is planned for development in 2013.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
304	Animal Genome
308	Improved Animal Products (Before Harvest)

Outcome #7

1. Outcome Measures

2012 Cow/Calf Boot Camp

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	42

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Forty two producers from 5 states (Arkansas, Florida, Kansas, Oklahoma, and Texas) attended the 2012 Cow/Calf Boot Camp near Kellyville, OK.

What has been done
The effectiveness and impact of the program was evaluated using pre and post tests along with an overall evaluation.

Results
Twenty eight % of the participants considered themselves full time cattle producers while 70% had 100 cows or fewer. When asked to rate the individual classes on a scale of 1 to 5, the average score was 4.47. In particular, producers rated the following sessions very high: Livestock Mortality Disposal - 4.77; Calving Season & Cow Efficiency - 4.75; Reproduction - 4.71; and Cow Nutrition Exercise - 4.69. When asked what the value of the workshop was to their operation the answers ranged from $10/head to $1,000/head. Eighty three % of the participants plan to adopt 1 or more of the production practices discussed at the workshop. Eighty % of the participants said they would recommend this class to other producers. One participant remarked that "Any rancher should be required to attend this type of class as a minimum to try to be a responsible operator." Another comment stated that "The program is awesome and has information to help any beginning or mature farmer." Pre-test scores averaged 12.5 with a standard deviation of 2.98 and a range from 8-20 correct. Post test scores averaged 16.3 with a standard deviation of 2.47 and a range from 11-22 correct. This test shows a 30.40% increase in knowledge gained from the

workshop. There were four questions that showed an increase in knowledge of over 100%. The overall value of this program is best determined by using the producer's own estimation of the average value ($/head) gained from the workshop, the average number of cattle per participant and the total number of participants. By this estimation the value of the OSU Cow/Calf Camp was $899,264.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
303	Genetic Improvement of Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
311	Animal Diseases

Outcome #8

1. Outcome Measures

2012 Meat Goat Boot Camp

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	49

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Forty nine producers attended the 2012 Meat Goat Boot Camp.

What has been done
The effectiveness and impact of the program was evaluated using pre and post tests and an overall evaluation.

Results
Of the 49 participants, this was the first extension program that 37 had attended. When asked to rank the topics that were the greatest of value to them the top five sessions were FAMACHA Eye

Scores and Fecal Egg Counts, Parasite Life Cycle Management, Goat Nutrition, Hay Evaluation, and Birthing and Neonatal Care. Eighty three % of the participants plan to adopt 1 or more of the production practices discussed at the workshop. Pre-test scores averaged 17.0 with a standard deviation of 3.84 and a range from 2-25 correct. Post test scores averaged 23.3 with a standard deviation of 3.25 and a range from 14-29 correct. This test shows a 37.1% increase in knowledge gained from the workshop. There were five questions that showed an increase in knowledge of over 100%. When the pre and post test questions are grouped by subject matter there are seven subject matter groups. Following are those subject matter groups and the change in knowledge gained for each group. Marketing - 114.55%; Nutrition - 83.61%; Forages - 49.18%; Parasite Control - 37.8%; General Herd Management - 24.57%; Business Planning - 18.52%; Record Keeping - 10.59%. The overall value of this program is best determined by using the producer's own estimation of the average value ($/head) gained from the workshop, the average number of goats per participant and the total number of participants. By this estimation the value of the OSU Meat Goat Boot Camp was $689,430.

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
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #9

1. Outcome Measures

Psture recovery following drought

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	22

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oklahoma has experienced severe drought during the past two years which will have long-term negative effects on forage production for livestock producers.

What has been done
Ottawa County: This educational program was initiated in March of 2012.

Results
Sixty four surveys were distributed with 22 returned (34%). The total number of acres managed by those responding to the survey was over 23,000 acres, with approximately 60% of the reported acres having moderate to severe drought damage. The average value of pasture and forage losses due to drought was estimated at nearly $130/acre. All respondents reported plans to use information they learned at the meeting. Approximately 30% indicated using weed control only, with 65% planning to use both weed control and fertilization, with 100% indicating plans to either decrease or maintain herd size. The estimated value of the information was approximately $65/acre or greater than $1.5 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources

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

Extreme drought caused a reduction in several on-going programs. However, educational efforts in cattle management under such conditions, tax management, culling options, altenative feeds, cattle stress, etc. were increased.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

For the Master Cattleman, program, graduates estimate of annual improvement in their cattle operation's profitability was $3,500 for a total annual impact of $2.5 million. 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 3 people to the Master Cattleman program.

The estimated value of the OSU Cow/Calf Boot Camp to producers was $899,264.

The estimated value of the OSU Meat Goat Boot Camp to producers was $689,430.

With extreme cost of hay in 2012 due to the continued drought, the economic impact of minimizing hay waste to the state is estimated to be $3.5 million dollars per year. This assumes that only 5% of the 86,000 beef cattle operations adopt the use of one or more of these three technologies.

The estimated value of the Pasture Recovery Following Drought program to producers was approximately $65/acre or greater than $1.5 million.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Global Food Security and Hunger - 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	20%		5%	
133	Pollution Prevention and Mitigation	3%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		20%	
204	Plant Product Quality and Utility (Preharvest)	11%		10%	
205	Plant Management Systems	35%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		10%	
212	Pathogens and Nematodes Affecting Plants	4%		10%	
213	Weeds Affecting Plants	5%		5%	
215	Biological Control of Pests Affecting Plants	2%		5%	
216	Integrated Pest Management Systems	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	18.0	0.0	6.0	0.0
Actual Paid Professional	22.0	0.0	15.0	0.0
Actual Volunteer	3.6	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**
590000	0	576055	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
590000	0	576055	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2115855	0	3186466	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Wheat cultivar performance testing and demonstration throughout Oklahoma

Wheat breeding, variety development, and introgression of new traits into elite germplasm

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

Provide effective, non-classroom educational opportunities for industry professionals, Extension educators, farmers, and ranchers.

Conduct on-farm research and demonstration of nitrogen rich strips and use of hand-held sensors

Explore opportunities for market-based solutions to global climate change and evaluate potential for Oklahoma stakeholders to participate in these opportunities

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?

Dr. Randy Boman is active in the Cotton CoP. He participated in conference calls and a meeting in Kansas City to establish the eXtension cotton Web site. We provided numerous numbered publications to upload to the Website. It was launched at the Beltwide Cotton Conference in Nashville in January, 2008. In 2012, this was still actively supported by our Beltwide Extension Cotton Specialist Working Group, a true multi-state research and extension effort. He continues to serve as the subject matter editor for the Ginning and Classing section for the Cotton Community of Practice. All subject matter sections were updated in the fall of 2012 by the various editors. Dr. Guy Collins of the University of Georgia is handling coordination of content updating. We have a direct link on both websites we manage. URL: www.extension.org.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	99222	5726735	2300	30000

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

Patent Applications Submitted

Year: 2012

Actual: 2

Patents listed

PVP on wheaat cultivar 'Gallagher' and a PVP on wheat cultivar 'Iba'

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	18	16	34

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Field Demonstrations

Year	Actual
2012	215

Output #2

Output Measure

- Varieties of wheat released

Year	Actual
2012	2

Output #3

Output Measure

- Crop production manuals and production newsletters

Year	Actual
2012	71

Output #4

Output Measure

- Cotton Web Page

Year	Actual
2012	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of dual-purpose wheat acreage where first hollow stem criterion used for decision making
2	Number of wheat varieties released to address agronomic and end-use quality needs of hard red winter wheat industry
3	Locally-controlled evaluations and agronomic data for oilseed crops
4	Percentage of wheat acres sown to varieties with improved pest resistance, yield potential, and end-use quality.
5	Increase in knowledge and adoption rate of reduced tillage practices and crop rotation - acres effected
6	Number of crop acres where fertilization decisions include sensor-based fertilization information
7	Locally-controlled evaluations and agronomic data for small grains crops
8	Expansion of pedigreed seed production and capacity to increase wheat grain yield and end-use quality
9	Drought Probability Assessment in Oklahoma
10	Best management practices for pasture recovery following drought.
11	Agricultural Testing Reduces Production Costs and Minimize the Impact of Agriculture on the Environment
12	Improved Chicken Litter Handling and Transport
13	Increasing phosphorus use efficiency of wheat
14	Feasibility analysis of a market based incentive program for decreasing N2O emissions in Oklahoma through improved nutrient management.
15	Swine Effluent Project

Outcome #1

1. Outcome Measures

Percentage of dual-purpose wheat acreage where first hollow stem criterion used for decision making

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat fields utilized for livestock grazing during the fall/winter and then harvested for grain by early summer are termed "dual-purpose" wheat fields. Proper timing of livestock grazing termination at the ¼ inch First Hollow Stem (FHS) stage of growth is critical in avoiding large grain yield losses caused by overgrazing wheat pastures. Because grazing termination dates can vary greatly on a field-by-field basis due to planting date and the particular variety planted, FHS is the single best way for stocker cattle producers to determine exact times for grazing termination. Oklahoma has about 5.7 million acres of wheat planted annually, of which, about 2.5 million acres are utilized by farmers as ?dual-purpose? wheat acres.

What has been done
Research indicates overgrazing wheat pasture by just one week can result in a decreased grain yield of up to 25% at harvest and mistiming grazing termination by two weeks will reduce the bushels of wheat at harvest by up to 60%! Given average yield, this equates into a 19 bu/ac loss. At current prices, this amounts to a $150 + per acre potential loss of income for "dual-purpose" wheat producers or a $380,000,000 potential annual loss for the state of Oklahoma. To help prevent these losses, we monitor first hollow stem, conduct in-service trainings, and hold grower workshops on methodology and benefits of scouting for first hollow stem.

Results
It is estimated that at least 75% of dual-purpose wheat producers in Oklahoma use first hollow stem as a criterion for removal of cattle from wheat pasture. First hollow stem was monitored at two locations (Stillwater and El Reno, OK) and data were distributed to extension educators and stakeholders via electronic newsletter. It is estimated that at least 75% of dual-purpose wheat producers follow these numbers and use them as a "rule of thumb" estimator for removal of cattle from wheat pasture. That change from traditional methods helped producers reduce lost

production by about $285 million in 2012.

Several producers have commented on the usefulness of this information. A prominent rancher in southern Oklahoma, for example, commented "I appreciate you guys distributing the first hollow stem data from the El Reno site. It matches what I have been finding in my field and lets me know that I am making the right decision".

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Number of wheat varieties released to address agronomic and end-use quality needs of hard red winter wheat industry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat and the associated grazing component are worth in excess of $1.5 billion annually to the Oklahoma economy. In the winter-wheat market, farmer profitability is yield-driven while end-user value is quality driven. While yield potential and end-use quality are not mutually exclusive traits, developing and marketing cultivars that satisfy both requirements is extremely difficult. The fact that there are relatively few scientists and even fewer private companies working in the area of wheat improvement exacerbates the problem.

What has been done
The Oklahoma State University Wheat Improvement Team was developed as a cross-cutting collection of scientists who work collaboratively to develop, test, and distribute improved wheat cultivars for the Southern Great Plains. As part of this effort over 900 individual crosses are made on a yearly basis. In addition approximately 45 cultivars are evaluated in replicated small grain performance trials at 24 sites throughout Oklahoma. Farmers are involved in both of the

processes through advisory organizations and direct participation in research trials.

Results

The Oklahoma Agricultural Experiment station released the hard red winter wheat cultivars "Gallagher" and "Iba" in 2012. These cultivars represent the efforts of the Oklahoma State University Wheat Improvement Team to improve upon "Duster", the most popular wheat variety in the state. Gallagher 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. Iba offers increased yield potential, foliar disease resistance, and kernel size with an extremely broad area of adaptation. It is anticipated that these two varieties will capture the 1.2 million (22.2%) of Oklahoma wheat acres currently occupied by Duster in the next five to seven years, reducing the need for fungicides while increasing farmer profitability. Licenses from released varieties have generated approximately $1.15 million in intellectual property income for Oklahoma State University thus far.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Locally-controlled evaluations and agronomic data for oilseed crops

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

For many years the vast majority of Oklahoma cropland acres have been seeded to continuous winter wheat. For example, in Canadian County from 1998 to 2007, 87 percent of total crop acres were seeded to wheat. Continuous cropping of annuals contributed to the buildup of yield-constraining weeds, diseases, and insects. Economic returns have been hampered by yield losses and by reductions in grain quality.
For years, crop rotations had been recommended to mitigate these problems. However, crop rotations were not common in Oklahoma. Alternative winter small grain crops such as oats, barley, and rye were not economically competitive. In many cases, attempts to include summer crops such as corn, soybeans, and grain sorghum were not successful because they do not fit well in a rotation with winter wheat and do not perform well in dryland conditions in Oklahoma. On average, 16 percent of planted soybean acres and 17 percent of corn acres planted for grain in the state are not harvested. In some years corn is plagued with mycotoxins. In 2011, 40 percent of the acres planted to soybeans in the state were abandoned. Similarly, in 2011, 36 percent of the acres planted to corn were not harvested for either silage or grain.

What has been done
Prior to 2004, winter canola was not produced in the state, there was no local market for canola, and Oklahoma producers did not have an economically viable alternative winter crop to rotate with winter wheat. OSU under the leadership of Dr. Peeper assembled a multidisciplinary DASNR team and initiated a comprehensive research program.

Results
The team developed best management practices for canola and determined that (a) wheat yields following canola were significantly greater than wheat yields experienced in continuous wheat and (b) expected net returns are greater for canola-wheat rotations than for continuous wheat. Producers respond to economic incentives.

Prior to 2004, winter canola was not produced in the state. In 2009, for the first time, the Oklahoma Agricultural Statistics Service reported canola planted acres.

Crop year	Canola Acres as reported by OASS
2003-04	0
?	?
2008-09	42,000
2009-10	60,000
2010-11	100,000
2011-12	150,000

This growth in canola acres is one result of the OSU Crop Management Team.
- Wheat producers have an economically viable alternative for managing weeds and diseases.
- Several buyers are active in the State
- Canola is processed in the state.
- Private companies are investing in variety development.

If private companies continue to assist with investments in variety development and crop management research, winter canola could be become an important economic development engine for the state of Oklahoma. In addition, the overall quality and value of hard red winter wheat delivered to Oklahoma elevators could be improved substantially.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #4

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
2012	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 8% and 2%, respectively. Acreage of the disease and Hessian fly resistant cultivar 'Duster' increased from 0.3% of acreage in 2007 to 22.2% in 2012 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 #5

1. Outcome Measures

Increase in knowledge and adoption rate of reduced tillage practices and crop rotation - acres effected

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of crop acres where fertilization decisions include sensor-based fertilization information

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	500000

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
Oklahoma State University has developed hand-held sensors and corresponding web-based decision aids that can be used to generate in-season nitrogen recommendations based on yield potential. This method is much more accurate than yield-goal-based systems in predicting high or low-yielding years where nitrogen fertilizer application rates should be adjusted accordingly. Sensor based nitrogen management presentations and demonstrations were given at 40 grower meetings with approximately 2,600 individuals in attendance in 2012. Two websites devoted nutrient management (nue.okstate.edu and npk.okstate.edu) were viewed approximately 19,500 times in 2012.

Results
In the fall of 2012 it is estimated that the N-Rich Strip and SBNRC was established on nearly 500,000 acres of Winter Wheat and Winter Canola. Recent research concluded that this technologies increases profit in winter crops by $10/ac resulting in a state wide impact of approximately $5 million. Additional to the success of the N-Rich strips is the commercialization of the smaller Hand Held GreenSeeker sensor. This sensor is sold at 10% of the cost ($495) of the larger unit historically used. The new Hand Held has been selling well in Oklahoma and across the United States. The Hand Held has also meet great support internationally. The adoption of this low cost sensor will greatly impact the state of Oklahoma as the implementation of the N-Rich Strip and Sensor Based Nitrogen Calculator which will ultimately the increase economic and environmental sustainability of winter wheat production in Oklahoma.

4. Associated Knowledge Areas

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

Outcome #7

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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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. This site received over 32,000 page views in 2012 and was reinforced with the @OSU_smallgrains Twitter feed. Hard copies of results were distributed to over 8,000 stakeholders in the state of Oklahoma via direct mailing and to over 600 producers via electronic copy.

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 #8

1. Outcome Measures

Expansion of pedigreed seed production and capacity to increase wheat grain yield 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
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Quality seed is the foundation for profitable and sustainable crop production. Unfortunately, most wheat acres in Oklahoma are seeded using farmer-saved seed with low purity and/or quality. In addition, farmer-saved seed is frequently contaminated with Italian ryegrass or other weed seed that ultimately reduce the marketability and end-use quality of Oklahoma wheat. Increasing the use of pedigreed seed would alleviate many of these issues and increase farmer access to improved genetics. Demand for certified seed has increased among farmers, but greater production capacity at all levels of the certification process (foundation, registered, and certified) is needed to ensure adequate supply.

What has been done
The Oklahoma Crop Improvement Association (OCIA), Oklahoma Foundation Seed Stocks (OFSS), private seed retailers, and Oklahoma Cooperative Extension have increased awareness regarding the importance of seed quality. Certified seed availability was increased using a three-pronged approach. First, a conscious effort was made to recruit new certified seed producers and to increase capacity of current certified seed producers. Second, release of new wheat varieties by the Oklahoma Agricultural Experiment Station was delayed by one year to increase seed availability the year of release. Finally, OCIA and OFSS increased capacity to ensure an adequate, steady supply of foundation and registered seed.

Results
Wheat acres sown to registered seed for sale as certified seed the following year more than doubled (23,452 vs. 50,319 acres) from 2003 to 2012 and the number of varieties available to choose from increased from 19 to 16. Production of breeder and foundation seed during this time period has increase accordingly to meet demand. For example, there were 344 bushels of foundation "Duster" available in 2006, the year of its release. In contrast, there were 3,142 bushels of foundation "Gallagher" available for planting when it was released in 2012. This means more bushels of improved varieties in more seedsmens' hands more quickly. Planting of certified seed by farmers and ranchers has increased as well. Over the past five years acres planted to certified seed of OSU-developed varieties has increased from 112,000 to 785,000, assuming a one bushel per acre seeding rate.

4. Associated Knowledge Areas

KA Code	Knowledge Area

204 Plant Product Quality and Utility (Preharvest)
205 Plant Management Systems

Outcome #9

1. Outcome Measures

Drought Probability Assessment in Oklahoma

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Drought costs are estimated to vary from $6 to 8 billion per year in the United States; however, single events can cause losses as high as $39 billion. Accurate assessment of seasonal patterns in drought probability is important because if the crop cycle can be matched with periods when drought is less likely to occur, yield losses due to drought may be reduced. Current drought probability assessment methods are typically based on long-term atmospheric data such as rainfall and maximum and minimum temperatures. No existing methods use actual soil moisture measurements to assess drought probabilities. We hypothesized that, when long-term soil moisture data are available, they can be used to create soil water deficit-based drought probability assessments, which would be more reliable than those based on the atmospheric data alone.

What has been done
Fifteen years of daily precipitation, air temperature, and soil moisture measurements for eight Mesonet stations across Oklahoma were analyzed to calculate the probability of water deficits sufficient to cause plant water stress for each day of the growing season. For the new soil water deficit method, the drought threshold was set at 50% depletion of the soil?s total available water capacity. For the atmospheric water deficit method, a previously proposed 50 mm (2 inch), 7-day cumulative deficit was used.

Results
Drought probability values calculated by the atmospheric method were unreasonably low and consistently lower than probabilities estimated by the soil water deficit method. The performance of the atmospheric method was improved by changing the threshold to 37 mm (1.5 inch) or by changing to a 15-day cumulative deficit. The new soil water deficit-based method gave plausible

and consistent results when applied to both the 0- to 40- and 0- to 80-cm soil layers (16 or 32 inches) and should be utilized when long-term soil moisture data are available. This research was recently published in Agronomy Journal and has been the subject of recent press releases, a radio interview, and an invited presentation in the Oklahoma Winter Crop School.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Best management practices for pasture recovery following drought.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Of the 8 million acres of introduced forages grown in Oklahoma, nearly all were negatively impacted through the excessive heat, prolonged drought, and heavy grazing pressure during the drought of 2010-2012. Even when growing conditions return to normal, lingering effects on pasture recovery related to drought will remain. Most notable of these will likely be reduced persistence, couple with slower regrowth.

What has been done
During 2012, a total of 11 Pasture Recovery Following Drought programs covering 13 counties were held to address specifics of pasture recovery due to extreme drought conditions using weed control, fertilization, and grazing deferment. Five hundred nineteen surveys were distributed with 193 completed (37% return rate). Conservative estimates suggest that forage managers of nearly 500,000 acres of introduced forage and pasture production in Oklahoma attended one of these programs. These acres represent approximately 5% of the total acreage devoted to the production and management of introduced pastures in Oklahoma.

Results

Survey respondents assessed that 79% of the introduced pastures in Oklahoma suffered moderate to severe drought damage with an average forage production loss of $136 per acre. This resulted in estimated forage and pasture losses during 2011 at $26 million just for the 37% who completed the survey. Across Oklahoma, a conservative estimate of total forage losses during 2011 of $1 billion is possible. Based on drought damage and the uncertainty of pasture recovery, 99% of those who responded to the survey indicated plans to use information they learned at one of these meetings. Over 95% indicated plans to use some combination of weed control, fertilization, and grazing deferment as their primary tools for pasture recovery. Likewise, 95% of those who responded to the survey indicated that they planned to either maintain or decrease herd size during 2012. Forage producers valued this program at $90 per acre. Thus, the economic impact of this program was valued at $17.7 million by those attending one of the 11 county programs. The Pasture Recovery Following Drought program can recover $650 million of drought-damaged forage and pasture in Oklahoma.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

Agricultural Testing Reduces Production Costs and Minimize the Impact of Agriculture on the Environment

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural testing is needed by all producers to improve their profits and by Extension personnel to enhance their educational effectiveness. For example, soil testing has been proven to be one of the most important Best Management Practices (BMP) to improve nutrient use efficiency. However, many producers routinely fertilize their fields without testing the soil. It is possible to apply unneeded fertilizer or animal manure if the nutrient status of cropland or pasture is unknown. This not only costs producers money, but the additional nutrients may enter water

supplies and cause environmental problems. On the other hand, applying inadequate fertilizer could reduce yields and decrease profits. One of the major reasons for farmers not performing soil and other agricultural tests is the lack of understanding of their importance or the lack of confidence in test results.

What has been done
The Oklahoma State University Soil, Water and Forage Analytical Laboratory analyzed over 60,000 various samples for thousands of farmers, ranchers, homeowners, and researchers in a timely fashion. Farmers and homeowners use those results to guide their fertilizer application. Extension educators used the information we provided to enhance their outreach activities.

Results
Each year, we directly serve thousands urban and rural clientele and millions of acres of land are impacted. Test results are used by producers to formulate their fertilizer program, especially to develop animal waste management plans. Our timely soil testing and manure analyses have facilitated waste nutrient management plan development for poultry producers and other animal feeding operations (AFOs) mandated by state and federal regulations. The recommendations from the lab have increased nutrient use efficiency; therefore, the yields of crop production for producers who use soil testing should be improved while the costs of fertilizer use decrease. Soil test has proven to save $5 to $15/acre in nitrogen cost by crediting residual nitrate nitrogen. It could potentially save farmers $20 million if just 2 million acres are soil tested. The impact of agriculture on the environment as a non-point source should also be greatly reduced by following soil test recommendations and applying the right amount of nutrients at the right time.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

Improved Chicken Litter Handling and Transport

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The poultry industry has an economic importance in Eastern Oklahoma, serving as a major source of employment in rural areas and often a more profitable alternative to traditional agricultural enterprises in the region. Most of these poultry operations are concentrated animal feeding operations (CAFOs). Poultry CAFOs are supported by the import of animal feed containing nutrients such as nitrogen (N), phosphorus (P), and potassium (K); these nutrients are then exported from the farm in the form of agricultural products. However, much of the nutrients imported with the feed will remain on the farm in the form of manure. There hence lies a need to reduce litter mass with little monetary and labor inputs for the purpose of reducing litter transport costs and increasing hauling distances. The objectives of this study were to: (i) determine to what degree an alternative litter storage process (composting) designed to promote C degradation would decrease mass and affect litter properties including nutrient concentrations and carbon forms, and; (ii) conduct an economic analysis of this storage process in the context of transporting litter from poultry dense watersheds to areas deficient in soil P.

What has been done

Results

Our published results suggest that composting chicken litter will reduce its mass by about 20 percent. This is expected to result in a savings of over $35 million over the next 20 years in subsidies, transportation costs, and reduced fertilizer expenditures. Our on-going research is estimating the impact on energy savings.

Our research on the application of poultry litter to sweet sorghum indicates that litter can be an economically viable substitute for inorganic fertilizers when applied at nutrient equivalent rates. According to our estimates, poultry litter can be profitably shipped up to 100 miles when compared to commercial fertilizer. Moreover, extending the use of poultry litter as a fertilizer source will enable producers to fertilize sweet sorghum, a crop that is usually left non-amended. Poultry litter, when field applied at the optimal rate will provide a per acre impact of $75 per acre compared to non-amended fields. Helping improve the profitability of sweet sorghum production will have a positive impact on the biofuel industry in Oklahoma by reducing the cost of biofuel stocks. Increasing the off-site use of poultry litter will also provide substantial environmental impacts to Oklahoma by reducing the potential for phosphorus runoff into its waterways.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
205	Plant Management Systems

Outcome #13

1. Outcome Measures

Increasing phosphorus use efficiency of wheat

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Demand for phosphorus (P) is steadily rising and the P reserves relied on are decreasing in both quantity and quality. These reserves are predicted to reach near exhaustion within the next 46-60 years. In addition, global demand for cereal crops is estimated to increase 31% by 2030. To meet this demand it is imperative that resource efficiency, especially P-use efficiency, of all major crops be increased. Failing to do so could lead to the exploitation of marginal land and the resulting negative environmental and social consequences.

What has been done
Studies were initiated to screen for P-use efficiency among 22 wheat accessions in low P acid and calcareous soils. In addition, a method was developed for differentiating between P-uptake efficiency (i.e., the ability to uptake relatively non-available soil P forms) and P-utilization efficiency (i.e., the ability to produce biomass with little P uptake). Studies have also been initiated for examining accession mechanisms that increase P solubility in the rhizosphere, which contributes to P-uptake efficiency.

Results
Phosphorus-use efficiency screening has been completed for all 22 wheat accessions. Chisolm-S and MO4*5109 were the two most P-uptake efficient accessions under acidic conditions, while Garrison, Fuller, and Ruby Lee were the most P-utilization efficient. Among calcareous soils, SD0669 and P03207A-7 were the most P-uptake efficient while W98008J1 was the most P-utilization efficient accession. Rhizosphere studies have been completed on these cultivars; results will provide information about how P-uptake efficient accessions are able to make soil P more available for uptake. This information will help breeders in developing more P-use efficient cultivars.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

Feasibility analysis of a market based incentive program for decreasing N2O emissions in Oklahoma through improved nutrient management.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nitrous oxide (N2O) is greenhouse gas that can be produced by the application of nitrogen fertilizers, among other things. Incentive-based solutions need to be evaluated as potential methods to reduce N2O emissions from agricultural operations.

What has been done
A team was assembled in 2012 to evaluate the potential for an incentive based solution to reduce N2O emissions from agricultural operations. The Environmental Quality Incentive Program (EQIP) through the Natural Resources Conservation Service (NRCS) was explored as an avenue for providing incentives.

Results
It was determined that a market-based incentive program for improved nutrient management to decrease N2O emissions from Oklahoma cropland would result in an infusion of potentially $1.5 million of EQIP funds to the State. This infusion was provided to allow for on farm assessment of NRCS tools that have recently been developed to assess farm greenhouse gas (GHG) budgets. The Project will also evaluate the feasibly of a greenhouse gas credit program based on reductions in N2O emissions resulting from sensor-based N management and cover crop management. The total EQIP funding provided to Oklahoma in 2013 will be determined by producer participation in Oklahoma as well as in other participating State.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation

Outcome #15

1. Outcome Measures

Swine Effluent Project

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma's rapid growth in animal population and density has heightened concerns over animal waste management. Swine waste has increased from 2834 MT in 1992 to over 178,313 MT in 2007. In the Oklahoma Panhandle, nearly all of the swine waste is stored in open-air lagoon systems. When properly applied and remunerative, swine lagoon effluent (SE) can be used as manure with minimal environmental and nuisance concerns, such as odor. Swine manure benefits producers by reducing waste management costs and the need for chemical fertilizers because SE contains multiple essential crop nutrients. By recycling nutrients, animal manures enhance sustainable agriculture and improve overall animal production efficiency.

What has been done
A long-term field experiment was conducted between 1995 and 2007 at the Oklahoma Panhandle Research and Extension Center (OPREC) near Goodwell, Oklahoma. Field experiments were conducted to evaluate the long-term effects of equivalent nitrogen rates of swine lagoon effluent (SE), beef manure (BM), and commercial fertilizer on the yield and economic returns of irrigated corn (Zea mays L.) grown on calcareous Gruver silt loam soil. A randomized, complete-block, split-plot design with three replications was used to test the main effects of N source and equivalent N application rates of 56, 168, and 504 kg N ha-1.

Results

Study results revealed that the two organic fertilizers tested in the experiment, BM and SE, are adequate substitutes for chemical fertilizers. No significant difference in corn yield was found between the organic and chemical sources of nutrients, and BM and SE generated higher economic returns than AA. The findings were generally robust across the wide range of prices encountered during the experiment, although neither SE nor BM would not have been as profitable as AA during the cheap energy prices experienced in the late 1990s (1998-2000). Hence, this study is in agreement with previous research that found animal manures to be adequate, and oft en remunerative, substitutes for chemical sources of N. Site-specific conditions such as weather, animal waste management practices, and soil properties should be considered before results can be generalized to other locations outside the Oklahoma Panhandle.

The results of the study were picked up by the agricultural media. An article in Science Daily was recently published that discussed the study findings, bring the results to the broader farming community. See the following reference: "Manure Provides Higher Returns Than Chemical Fertilizers, Economist Says." Science Daily. Available at http:\\www.sciencedaily.com.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
205	Plant Management Systems

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

Severe drought the last two years have caused problems related to crop research and demonstration. It has also caused numerous Extension meeting and conferences to help producers to cope and adapt.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A survey was mailed to 9,500 Oklahoma farmers relating to **Tillage Practices**. It was found that on average, Oklahoma farms that use no till (NT) methods crop more than twice as many acres as those that use intensive tillage (IT) methods. Fifty percent of the farms that use NT plant more than 1,000 acres to annual crops compared to 16 % the farms that use IT. The NT farms have more diversified cropping operations and use crop rotations. The IT farms plant more than 90 percent of their annual crop acres to wheat and seldom rotate to

other crops.

During 2012, a total of 11 **Pasture Recovery Following Drought** programs covering 13 counties were held to address specifics of pasture recovery due to extreme drought conditions using weed control, fertilization, and grazing deferment. Five hundred nineteen surveys were distributed with 193 completed (37% return rate). Conservative estimates suggest that forage managers of nearly 500,000 acres of introduced forage and pasture production in Oklahoma attended one of these programs. These acres represent approximately 5% of the total acreage devoted to the production and management of introduced pastures in Oklahoma.

Survey respondents assessed that 79% of the introduced pastures in Oklahoma suffered moderate to severe drought damage with an average forage production loss of $136 per acre. This resulted in estimated forage and pasture losses during 2011 at $26 million just for the 37% who completed the survey. Across Oklahoma, a conservative estimate of total forage losses during 2011 of $1 billion is possible. Based on drought damage and the uncertainty of pasture recovery, 99% of those who responded to the survey indicated plans to use information they learned at one of these meetings. Over 95% indicated plans to use some combination of weed control, fertilization, and grazing deferment as their primary tools for pasture recovery. Likewise, 95% of those who responded to the survey indicated that they planned to either maintain or decrease herd size during 2012. Forage producers valued this program at $90 per acre. Thus, the economic impact of this program was valued at $17.7 million by those attending one of the 11 county programs. The Pasture Recovery Following Drought program can recover $650 million of drought-damaged forage and pasture in Oklahoma.

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%		5%	
132	Weather and Climate	0%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		25%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		13%	
206	Basic Plant Biology	0%		14%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
212	Pathogens and Nematodes Affecting Plants	0%		33%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.0	0.0
Actual Paid Professional	0.0	0.0	12.0	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	543018	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	543018	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3003720	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

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

2012	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:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	37	37

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2012	29

Output #2

Output Measure

- Peer-reviewed publications including journal articles

Year	Actual
2012	37

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Graduate students graduated
2	Microorganisms and agricultural crops
3	Plant pathogen identification
4	Plant genes involved with stress signaling
5	Emergence of viral diseases
6	Aphid resistance

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
2012	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Advanced degreed students are required to continue development of society and a major objective of research universities is to train students to use their creativity through the scientific methods to conduct research.

What has been done
M.S. and Ph.D. degree programs are conducted and students mentored in research methods by scientists.

Results
Students matriculate with advanced degrees and move on to careers in science, technology and engineering.

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

Microorganisms and agricultural crops

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Plant productivity is critical for putting food on the table and for providing for the economic and social well-being of society. The bottom line is that the food supply must double by 2050 to meet the needs of a burgeoning world population. To do this, new technologies and understandings focused on improving plant productivity needs development. The vast majority of research on plant productivity is associated with the above ground plant parts. Much less is understood concerning the below ground portion of the plant. Manipulation of root characteristics and soil microbial communities are an obvious area where progress can be made in enhancing wheat productivity. Microorganisms are essential for the productive development of agricultural crops. The complexity of the system has stymied researchers on tying specific microorganisms to crop productivity.

What has been done
We recently developed and published an approach to identify specific microorganisms that are directly associated with wheat productivity, including those that promote or reduce productivity.

Results
We identified 42 positive and 39 negative productivity associated organisms as well as which taxonomic groups are more likely to contain positive or negative productivity associated organisms. Furthermore, overall analysis revealed that plant productivity is intimately associated with the plant microbial community.

4. Associated Knowledge Areas

KA Code	Knowledge Area
206	Basic Plant Biology

Outcome #3

1. Outcome Measures

Plant pathogen identification

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The military and defense communities seek robust capability to identify pathogens (of humans, animals or plants) in a field setting with high reliability and sensitivity, but with technology that is portable and electricity-free.

What has been done
NIMFFAB worked with government support to adapt and validate real-time PCR protocols for plant pathogens to a small, field-deployable thermocycler in which reagents are provided in lyophilized pouches.

Results
The technology and specific protocols allow operators having minimal training to perform reliable assays in remote and possibly dangerous settings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants

Outcome #4

1. Outcome Measures

Plant genes involved with stress signaling

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding the function of key plant genes involved in stress signaling will provide novel biotechnological solutions for crop improvement. Plants face the threat of multiple stresses simultaneously under field conditions. However, most studies on stress are done using single stressor at a time. Drought and ozone are two common stresses that can co-occur during summer times. In the wake of the current drought conditions prevalent in the state and the increasing levels of tropospheric ozone, an understanding of the combined occurrence of these two stressors is relevant especially for crops like soybeans.

What has been done
We have analyzed the biochemical, physiological and molecular responses to combined ozone and drought in Medicago truncatula. We demonstrate that there are novel coping mechanisms in extant germplasm that can help plants overcome the combined stresses effectively. We are pursuing a similar study in soybeans using two cultivars that show contrasting phenotypic responses to combined ozone, drought and heat. A proposal to the AFRI foundational program is currently under review.

Results
An Arabidopsis RNA binding protein was shown to be important during ozone-induced oxidative stress, heat stress and also drought. We are in the process of identifying the RNA targets of this protein. We also are analyzing the interactions of this protein with other plant proteins. Identifying key regulatory factors during combined stresses will provide rational targets for engineering resistance to multiple stresses that operate under field conditions.

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

Outcome #5

1. Outcome Measures

Emergence of viral diseases

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The demands of society and the prospect of global climate change are leading to the planting of novel crops in new areas, setting the new ventures up for outbreaks of previously unrecognized diseases caused by viruses and other plant pathogens. Understanding of emergence of new viral diseases can blunt the effects of such outbreaks. Those responsible for plant biosecurity in various countries and jurisdictions now consider the implications of the virus diversity project findings of the existence of many more viruses than are currently recognized.

What has been done
The universal plant virus microarray probes have been used as e-probes of metagenomic databases from plants carrying a disease of unknown etiology.

Results
Universal plant virus microarray assay of plant extracts correctly identified whether extracts had viruses detectable by dot immunoassay, and many cases supported the serological identification suggesting that it may be used in screening plant material for virus infection.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Aphid resistance

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over 250 species of aphids (Hemiptera: Aphididae) are known to feed on crop plants world-wide and thus, they are one of the most important families of agricultural pests. Aphids damage crops by not only depleting photoassimilates but also by transmitting pathogenic viruses. Aphis gossypii is an economically import pest on a wide range of crops, greenhouse vegetables, and ornamentals, placing it among the most destructive insects to agriculture.

What has been done
Differential gene expression studies detailing the transcriptional responses to aphid infestation in resistant melon plants have shown that aphid herbivory activates several defense pathways. Emerging data indicates that small RNAs, especially microRNAs, have diverse and important roles in regulating gene expression by translational repression in both plants and animals, including responses to insect herbivory. This project is designed to test the hypothesis that specific small RNAs regulate gene expression under the biotic stress caused by aphid feeding and are components of the resistance mechanism both as gene expression regulators and as plant defense molecules. Five small RNA libraries (3 plant & 2 aphid) have been constructed and sequenced using GAII Illumina Analyzer. Bioinformatic analyses have been conducted to identify microRNAs that are differentially responding to aphid feeding.

Results
The comparative analyses between aphid resistant and susceptible melon lines revealed that most of the conserved miRNA families were differentially regulated during the early stages of aphid infestation in the resistant and susceptible interactions. Along with the conserved miRNA families, 18 cucurbit-specific miRNAs were expressed during the different stages of aphid herbivory. The comparison of the miRNA profiles in the resistant and susceptible interactions provides insight into the miRNA-dependent post-transcriptional gene regulation in aphid resistance. These results from miRNA analysis would assist breeding programs by serving these

altered miRNAs as markers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

• The area of plant microbe interactions is a complex interdisciplinary endeavor. Despite recent programs and the areas relative importance there are still too few programs that target the plant-microbe interface.
• Tranformative advances such as those initiated by the PIs often take time to be understood and evaluated by the mostly conservative government grant panels in order to fund further progress.
• Limited and decreased funding for basic research.
• Added administrative burdens.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

• NIMFFAB faculty were awarded **3rd place** in the OSU Provost's **2012 Creativity in Research Award Competition**.
• Mali Mahalingam was awarded the 2012 Phoenix award for Outstanding Graduate Faculty awarded by the OSU Graduate College and GPSGA.
• Ramanjulu Sunkar was invited to become Review Editor for the Journal Frontiers in Plant Genetics and Genomics.
• Published articles in high impact journals: PloS ONE and Molecular Plant Microbe Interactions.

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	6%		10%	
202	Plant Genetic Resources	9%		10%	
204	Plant Product Quality and Utility (Preharvest)	10%		15%	
205	Plant Management Systems	50%		40%	
502	New and Improved Food Products	7%		20%	
901	Program and Project Design, and Statistics	3%		5%	
903	Communication, Education, and Information Delivery	15%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	13.0	0.0	2.0	0.0
Actual Paid Professional	20.0	0.0	3.0	0.0
Actual Volunteer	22.4	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**
480000	0	118654	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
480000	0	118654	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1986628	0	656340	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 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. •Survey Oklahoma Consumers (Gardeners) 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 are conducted based on public interest and County Educator requests. •Participate and support eXtension both Consumer Horticulture/Master Gardener Community of Practice and the Grape Community of Practice sites •Conduct Master Gardener/Junior Master Gardener Training •Conduct pesticide training and education •Assist in Youth at Risk and 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?

In 2012 approximately 10 responses were provided by state specialists to users of eXtension through the Ask an Expert feature of the Gardens, Lawns & Landscape Community of Practice eXtension web site. In 2012 the Grape Community of Practice eXtension website was managed by an extension fruit specialist from another land grant institution and by an extension employee at Oklahoma State University. The top article for the grape site was the Spanish version of "Parts of the Grape Vine: Shoots" with 7,825 views. That makes it the 48th most viewed page on eXtension out of 88,513 pages. Overall the Grape Community of Practice had 232,679 page reviews and 174,198 unique page reviews.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	189005	0	11940	0

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	11	9	20

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- New Master Gardeners trained

Year	Actual
2012	232

Output #2

Output Measure

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

Year	Actual
2012	20

Output #3

Output Measure

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

Year	Actual
2012	107

Output #4

Output Measure

- Number of statewide "Oklahoma Gardening" shows produced

Year	Actual
2012	34

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of horticultural crop producers newly certified as organic
2	Number of volunteer hours provided to community horticulture programs statewide
3	Number of home gardeners experiencing increased awareness and knowledge about environmental issues and IPM principles
4	Extension outreach to underserved new and beginning producers of horticultural food crops.
5	Research and outreach to fresh market horticultural food crop producers to extend their growing season to include cool season greens crops produced in high tunnels.

Outcome #1

1. Outcome Measures

Number of horticultural crop producers newly certified as organic

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
502	New and Improved Food Products

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
2012	47263

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 Horticulture 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 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 Master Gardener Program now has 22 counties participating in the program as of January 2013. The following data was provided by 14 of the 22 counties. Approximately 232 new Master Gardeners were trained during the 2012 training season. Close to 1,000 active Master Gardeners volunteered their time, contributing

approximately 47,263 volunteer hours resulting in over 4,324,786 educational interventions with Oklahomans and as many as 1,234+ educational and community programs and activities being conducted in their communities in 2012. This translates to over $826,630.00 in service that was donated by volunteers (wage rate of $17.49/hour was used, which includes a 12% estimate of fringe benefits. This hourly rate is the assigned wage for nonagricultural workers in 2010 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.

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	4324786

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public concern for the environment continues to increase. Traditional landscape management practices have involved extensive use of pesticides, fertilizers, and other materials that could harm the environment if not used properly. Integrated Pest Management (IPM) uses biological principles, cultural practices, and some chemicals to control pest populations with minimal environ¬mental impact.

What has been done
Over 1,234 gardening programs and IPM workshops, educational programs/seminars and Oklahoma Gardening segments are used to educate the public of IPM practices and other related

gardening topics. Research in conjunction with the IPM TIP team has initiated work using perennial ornamental plants to attract pollinator and predatory insects to home gardens.

Results
Homeowners are better educated and can make choices in maintaining the landscape that are more environmentally friendly. The impact of the research is that additional pollinator insects and predatory insects should result in greater fruit yield from home vegetable gardens and consumers will use fewer insecticides in their gardens.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Extension outreach to underserved new and beginning producers of horticultural food crops.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Underserved new and beginning producers of horticultural food crops have traditionally been difficult to contact due to the diverse locations and types of crops that they are growing. Because of this, the flow of information to these farmers has been limited. Basic information related to field preparation, soil fertility, pest management, and crop management is needed to increase these farms chances of being successful.

What has been done
A project was funded by a grant from the USDA Risk Management Agency (RMA) developed two workshop/field days. The workshop/field days were used to increase new and beginning horticulture food crop farmer's knowledge and skills of production risk management techniques

including business and insurance considerations, field preparation, soil fertility, plasticulture, cover crops, pest management, and food safety considerations.

Results
Approximately 90% of participants agreed they were more informed about soil management for sustained production, including soil sampling and testing. 55% of conference participants strongly agreed they are more aware of continuing risk management education opportunities for specialty crop producers. Farmers estimated the economic benefit to their operation from participating in the workshop/field days ranged from $250-$2500 with the average benefit being $889 per farm.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Research and outreach to fresh market horticultural food crop producers to extend their growing season to include cool season greens crops produced in high tunnels.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1077

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Developing season extension techniques for fresh vegetable production is a key aspect of helping farmers increase the number of months that they are able to produce and sell fresh produce in the state. Leafy greens include both brassica greens and spinach which can be eaten fresh and cooked. Both types have high levels of nutrients and are considered very healthy foods for adults and school children. Our project determined not only what varieties perform best in high tunnels, but also which crops would have the highest potential for profitability for fresh producers within the state.

What has been done

A research and outreach project was partially funded by a specialty crop grant from the Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) to help support efforts to increase the production of edible horticulture crops. A final report of the project is available at: http://www.hortla.okstate.edu/industry/vegetables/pdf/HighTunnelLeafyGreensReport2012.pdf.

Accomplishments for 2010-2012 season:
Trials were initiated at four different sites around the state including: Ardmore, Oklahoma City, Lane, and Tulsa. Field days were held at Tulsa, OKC, and Lane during the first year in addition the Ardmore site had five different tour groups that visited their leafy greens trial site. These outreach efforts provided an excellent opportunity for local growers to see the crops being grown in high tunnels and to ask questions related to production and marketing. All site specific reports are included in the 2011 MP-164 Vegetable Trial Report available at: http://www.hortla.okstate.edu/industry/vegetables/index.htm

Accomplishments for 2010-2012 season:
Leaf lettuces for the second year consisted of the previous year's romaine and the addition of a red leaf lettuce to the trial replacing broccoli raab which was dropped from the trials. Another change included using transplants for the lettuce entries to speed up the establishment and improving the yield due to multiple crops being harvested vs. only one harvest for the first season. Field days were held at Tulsa, OKC, and Lane during the second year again the Ardmore site had five different tour groups that visited their leafy greens trial site. These outreach efforts provided an excellent opportunity for local growers to see the crops being grown in high tunnels and to ask questions related to production and marketing. All site specific reports are included in the 2012 MP-164 Vegetable Trial Report available at: http://www.hortla.okstate.edu/industry/vegetables/index.htm

Results

Farmers (larger-scale and smaller market gardeners), consumers, and school children have benefited from the information generated from these state-wide trials. As a result of the trials farmers now have information they need to increase their production of fresh vegetable crops to twelve months of the year. The result is that their cash flow should increase during the winter months which in the past was not as profitable compared to the frost free months. School children and consumers have benefited by having a supply of fresh leafy greens for salads and for cooked vegetables during the fall-winter-early spring.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
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.)
- Other (Low levels of formula funding.)

Brief Explanation

Limited formula funding has reduced the ability to conduct research and outreach with farmers.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Developing season extension techniques for fresh vegetable production

Profit potential from these crops varied because of market demand. Spinach commanded the highest price per pound with an average of $4.00/lb. Brassica greens crops averaged $1.30 to 1.50/lb. while Swiss chard went for $2.00/lb. and lettuce for $3.00 per whole plant. Gross receipts from a typical 20' x 96' high tunnel could range from $2,696 to $7,373 for cool season greens grown during the winter months. When information from both years is considered the authors conclude that a crop mix of leafy vegetables has potential to produce salable crops throughout the coldest months of the year without supplemental heat in a high tunnel. These results will be used to help farmers provide highly nutritious fresh produce for school children and the general public while helping farmers generate income during a previously non-productive season.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Climate Change - Ecosystem and Environmental Quality 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
104	Protect Soil from Harmful Effects of Natural Elements	5%		10%	
111	Conservation and Efficient Use of Water	11%		10%	
112	Watershed Protection and Management	12%		10%	
121	Management of Range Resources	13%		15%	
123	Management and Sustainability of Forest Resources	9%		10%	
132	Weather and Climate	10%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
134	Outdoor Recreation	5%		0%	
135	Aquatic and Terrestrial Wildlife	8%		5%	
136	Conservation of Biological Diversity	4%		5%	
141	Air Resource Protection and Management	5%		5%	
205	Plant Management Systems	5%		5%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
605	Natural Resource and Environmental Economics	3%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	7.0	0.0	6.0	0.0
Actual Paid Professional	18.0	0.0	15.0	0.0
Actual Volunteer	9.8	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**
500000	0	598390	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
500000	0	598390	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2395112	0	3310012	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Design and conduct research
- Submit grant proposals
- Produce scientific publications
- Specialty conferences to address environmental issues of concern to Oklahoma,
- An Environmental Quality and Waste Management publications series
- A website that expands upon the information presented in the publication series, providing the range of information

- Develop Mesonet weather-related decision tools
- A high-visibility symposium series will share high quality research and extension programs with technical and lay audiences.
- Poultry Waste Management Education
- Water Quality educational programs

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

3. How was eXtension used?

Oklahoma Cooperative Extension Service has provided leadership for the Prescribed Fire Community of Practice for eXtension. Goal is to have 100 FAQ and 30 articles ready for the 2013 launch of the site.

Josh Payne, working with a team from Oklahoma State, North Dakota State, and Cornell University developed a comprehensive learning module addressing livestock and poultry mortality management. Twenty-five FAQ videos were developed by OSU and have been posted on eXtension Animal Manure Community of Practice website. http://www.extension.org/pages/28022/livestock-and-poultry-mortality-composting

Doug Hamilton wrote 3 web pages and Scott Frazier wrote one webpage for the eXension anaerobic digestion website. http://www.extension.org/pages/26608/introduction-to-biogas-and-anaerobic-digestion

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	63045	4866407	3450	330000

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	16	18	34

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2012	55

Output #2

Output Measure

- Manuscripts submitted for consideration of peer-reviewed publication

Year	Actual
2012	104

Output #3

Output Measure

- Extension conferences, workshops and training sessions

Year	Actual
2012	221

Output #4

Output Measure

- Research and Extension reports and fact sheets

Year	Actual
2012	42

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	Peer-reviewed publications
5	Number of users accessing website designed to deliver information about water policy, conservation and efficient use
6	Number of web-based weather related decision tools provided through Oklahoma Mesonet to improve crop and livestock production and safety and/or reduce costs
7	Survey of landowner attitudes toward prescribed fire
8	Climate-driven implications for plantation forestry in the southern Great Plains
9	Mechanisms to understand bird distributions in dynamic landscapes
10	Invasive plants in Oklahoma grasslands
11	Oklahoma 4-H High Adventure Program
12	Natural Stream Restoration and Enhancement Education, Demonstration, and Outreach in the Illinois River Basin
13	Ground Water Mechanisms of Erosion and Failure
14	Solute and Contaminant Transport between Streams and Alluvial Floodplains
15	Alternative Manure Technologies Video Series
16	New Abatement Technologies for Nut Harvester Pick Up Machines
17	Particulate Matter Abatement Technology

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
2012	488

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The 1998 Oklahoma Registered Poultry Feeding Operations Act and the Poultry Waste Applicators Certification Act were originally established in response to concerns about phosphorus from poultry litter waste polluting important water resources.

What has been done
As set forth in the Acts, all poultry production operators and poultry waste applicators must complete an initial nine-hour series of Poultry Waste Management Education (PWME) sessions followed by continuing education. In 2012 the Oklahoma Cooperative Extension Service Poultry Waste Management Education Program continued to provide the required training, addressing water quality concerns associated with improper or excessive land application of poultry litter.

The Poultry Waste Management Education program now encompasses much more than the I-9 and Continuing Education classes. Program activities conducted during 2012 included:
-A newly redesigned website offering fact sheets, links and schedules in a more user-friendly format
-Publication and distribution of a comprehensive Poultry Litter Nutrient Management Guide and a biannual newsletter, Poultry Practices
-Updated video presentations
-Innovative research projects to fuel new and timely Continuing Education topics
-Redesigned database of producer education records for faster data retrieval and verification of class attendance

Results

A survey of 169 producers attending 2012 Continuing Education classes reported that:
- 100% thought the class topics were timely and fit their needs
- 100% thought the classes matched their level of experience
- 100% thought the new 2 hour class length is appropriate
- 99.4% thought the smaller class size contributed to an improved learning experience

Reduction in poultry waste applied in nutrient-limited watersheds
Increase in poultry waste exported out of NLWs and out of state
Improved communication with poultry producers and poultry waste applicators via website and on-line tools
Streamlined system for tracking and reporting education attendance supports regulatory compliance
Reduction in P loading and P concentrations in nutrient limited watersheds

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.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	205

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 #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
2012	581

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

Peer-reviewed publications

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	34

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #5

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
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3474

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 #6

1. Outcome Measures

Number of web-based weather related decision tools provided through Oklahoma Mesonet to improve crop and livestock production and safety and/or reduce costs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Oklahoma Mesonet has assembled and created weather-based tools that give Oklahoma agricultural producers and natural resource managers the opportunity to move from calendar-based to weather-based farm management. Weather-based farm management can reduce farm inputs, increase crop yield and quality, improve farm sustainability, provide new integrated pest management (IPM) opportunities, improve environmental protection and expand crop marketing information. The Oklahoma Mesonet through Mesonet.org for desktops and tablets and m.Mesonet.org for mobile devices provides farmers and ranchers weather-based risk management tools and information.

Weather-based management has been made possible because the Oklahoma Mesonet operates one of the most data-rich weather networks in the world. New weather data are transmitted every 5 minutes from a statewide system of 120 automated weather-monitoring towers. This constant flow of quality assured, research-quality weather data are used to maintain a wide spectrum of weather and agricultural decision support products made available via traditional and mobile websites. The challenge in implementing weather-based agricultural management includes increasing producer comfort with computer operation, expanding grower weather knowledge, simplifying weather data display, and shaping decision support products to meet day-to-day farm management needs.

What has been done
Oklahoma State University, the University of Oklahoma and the Oklahoma Climatological Survey (OCS) through the Oklahoma Mesonet have created multi-faceted agricultural and natural resource extension outreach and research programs. Mesonet.org provides desktop and tablet access to weather data and products at no cost to Oklahoma farmers and ranchers. An Agriculture section within Mesonet.org organizes decision support products by crop and livestock commodity. Ongoing extension/outreach efforts inform growers about available products and introduces them to weather-based farm management tools via farm show exhibits, educational presentations, television, web tutorials, and printed materials.

2012 was a major year for agriculture and Mesonet. In August 2012, the Mesonet Agweather website was replaced with an Agriculture section within the Mesonet.org website. As part of the Agriculture section launch products and information on the Agweather website were reformatted

for the Mesonet.org website and as part of this process designed for use on mobile devices, especially tablets. The Cattle Comfort Advisor was added as a fully operational advisory.

Plant Available Water maps were added. These provide an estimate of soil water for plant growth from the soil surface down to four inches, the soil surface down to sixteen inches and the soil surface down to thirty-two inches. These maps provide a statewide view of soil water in inches that can be compared to rainfall in inches and evapotranspiration in inches.

New long-term average maps were brought online in 2012. These can be used to compare any month against any other month or deviation from the long-term average for any data set from the Oklahoma Mesonet system.

Results

The informal feedback from the Oklahoma agricultural community is very complimentary of the Oklahoma Mesonet. Farmers and ranchers are turning to the Mesonet to monitor rainfall and soil moisture, especially in this time of historic drought. To minimize drift hazard, they are using the Mesonet Drift Risk Advisor. Monitoring soil temperature has become more important as seed costs have climbed dramatically in the last couple of years. When determining the best time to bale hay or harvest, growers monitor current and forecast relative humidity.

One producer noted how he used Mesonet to know if a far away field received rain or not. Knowing rainfall amounts lets him avoid wasted trips. A wasted trip means lost revenue, time and unnecessary emissions. A hay producer stated he uses the Mesonet to monitor humidity changes for hay baling, without having to drive to the field. This producer not only saves time and money, the Mesonet allows him to monitor the field conditions from home and get more sleep. This better rested farmer is a safer farmer. Near Willow, OK a producer used 10 and 24-inch soil moisture to decide not to plant dry land cotton. He saved the input costs and reduced his financial risk.

Mark Hodges, past Executive Director for the Oklahoma Wheat Commission, has used Oklahoma Mesonet soil moisture and rainfall maps to build customer relations with international grain buyers of Oklahoma wheat. While Mark has not put a direct value on Oklahoma Mesonet data, he has stated that Mesonet information has been part of Oklahoma grain sellers marketing millions of bushels of wheat over multiple years to buyers in Mexico.

Mesonet serves agricultural and horticultural enterprises on several levels. Dennis Brigham of Bentley Turf Farms told how he turneds to Mesonet Agweather for weather information to help him schedule sod installation by his company's installation crews. One day north of Mustang, a Bentley Turf Farms' crew was busy laying sod, while to the southwest a severe storm cell spawned a tornado. Dennis used the radar on the Mesonet Agweather website to track the storm. He determined that there was a high probability the tornado would track over the location where the crew was laying sod. Mesonet Agweather gave him enough lead-time to contact the crew leader and get the crew to travel south out of the tornado's track. On this day, Mesonet Agweather quickly transitioned from being a day-to-day scheduling tool to a life and death safety tool.

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. Miss Klockow was only able to survey crop producers. This estimated value does not include the Mesonet value to livestock producers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
205	Plant Management Systems

Outcome #7

1. Outcome Measures

Survey of landowner attitudes toward prescribed fire

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The lack of prescribed fire has been identified as a major natural resource concern in Oklahoma. The OCES has spent significant resources to address this issue. However, information on public attitudes and perceptions was lacking to direct these outreach activities. Thus, we designed a survey to gather the necessary information to provide resource agencies so that their effort is directed appropriately to achieve an increase in prescribed fire acreage and an increase in public acceptance of fire as a management tool.

What has been done
We designed two questionnaires to assess perceptions of Oklahoma residents and agricultural producers to prescribed fire and eastern red cedar encroachment. To achieve this, we mailed 1,000 questionnaires to agricultural producers and another 1,000 to the general public. Follow-up phone surveys were obtained from 10 percent of all nonrespondents to assess bias.

We created three new fact sheets, a new fire effects video, and a new community of practice for eXtension. We used a combination of presentations, fact sheets, web sites, and circulars to disseminate information from this work. All outreach was directed based on survey research results. Our general findings were that landowners were most concerned about liability, 70% were not aware that prescribed fire associations existed, and do not burn during the growing season.

We delivered an oral presentation of these findings at the 24th Tall Timbers Fire Ecology Conference; that presentation resulted in a peer reviewed paper. Research results were also presented to the Noble Foundation Agriculture Division to aid them in their outreach efforts to private landowners within the state of Oklahoma.

Results

The Oklahoma Prescribed Fire Council is initiating a state-wide liability insurance program which should be available for 2013. This should significantly decrease liability concerns for landowners in regards to prescribed fire that were identified from our research. Three additional fire associations have been formed in Oklahoma based on work to increase knowledge of their benefits. One of the more significant changes in condition over the past five years is that the use of prescribed fire is now being considered beyond the typical dormant season. This will allow more land area to be properly managed.

Additionally, we were able to modify CRP policy in Oklahoma to allow for fire disturbances closer to historical frequencies. This impacts over 1,000,000 acres of land in Oklahoma.

This will impact 47 counties in the Southern Great Plains. Based on the research results, we conducted multiple extension events to educate landowners and land managers. These included: two summer fire field days which were attended by over 100 participants, nine land management field days (over 350 participants), and over 30 presentations to various audiences in Oklahoma, Nebraska, and Kansas. These included presentations at the Nebraska State Habitat Meeting, Oklahoma Chapter of The Nature Conservancy Board of Directors Meeting, National Farm Bureau Young Farmer Meeting, Oklahoma Wildlife Management Association Annual Meeting, Pheasants Forever Annual Meeting, National Bobwhite Conservation Initiative Meeting, NRCS Fire Trainings, and an NRCS webinar. Additionally, we disseminated information to resource professionals in the state of New Mexico to assist with their prescribed fire program. Thus, the entire project is based on Oklahoma stakeholder responses.

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 #8

1. Outcome Measures

Climate-driven implications for plantation forestry in the southern Great Plains

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The current drought in Oklahoma illustrates some stresses on tree growth that are predicted to become more frequent events due to climate change. Temperature-mediated increases in woody plant water use and water stress can affect the distribution of forest ecosystems at the grassland-forest ecotone of the southern Great Plains, with repercussions for industrial forestry in the region. Species in these forests grow near the moisture limit of their ranges. Small increases in temperature can increase vapor pressure deficits (VPD), which in turn may increase tree water use and hasten mortality during severe drought.

In addition to heat and water stress, climate change is predicted to increase the frequency and severity of damaging storms. Ice damage, in particular, can be costly. Thus, it is important to predict the characteristics of trees most susceptible to such damage.

What has been done
We engaged in a series of studies to address aspects of climate-mediated tree loss and seedling survivorship. Significant findings from that work indicate that trees of larger diameter were more susceptible to mortality from ice damage. The site condition where seedlings are establishing, e.g., under open or more shaded conditions, had a large bearing on drought tolerance. Increasing temperature from 30 to 33 degrees C resulted in more negative xylem water potentials and resulted in fewer days until transpiration was reduced after water was withheld. Ultimately, seedlings grown at 33 degrees C died 13% earlier that seedlings grown at 30 degrees C during terminal drought. Results suggest if temperature and droughts increase in the future, the forest-grassland ecotone could shift because increased seedling mortality will prevent recovery following disturbance of overstory trees.

Finally, results from a comparative mulch study showed that tree-based mulch benefits plant growth and survival by maintaining greater soil moisture, decreasing competition from weeds, and moderating soil temperatures compared with not using mulch. In particular, Eastern redcedar (Juniperus virginiana) provided similar benefits as other common wood mulches and is a viable forest product.

Results
This study will assist forest managers to select genotypes to improve forest productivity over the wide-range of site conditions likely to be available in the region over the next several decades.

The research contributed to the development of a climate change/decision support model using multiple long-term weather and forest growth and yield data sets. This model will facilitate the viability of beneficial forest management practices in the face of pending climatic changes.

The research led to the publication of 2 peer-reviewed publications, 3 peer-reviewed technical bulletins, and a presentation at a national meeting in 2012.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
132	Weather and Climate

Outcome #9

1. Outcome Measures

Mechanisms to understand bird distributions in dynamic landscapes

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Land use changes in the Southern Plains are reflected in the population responses and habitat selection of wildlife. In broad terms, grassland species have been declining in population and loss of range due largely to the conversion of native grasslands to shrubland from encroaching woody vegetation, to cropland from agricultural development, and to a mix of residential, corporate, and industrial land cover in urbanizing areas. The responses of grassland birds to these land use changes have been overwhelmingly negative, both across Oklahoma and more generally across North America. In contrast, some species of birds have increased in population in the Southern Plains and are expanding their distribution. The precise mechanisms through which these species have been able to exploit the features of novel environments, however, are seldom clear. We also lack the ability to determine if the species expanding are actually choosing habitats that confer an advantage or if they are falling victim to the phenomenon of "ecological traps" in which an area is perceived to be high quality but actually is not. A better understanding of these

mechanisms can aid conservationists and land managers in providing the types of conditions most beneficial to the species of greatest conservation need.

Citizen science programs featuring the contributions of amateur birders provide critical information for avian conservation. In particular, the North American Breeding Bird Survey is the longest-running, standardized, continent-wide survey of birds during the spring and summer breeding seasons. The Christmas Bird Counts, stretching back 113 years, and the newer Great Backyard Bird Count specifically target bird distribution and abundance during the winter months. These programs are the only dedicated means to obtain population and distribution estimates for Arctic-breeding species that are poorly sampled by the Breeding Bird Survey. The Southern Plains region provides a significant amount of habitat for multiple species that are rare elsewhere including Cackling Goose (Branta hutchinsii), Harlan's Red-tailed Hawk (Buteo jamaicensis harlani), Harris's Sparrow (Zonotrichia querula), and Smith's Longspur (Calcarius pictus). Without a concerted effort from birders in Oklahoma, our ability to track conditions for these and other species is greatly diminished.

What has been done

We address these issues from the dual perspectives of field research on priority species and outreach activities to encourage participation in citizen science. With respect to field research, we conducted two relevant studies in 2012 that focused on species that have undergone dramatic changes in habitat use and/or distribution. Mississippi Kite (Ictinia mississippiensis) is a medium-sided raptor that has become increasingly abundant in the Southern Plains and makes use of residential areas (primarily parks and neighborhoods with large shade trees) for nesting. We found that while kites may have some preference for certain species of trees as nest sites, they were far more influenced by the abundance of prey (cicadas and grasshoppers) in the immediate vicinity. A second study of Western Kingbird (Tyrannus verticalis) quantified nest success in this songbird that along the eastern edge of its distribution in Oklahoma has largely abandoned traditional territories in grassland and rangelands for what might be a unique semi-colonial nesting behavior in urban areas. We documented both high nest success and unprecedented nesting density of these birds in our population.

With respect to citizen science participation, we engaged students and other citizens through coverage of sponsorship of various events at community meetings (e.g., the Payne County Audubon Society and Oklahoma Ornithological Society), on dedicated blogs, through email listservs and social media, and on a local radio station.

Results

Poster presentations of the Mississippi Kite and Western Kingbird studies were presented at the annual science meeting of the Oklahoma Ornithological Society and have both been accepted for the international Wilson Ornithological Society annual meeting in 2013. These studies are significant in demonstrating the importance of food availability as a species predictor of wildlife habitat (kites) and the development of a novel nesting strategy in terms of habitat selection and interaction with conspecifics (kingbird). These studies provide fruitful ground for additional investigations that will increase our ability to manage native wildlife under rapidly changing conditions in urbanizing areas.

Citizen science participation in the region increased dramatically in 2012. For example, Payne County set a new record for participation in the Great Backyard Bird Count, briefly occupying a national top 10 position among communities reporting data. Ultimately, levels of participation in

that event placed Stillwater, OK on par with Houston, TX in terms of total checklists submitted, indicating a far greater likelihood that Stillwater participants tended to submit more than one checklist. The relevant blogs in which citizen science topics were addressed were accessed 26,311 times in 2012.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Invasive plants in Oklahoma grasslands

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The increased number of acres invaded by exotic plant species (e.g., grasses and legumes) throughout Oklahoma has been identified as a major threat to the state's natural resources. In addition, the absence of a centralized source of information concerning invasive species identification and management has hindered the ability of land managers to control invasive species on their land.

What has been done
Concurrent research projects related to this topic included efforts to assess the efficacy of patch-burn grazing in combination with spot-spraying to control sericea lespedeza; 2) a project to assess soil chemical changes occurring following removal (herbicide treatment) of salt cedar; and 3) an investigation into small mammal populations in tallgrass prairie invaded by Old World bluestem. In addition, we contributed to the development of the Oklahoma Invasive Plant Council (OkIPC), an organization whose goal is to facilitate efficient and effective management of invasive plants for the protection of the economic and natural resources of Oklahoma's private and public lands and waters.

Results
Over the past year, OkIPC has continued the coordination and development of practices focused on the reporting of kudzu invasions in Oklahoma by promoting the communication among federal, state, and local officials. We have directly increased the knowledge of over 1200 resource professionals and land managers concerning the topic of invasive plant species versus noxious weeds, characteristics of invasive species, management practices to control invasive species, and alternative native species to use in their practice. Management of over 10,000 acres in OK has been altered as a result of this information. Research results were presented at state, regional, and international meetings of the Oklahoma Invasive Plant Council, Society for Range Management (Spokane, WA), Ecological Society of America meeting (Portland, Oregon), OK Section of the Society for Range Management and OK Section of The Wildlife Society. In addition, this research resulted in three peer-reviewed journal articles in 2012.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #11

1. Outcome Measures

Oklahoma 4-H High Adventure Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In his 2006 book Last Child in the Woods, Richard Louv tells of schools eliminating hands-on nature study from the curriculum in an effort to increase standardized test scores. Beyond the changes in school curriculum, the busy life of today's over-stretched and over-stressed parents allow little time for outdoor activities.

Unlike earlier generations, many of today's parents see the outdoors as a dangerous place. They fear strangers and kidnappings, gangs and drug dealers taking over parks and vacant corner lots, and encroaching wildlife from mountain lions to virus-bearing mosquitoes that have been

sensationalized by the media. We have scared children straight out of the woods and fields. The 4-H Program, and in particular the 4-H High Adventure Program, is uniquely situated to help address this issue.

4-H is a youth development education program that emphasizes positive youth-adult interaction and peer leadership. The Oklahoma 4-H High Adventure Program is an outdoor leadership program for teens intended to develop character and integrity in young people through the teaching of teamwork, leadership, and outdoor skills and allows them to share their knowledge with others. By experiencing the challenge of the out-of-doors, participants grow personally, developing an understanding of themselves and their limitations while instilling a new respect for the natural environment.

What has been done

The goal of all 4-H programs is youth development. Decision making, teamwork, problem solving, being responsible and having high self-esteem are just a few of the many skills 4-H helps to develop to enable youth to be productive and positive adults in our society.

The 4-H High Adventure Program involves youth who have an interest in the out-of-doors and welcomes them into an accepting, caring group. This program addresses Belonging, Mastery, Independence and Generosity. These Essential Elements and are critical to an effective 4-H experience.

To ensure that youth development and safety remain at the forefront of this program, specific objectives were developed:

1.Develop and strengthen the mental and physical skills of youth as required of a high adventure camper.
2.Offer a challenge for youth to accomplish a high level of self-confidence, individual worth, personal growth, and achievement.
3.Strengthen interpersonal relationship skills of so as to become a functioning team member.
4.Develop leadership and other life skills to assist youth to become contributing members of society and their families.
5.Develop an appreciation for and respect of natural resources by teaching environmentally correct backpacking and camping skills.
6.Design a comprehensive educational program for older youth that encompasses 4-H project areas including public speaking, recreation, outdoor life, photography, conservation of natural resources, consumer education, food nutrition, food conservation and safety, health, environmental awareness, personal development, clothing, safety, citizenship and leadership.

Results

The Oklahoma 4-H High Adventure Program had its beginnings in 1982 but was dropped in 1992 as lead staff left Oklahoma 4-H. Renewed interest in this program began in 2008 with the increased focus on primitive camping opportunities for 4-H members.
A mandatory one-day training is held in the spring for participants and one parent and/or guardian to explain the program, requirements, fees and expectations. Participants attend a weekend training that focuses on safety, health, personal hygiene, campsite selection, food safety and preparation and other topics that address successful wilderness backpacking.
The climax of the program is a 7-day trip backpacking experience to the Pecos Wilderness area in New Mexico. This Wilderness area is located in both the Carson and Santa Fe National Forests

and encompasses approximately 230,000 acres.
Selected comments from participants:
I have a new respect for myself and what I am capable of achieving.
I will practice Leave No Trace principles at home.
It is a week my daughter and I will have in common for the rest of our lives. (adult chaperone and father of participant)
Certified adult volunteers serve as positive role models and mentors for kids. They model and teach character while providing instruction in the proper use of and respect of equipment used in a wilderness camp setting.

4. Associated Knowledge Areas

KA Code	Knowledge Area
134	Outdoor Recreation

Outcome #12

1. Outcome Measures

Natural Stream Restoration and Enhancement Education, Demonstration, and Outreach in the Illinois River Basin

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Natural stream banks and the riparian land around them help to maintain water quality and control sedimentation in the streams. They also provide food and habitat for the aquatic and terrestrial communities. When these areas are degraded, either from human interference or natural occurrences, they cease functioning to their full capacity. Natural stream restoration and enhancement is new way designing stream restoration projects that uses natural materials instead of concrete to stabilize the bank and uses native plants to restore the riparian area. It also uses engineering techniques such as bank sloping and installing in-stream rock and log structures to reduce velocity and direct the flow back to the center of the stream. Because the techniques used for this type of stream restoration are new, there is a definite need for training for

this type of design and implementation.

What has been done
A project was initiated by Oklahoma Cooperative Extension and the Oklahoma Conservation Commission (OCC) to restore 11 degraded stream bank sites in the Illinois River Basin. This project repaired 6,657 feet of stream bank that had significant erosion problems. Educating and working with area landowners allowed OCC to begin the process of enrolling additional acreage in the Conservation Reserve Enhancement Program. An Additional goal of this project was to educate a wide variety of people on the benefits of using bioengineering techniques to reduce erosion and repair streams to a more natural state through workshops, field days and on-site community education. The education effort built local expertise on the design and construction elements. This will help ensure that this project's benefits continue long-term by maintaining a healthy riparian system which provides additional benefits to the stream and the stream corridor. Information gleaned from additional monitoring of the sites is being used in conjunction with the restoration project. Combining this information will be a useful tool in determining which techniques work best in particular stream orders.

Results
This work has laid the groundwork for an expanding industry of natural stream restoration within Oklahoma, and partnerships have been formed between several state and federal agencies in part because of this project. As a result of workshops, field days, on-site community education and conference events, over 1,250 individuals have been educated and trained on the principles and techniques of natural stream restoration. In addition, over 30,000 people have been introduced to the idea of natural stream restoration through newspaper articles and television segments. This project has shown that in general, Oklahomans are willing to pay $85.63 per year for improvements to stream banks, and $16 per year for improvements in water quality and clarity. Additionally, Oklahomans think they should be compensated by $140 per year for the degradation of water quality. The city of Tahlequah recently passed a bond issue that includes money for additional stream work in their community. City officials said the four restoration sites completed in Tahlequah served as a spark for the City to continue improving Town Branch Creek and the land adjacent.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #13

1. Outcome Measures

Ground Water Mechanisms of Erosion and Failure

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Excessive sediment is one of the most common surface water pollutants across the world. Much of the sediment originates from stream banks in many watersheds. The interaction between surface water and shallow ground water in predicting sediment transport is not fully understood. The importance of ground water seepage and piping with respect to other fundamental processes of river erosion is largely unknown, although seepage and piping features are observed on stream banks spanning a wide range of geomorphologic conditions. Specific seepage and piping mechanisms that cause bank failure may never manifest themselves as transparent features on unstable banks. This research hypothesizes that multiple ground water flow mechanisms, combined with fluvial processes, affect the occurrence and timing of stream bank erosion and failure. Ground water forces can act over extended periods to destabilize banks between flow events. Specific seepage mechanisms become prevalent under certain predictable stream bank stratigraphy and hydrologic conditions.

What has been done
Research currently underway includes conducting three-dimensional soil column experiments to determine the occurrence and prevalence of different seepage erosion mechanisms (i.e., seepage gradient forces and undercutting) and to determine the sequence of erosion steps leading to failure by ground water flow through soil pipes. Laboratory experiments are also investigating the fluvial resistance of soils subjected to seepage forces using submerged jet tests. A more fundamental detachment model is being developed for modeling sediment transport that can account for seepage gradient forces. Results from the laboratory experiments are being examined at the field scale through innovative field experiments. Field sites in Mississippi and Oklahoma have been instrumented to monitor pore-water pressures, seepage erosion, and seepage gradient forces during controlled seepage-induced failure experiments. Research activities this year investigated the role of seepage and piping on stream bank, hill slope, and gully erosion. This research continued to demonstrate the importance of seepage erosion processes in leading to erosion, failure, and sediment loading to streams. Through additional support provided by a National Science Foundation (NSF) grant, research activities have included evaluating a stream bank stability model for predicting lateral retreat on composite stream banks. Seepage erosion and failure experiments were conducted and analyzed for sandy loam and loamy soils in three-dimensional laboratory-scale boxes. Theoretical research has been performed on developing and evaluating a mechanistic detachment model to predict soil erodibility due to fluvial and seepage forces. Research also included soil piping experiments utilizing an innovative constant-head trench system to conduct constant head soil pipe and internal erosion experiments in two contrasting stream banks. Construction has been completing

on the Cow Creek Stream bank Research Facility, establishing a stream bank erosion and failure research facility.

Results

Impacts of this research include transforming the way in which stream bank, hill slope, and gully erosion processes are modeled for engineering design and analysis through development of fundamental erosion equations, emphasizing the role of groundwater mechanisms; development and testing of new tools for measuring soil resistance to erosion; documenting the importance of process-based modeling in the billion dollar industry of stream restoration and rehabilitation; and quantifying contributions of stream bank erosion and failure in leading to sediment and phosphorus load in scenic rivers in eastern Oklahoma to document impacts of conservation programs such as the Conservation Reserve Enhancement Program (CREP). Research on the role of ground water processes for stream bank stability has significantly extended theory on the role of ground water in erosion and provided new tools for multidisciplinary researchers to determine the importance of seepage erosion and undercutting for numerous soils, hydrologic, and environmental conditions. Stream bank modeling demonstrated the importance of considering pore-water pressure effects for predicting lateral stream bank retreat or the design of stream bank protection measures. The more fundamental detachment model for erosion by fluvial and/or seepage forces can be used in place of the commonly utilized excess shear stress model with parameters that can be derived from flume tests or/and jet erosion tests. Soil piping and internal erosion research highlighted the need for improved models of these processes for predicting dam, levee, stream bank and gully failures.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #14

1. Outcome Measures

Solute and Contaminant Transport between Streams and Alluvial Floodplains

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The prevailing wisdom is that phosphorous transport place primarily in surface runoff. A growing collection of research indicates that subsurface transport of phosphorus can be significant. Vegetative filter strips are proposed to protect aquatic organisms from pesticides in runoff, but there is debate regarding the efficiency and filter size requirements. The controversy is largely due to the belief that no quantitative methodology exists for predicting runoff buffer efficiency when conducting acute and/or chronic environmental exposure assessments. Significant research progress has occurred on quantifying solute and contaminant transport between riparian floodplains and streams. It is hypothesized that hydrologic heterogeneities (e.g., macropores and gravel outcrops) in the subsurface of floodplains play an integral role in impacting flow and contaminant transport between the soil surface and shallow alluvial aquifers.

What has been done

Innovative field studies, including plot scale (1 by 1 m and 3 by 3 m) solute injection experiments along with geophysical imaging, were performed on both gravel outcrops and non-gravel outcrops. Research is also underway to quantify the magnitude of sediment and phosphorus loading from stream bank erosion and failure in sensitive watersheds in eastern Oklahoma. The research is quantifying the impact of riparian management practices in limiting sediment and phosphorus input from this source. This research demonstrated that even small floodplains can have heterogeneous flow pathways that can considerably impact the leaching potential of tracers and phosphorus through the soil. Research on streambank contributions of sediment and phosphorus suggests that riparian protection in the Barren Fork Creek watershed results in approximately five times reduction in kg of contributed water soluble phosphorus per year per meter of stream bank. Areas protected by riparian vegetation experienced at least four times less stream bank retreat over a seven year period. Previous research on pesticide transport and VFS by my research group has proposed a modeling approach that links the U.S. Environmental Protection Agency's (EPA's) PRZM/EXAMS with a well-tested process-based model for VFS (VFSMOD). In research during the past year, we applied the modeling framework to determine (1) the most important input factors for quantifying mass reductions of pesticides by VFS in aquatic exposure assessments relative to three distinct U.S. EPA scenarios encompassing a wide range of conditions; (2) the expected range in percent reductions in acute and chronic estimated environmental concentrations (EECs); and (3) the differential influence of VFS when conducting acute versus chronic exposure assessments. This research utilized three, 30-year U.S. EPA scenarios: Illinois corn, California tomato, and Oregon wheat. A global sensitivity analysis (GSA) method identified the most important input factors based on discrete uniform probability distributions for five input factors: VFS length (VL), organic-carbon sorption coefficient (Koc), half-lives in both water and soil phases, and application timing. For percent reductions in acute and chronic EECs, VL and application timing were consistently the most important input factors independent of EPA scenario. The potential ranges in acute and chronic EECs varied as a function of EPA scenario and application timing. Reductions in acute EECs were typically less than percent reductions in chronic EECs because acute exposure was driven primarily by large individual rainfall and run-on events. Importantly, generic specification of VFS design characteristics equal across scenarios should be avoided. Dissemination of research findings on this objective during the past year have occurred through presentations at local, state, and national meetings and publication of peer-reviewed journal articles and conference proceedings during the project period

Results

This research has wide reaching implications for how riparian floodplains throughout the world are managed. Billions of dollars are spent annually through governmental programs in North America and Europe to mitigate surface runoff, sediment, pesticide, and nutrient loads through conservation and restoration of riparian buffers. Although these management plans can be effective, this research hypothesizes that subsurface P transport could also be a contributing factor in certain conditions with this transport occurring along focused as opposed to diffuse pathways. Research on VFS illustrates that the revised pesticide assessment modeling framework offers the ability to elucidate the complex and non-linear relationships that can inform targeted VFS design specifications. In fact, approaches developed on the fate and transport of pesticides through VFS has been directly incorporated into environmental risk assessment procedures for pesticide use and registration in the European Union (EU) and is currently being considered by the US EPA as part of an improved risk assessment process for pesticides.

4. Associated Knowledge Areas

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

Outcome #15

1. Outcome Measures

Alternative Manure Technologies Video Series

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Producers are reluctant to adopt new technologies without firsthand experience with the technology. It is particularly difficult to get positive exposure for manure related issues in traditional media. Creative methods are needed to expose producers to useful technologies for handling and treating animal wastes.

What has been done
Eleven videos highlighting innovative manure handling and treatment technologies were filmed, edited, and produced by the Oklahoma Cooperative Extension Service. Videos were uploaded

onto the OSU Waste Management Channel on YouTube to maximize exposure of the technologies. Technologies were selected working with partners in Arkansas, Louisiana, Texas, and Nebraska. We specifically sought out producers who have successfully adopted manure handling and treatment technologies on their farms. Technologies filmed were: a subsurface poultry litter spreader; a large-scale, poultry litter bailing operation; a between flock, broiler litter windrowing system; a rotary drum composter for poultry carcass disposal; a "weeping wall" solid-liquid separator for dairy manure; mechanically separated and composted dairy manure solids used as cow bedding; methane gas captured from a covered anaerobic lagoon used to incinerate swine carcasses; a "Biovator" style rotating drum swine carcass composter; lime enhanced precipitation of solids from alligator ranch wastewater; and vegetative treatment systems for feedlot runoff treatment.

Results

In the three years since creation of the YouTube channel, the videos have been downloaded more than 23,000 times with a total viewing time of nearly 300 hours. Videos have been downloaded in all fifty states plus Guam, Puerto Rico, the US Virgin Islands and American Samoa. In addition to the United States, the videos have been seen by viewers in 147 countries on all continents. More than one third of all downloads were the result of online searches, which shows that the exposure has been consumer driven. Producers are actively seeking examples of manure technology and downloading the videos. Another source of downloads was videos embedded on websites -- manufacturers of equipment added a link from their home website to our videos demonstrating equipment use on-farm.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #16

1. Outcome Measures

New Abatement Technologies for Nut Harvester Pick Up Machines

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nut harvesting has been identified as a major source of particulate matter emissions. In some areas, nut harvesting has been identified as the primary source of particulate matter emissions. Nut industries and regulatory agencies in several states are looking to implement new management practices or abatement technologies to reduce the particulate matter emissions produced during harvest.

What has been done
Dr. Buser is part of a research team that has designed and evaluated a low cost retrofit abatement device that can be used with existing pick-up machines to reduce particulate matter emissions. The research team includes Dr. Buser and researchers from the USDA-ARS Cotton Ginning Research Laboratory in Mesilla Park, NM, faculty from New Mexico State University, and Flory Industries in Salida, CA. In initial tests, the new technology was shown to remove 77 to 105 pounds of material per minute from the air stream. This is a major reduction. During the test the team identified several design parameters that should be addressed prior to further testing. The team has also developed several new concepts that they plan to evaluate on a laboratory scale in the near future.

Results
This innovative, and low cost, abatement technology design for nut harvesting pick-up machines provides producers the ability to remove more than 75 pounds of material per minute from the air stream. The significant reductions in particulate matter emissions achieved with this technology can improve the working conditions for the personnel operating the machinery and working in the immediate area

4. Associated Knowledge Areas

KA Code	Knowledge Area
141	Air Resource Protection and Management

Outcome #17

1. Outcome Measures

Particulate Matter Abatement Technology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As federal and state PM regulations change in terms of the specified indicator (e.g. total suspended particulate, PM10, PM2.5, etc.), the basis for determining abatement technology efficiencies must change. In the 1970s, total suspended particulate (TSP) was the regulated pollutant and numerous reports were published comparing various cyclone designs and TSP collection efficiency. Currently, PM2.5 is a regulated pollutant and there are very few reports comparing cyclone designs and PM2.5 collection efficiency.

What has been done
A particulate matter abatement device evaluation system has been designed, developed, and constructed and has been used to evaluate baffle type pre-separators, series cyclones, and the scalability of cyclones. These studies have shown that two 1D3D cyclones in series were more effective (97%) than a single 1D3D cyclone (91%); used to define the optimum baffle placement and inlet air velocity in terms of collection efficiency for the baffle-type pre-separator; and provided fundamental scalability cyclone research which showed that collection efficiency for 10 micron PM decreased from 99.5% to 94.5% as cyclone diameter increased from 6 to 36 in. Currently studies are being conduct to directly compare different cyclone designs that are currently being used in industry. In addition to evaluating and improving current device/system designs, new abatement technologies are being developed such as a device for reducing PM emissions from almond and pecan harvesting operations.

Results
This research can be utilized by industry and regulatory agencies to predict the effectiveness of a given abatement technology or technologies to reduce particulate matter emissions from a source with defined characteristics.

Can be used in prescription technologies for multi-point facilities

Example of recent industry application: a feed supplement company was given a notice of violation for excessive emissions. This company was facing closure due to the quantity of particulate matter being emitted from the facility. In addition, the company had a market for the material been emitted so it was missing out on potential sales. The company invested about $80,000 and installed new cyclones based on the criteria from this research and prior to the existing abatement devices. This system enhancement improved the facilities abatement system efficiency by 98%, increased average annual revenues by $470,423, and kept the plant from closure.

4. Associated Knowledge Areas

KA Code	Knowledge Area
141	Air Resource Protection and Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

An economic survey of Mesonet users completed by University of Oklahoma 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. Miss Klockow was only able to survey crop producers. This estimated value does not include the Mesonet value to livestock producers.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Safety - 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	3%		5%	
401	Structures, Facilities, and General Purpose Farm Supplies	16%		5%	
403	Waste Disposal, Recycling, and Reuse	6%		5%	
501	New and Improved Food Processing Technologies	20%		10%	
502	New and Improved Food Products	8%		10%	
503	Quality Maintenance in Storing and Marketing Food Products	9%		10%	
701	Nutrient Composition of Food	4%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	11%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	13%		25%	
723	Hazards to Human Health and Safety	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.3	0.0	4.0	0.0
Actual Paid Professional	2.0	0.0	5.0	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**
40276	0	219627	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
40276	0	219627	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
500000	0	1214872	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct research that evaluates food processing technologies with the aim of improving food value, quality, and safety. Provide technical applications, demonstrations and education for food processors.

2. Brief description of the target audience

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

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1916	561680	0	0

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

Patent Applications Submitted

Year: 2012

Actual: 1

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	18	20

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer-reviewed journal articles

Year	Actual
2012	18

Output #2

Output Measure

- Number of conferences and other extension outreach presentations

Year	Actual
2012	47

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of processors and/or regulatory agencies implementing new rapid testing methods
2	Number of food processors implementing new technologies or technology improvements
3	New products produced
4	Grain storage, food or pest control entities adopting new process or product
5	Certified Hazard Analysis Critical Control Points (HACCP) training
6	Food process evaluations

Outcome #1

1. Outcome Measures

Number of processors and/or regulatory agencies implementing new rapid testing methods

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Educational programs for food safety with fresh produce farmers were not carried out for Oklahoma in the past. The impact of this is that even small instances of food borne illness can have tragic results and cost the fresh produce industry millions of dollars.

What has been done
Curricula, fact sheets and programs have been updated to provide the educational basis for farmers to manage their crops for food safety. Work is ongoing to harmonize GAP curricula and programs throughout the country.

Results
Prevention is vital for insuring fresh produce food safety. More than 175 producers have received food safety training through the Oklahoma Market Gardening School since 2008 and numerous farmers have been trained at other venues including the Oklahoma Horticulture Industry Show and programs with the Oklahoma Department of Agriculture, Food, and Forestry. Extension programs in food safety have raised awareness and numerous farm operations across the state have initiated food safety programs for their farms based on Good Agricultural Practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
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 #2

1. Outcome Measures

Number of food processors implementing new technologies or technology improvements

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
BlackJack Beef Jerky (BBJ) is a new company near Chickasha that requested facility design and startup assistance. They manufacture beef jerky according to a recipe that they purchased from another company. The recipe called for a particular type of dehydration operation and they required help identifying and testing potential ovens and suppliers, how the ovens would be installed in their plant, and assistance with the development of a Hazard Analysis Critical Control Points (HACCP) food safety plan.

What has been done
Tim Bowser visited their new plant sight while it was under construction and discussed details of completion, including how the ovens would operate and fit within the shell. Tim drew several alternatives for oven configuration and sent drawings to them. BBJ later visited the Robert M. Kerr Food and Agricultural Products Center (FAPC) to test a spiral oven for use on their product. Jake Nelson and the entire 2nd floor FAPC crew assisted with tests and evaluation of their product. Jason Young provided a HACCP plan template that they could use as a starting point. The FAPC are continuing to support BBJ in their plant startup efforts.

Results
A new facility (>3,000 sq. ft.) has been constructed near Chickasha and is currently under startup. It will be a USDA inspected meat-processing facility. About fifteen new jobs are expected to be created for management, sales, marketing, delivery and production of beef jerky products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
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

New products produced

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The acreage of blackberries being grown in Oklahoma is increasing. Most blackberries are being grown as a fresh-market crop, but there is continued interest in producing value-added blackberry products from excess crop production. However, knowledge and experience with respect to which cultivars are best suited for production and best processing practices are lacking. With this knowledge in hand, the regional market for value-added blackberry products could be significantly expanded, thus creating new products, increased sales, and expanded employment.

What has been done
A novel partially-fermented blackberry beverage was produced using a process modified from traditional Korean practices that involves a mixed, high-oxygen fermentation of the fruit. Test conditions involved the use of two blackberry cultivars, natural fermentation versus fermentation with inoculated yeast culture, and high and low fermentation temperatures. Qualitative tests such as pH, titratable acidity, and percent soluble solids were conducted on the product at various stages in production as well as on the final product.

Results

The process resulted in a sweet beverage that contained around 2% alcohol and a pleasant blackberry flavor. Further testing is ongoing. However, the blackberry cultivars commonly grown in the Midwest appear to be very suitable for the production of this product. This knowledge furthers the development of this type of value-added blackberry product, which has potential marketability as a beverage and a dietary supplement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
701	Nutrient Composition of Food

Outcome #4

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Certified Hazard Analysis Critical Control Points (HACCP) training

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food processors are being asked to comply with a host of new food safety protocols and procedures in order to satisfy government regulations such as the Food Safety Modernization Act (FSMA) as well as to satisfy customer demands for written food safety plans, third-party food safety audits, and so on. Certified HACCP training gives processors the foundation they need in

order to put together a food safety plan that will pass muster with regulators, customers, and the public.

What has been done
A series of two-day HACCP workshops were held in 2012, some on the campus of OSU-Stillwater and some on-site for individual companies. These workshops provided participants with the opportunity to become certified in basic HACCP principles and through hands-on exercises to being the process of crafting their own HACCP plans specific to their processing operations.

Results
More than 80 participants received their Basic HACCP certification by attending HACCP workshops in 2012. This resulted in higher levels of compliance with food safety requirements, safer processing operations, and processors being able to sell their products in markets that require sellers to have written food safety plans in place.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
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 #6

1. Outcome Measures

Food process evaluations

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Processors of shelf-stable food products are often required by state or federal regulators to document the adequacy of the heat, drying, or other processes they use to render their foods commercially sterile. Larger processors may be able to accomplish this using their own in-house resources, but smaller companies must rely on outside expertise and testing facilities. These may be difficult to find and expensive to use.

What has been done

Laboratory testing facilities and personnel at the Robert M. Kerr Food and Agricultural Products Center (FAPC) are available to food processors as part of the Preserved Food Process Evaluation program. This program allows food processor to have their products tested at reasonable fee rates. From those test results, Process Authority letters are drafted. These letters provide processors with processing recommendations related to cook times and temperatures, maximum allowable pH values, and other critical safety limits related to product formulation and processing. The letters serve as reference for processors and food safety regulators in order to assure the safe production of the food products in question.

Results

More than 100 food products manufactured by 15 food processers were evaluated by the FAPC in 2012. A total of 98 Process Authority letters were issued; these letters provided companies with the information needed to produce safe products and the documentation needed to begin production in compliance with applicable state and federal food safety regulations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

Limited formula funding has hindered our ability to conduct applied research and technical assistance projects. In addition, financial and in-kind support from industry partners has been flat or in some cases has dropped as a result of the extended economic downturn.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Extension and outreach programs were evaluated based on before and after assessment of student knowledge.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Family Resiliency and Economic Well-Being

☑ 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
602	Business Management, Finance, and Taxation	10%		0%	
607	Consumer Economics	16%		0%	
801	Individual and Family Resource Management	31%		0%	
802	Human Development and Family Well-Being	35%		0%	
806	Youth Development	8%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	0.0	0.0
Actual Paid Professional	24.0	0.0	0.0	0.0
Actual Volunteer	15.5	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
575000	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
575000	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2300000	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Adaptation & supplementation of existing curricula

•Delivery through classes, One-on-One, News Releases/TV/Radio, Participation in Events, Displays

•Provide training and other staff development opportunities to county educators

•Create public awareness of programs and resources through promotional and educational materials to be distributed to teachers, agency professionals, and other community members.

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 a resource to educators

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	115012	6473911	7210	500000

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	3	0	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Revised online curriculum

Year	Actual
2012	0

Output #2

Output Measure

- Promotional materials and marketing campaign

Year	Actual
2012	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Participants will utilize recommended financial management practices
2	Participants will expand their knowledge of recommended financial management practices including a reduction in their debt levels and the use of credit.
3	Participants will have reduced their debt levels, their use of credit, feel more satisfied with and less stressed about their financial situation, and begin developing an asset base.
4	Participants in asset building classes (i.e. investments, retirement, home-buyer education, entrepreneurship) will have bought a home, started an investment account, started a retirement account, or started a business or have made a conscientious decision not to do so at the current time because of other financial priorities.
5	Adults receiving the program will attain increased interpersonal cognitive problem-solving skills
6	Adults receiving the program reporting increased use of interpersonal cognitive problem-solving skills with children/youth
7	Children and youth receiving the program will increase use of interpersonal cognitive problem-solving skills
8	Increase the number of Oklahomans using assistive technology and practicing safety and injury/secondary injury prevention
9	Increase parents' knowledge of non-hostile discipline strategies, how to handle parenting and relationship stress, and effective communication and conflict resolution skills
10	Percentage increase in preparation for emergencies

Outcome #1

1. Outcome Measures

Participants will utilize recommended financial management practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	141

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Economic indicators in Oklahoma, such as personal income are holding steady, the unemployment rate is 5.1%. However many families are struggling to make ends meet due to increases in health insurance rates and fuel costs. Increasingly, the aging population is taking on more credit card debt. Many Oklahomans find themselves in peril of legal action and excessive fees because they employ more disruptive financial practices like payday loans and bogus check writing.

What has been done
Since 2007 extension educators in 14 counties have offered a financial literacy program for persons involved in dire financial circumstances like bankruptcy. In January of 2008 District 6 county extension educators began offering this program to court-ordered bogus check writers. In this region, the number of checks that are written on accounts with insufficient funds totals more than 6,000 in a year. These bogus checks cost merchants and consumers as costs are passed on. The Region 6 District Attorney's office requested a partnership to deliver financial management classes to offenders in the District 6 counties: Grady, Caddo, Jefferson and Stephens. The program, Making Sense of Money Management has been offered 29 times since 2008. These counties have seen a 40% drop in bogus check.

Each member of the Family Economic Well Being Impact team dedicates 28 days to focus on financial literacy related programming. This includes offering diverse classes such as life skills education leading to employment, homebuyer education and basic money management and credit.

Results
This program has been expanded and is supported by 4 judges and 2 District Attorneys. The

program prevents incarceration of the fraudulent check writers. In addition, the court waives the $198 fee for participants who complete the program. During 2012, 141 participants completed the class reflecting a savings to them of $27,918.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #2

1. Outcome Measures

Participants will expand their knowledge of recommended financial management practices including a reduction in their debt levels and the use of credit.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	988

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The 2008 Jumpstart Coalition for Personal Financial Literacy survey reflected that financial literacy scores for high school students were lower than their peers tested in 2006. High school seniors only answered 48.3 percent of the questions correctly. For example, only 48% answered correctly that a credit card holder who pays only the minimum payment on a credit card balance would pay more in annual interest charges than someone who paid the balance in full each month.

Lacking basic financial knowledge will costs these students in the long term. Oklahoma has passed legislation requiring that high school students have training in financial literacy before graduation. The Passport to Financial Literacy requirements will affect students who will graduate in 2014. They are required to be literate in 14 topic areas outlined in the legislation.

What has been done

Extension educators on the Family Economic Well Being impact team offer programs targeting youth audiences including high schools. The High School Financial Planning Program offered through the National Endowment for Financial Education offers free materials to instructors and students addressing 11 of the 14 topic areas required by the Passport for Financial Literacy. Reality Check is a program developed by the Jumpstart coalition which according to their website is a quick, easy and free online resource designed to help young people see what it?s really going to take to live independently as an adult consumer.

Results
Since the High School Financial Planning Program was revised in 2007 the materials have been provided to over 28,000 students in Oklahoma with 4,157 in 2011. Additionally, all county educators are made aware of the availability of these materials and how they can be used to make connections with schools in their counties. Educators have used the Reality Check materials with 988 students in 13 schools.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics

Outcome #3

1. Outcome Measures

Participants will have reduced their debt levels, their use of credit, feel more satisfied with and less stressed about their financial situation, and begin developing an asset base.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
See outcome #1

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #4

1. Outcome Measures

Participants in asset building classes (i.e. investments, retirement, home-buyer education, entrepreneurship) will have bought a home, started an investment account, started a retirement account, or started a business or have made a conscientious decision not to do so at the current time because of other financial priorities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There has been a slowdown in the housing market and an increase in home foreclosures. This trend rose to 3.4% in 2012, but late housing payments were only slightly less than the national average at 2.3%. Purchasing a home represents the largest outlay of cash for most Americans and many view owning a home as an investment.

What has been done
Since 2001, Oklahoma Cooperative Extension Service has worked with various agencies in the state in a collaborative effort to provide standardized homebuyer education to potential homebuyers. Research shows that homebuyer education and counseling lowers the incidences of foreclosure. Extension educators have been trained and certified to deliver homebuyer education Individuals who receive homebuyer education from these educators are provided with the information they need to make good decisions about home purchase and homeownership.

Results
Thirty three percent of participants in classes report actually purchasing a home.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #5

1. Outcome Measures

Adults receiving the program will attain increased interpersonal cognitive problem-solving skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma ranks among the top 5 in all states for number of divorces; 32% of all adults have divorced compared to 21% nationally and a higher percentage of married Oklahomans have thought about divorce (56%) than in the country as a whole (42%). Oklahomans marry an average of 2.5 years younger than the national median age at first marriage, and those marrying under the age of 20 are the most likely to have gotten a divorce. Children whose parents divorce are often traumatized, especially when those parents inadvertently use their children to get back at their spouse or when their anger and hurt spills over into their relationship with their child.

What has been done
OCES conducted Co-Parenting Through Divorce classes that teach parents how to reduce the effects of divorce on their children

Results
Co-Parenting Through Divorce classes were conducted in 22 counties and helped 1,500 parents. Because the class is court-mandated in many counties, parents generally arrive upset and angry about having to take the class, but leave appreciative of having attended.

4. Associated Knowledge Areas

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

Outcome #6

1. **Outcome Measures**

Adults receiving the program reporting increased use of interpersonal cognitive problem-solving skills with children/youth

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Children and youth receiving the program will increase use of interpersonal cognitive problem-solving skills

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Increase the number of Oklahomans using assistive technology and practicing safety and injury/secondary injury prevention

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	82030

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In Oklahoma, falls, fires/burns, and poisonings account for the majority of unintentional home injury deaths among all age groups. Among all age groups, older adults are most likely to die due to home injury. Over 13% of Oklahoma's population is age 65 years and older, and of those, 31.3% live alone. One out of three adults age 65 and older fall each year, costing Medicare between $9,000 and $13,500 per fall. Approximately 9% of Americans suffer from some form of

serious physical disability. It is estimated that between 15 and 30 percent of American farm operators and farm workers have physical disabilities, many of them sustained on the farm .

What has been done
The Oklahoma AgrAbility Project provides direct service, education and networking to support the rehabilitation and assistive technology needs of Oklahoma farmers, ranchers and their family members impacted by a disabling condition.

In 2012 information and resources were delivered to 82 people in 33 counties. Presentations and exhibits occurred at 98 Agriculture and Disability related events impacting 81,948 citizens.

Results

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Increase parents' knowledge of non-hostile discipline strategies, how to handle parenting and relationship stress, and effective communication and conflict resolution skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
During times of adversity, the ability to effectively respond to life's challenges is critical. Financial struggles to make ends meet, job loss, military deployment, substance abuse, and family separation or divorce are just a few of the events that can negatively impact all Oklahomans from infants to adults. How parents respond to life's challenges can have a lasting effect on their children.

What has been done
Oklahoma has adopted Active Parenting Now and Active Parenting of Teens as the parenting skills and parent-child relationship program for Oklahoma families. These curricula are listed on

the U.S. Department of Health and Humans Services SAMHSA National Registry of Evidence-based Programs and Practices (NREPP). Outcomes improved by these programs include: parental attitudes and beliefs, parent-child relationship problems, and positive and negative child behaviors.

Fourteen educators have completed training as leaders of Active Parenting Now and are eligible for certification.

Results

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Percentage increase in preparation for emergencies

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the Federal Emergency Management Agency (FEMA), Oklahoma currently ranks third in the nation for the number of disaster declarations. 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.

What has been done
OCES is in the process of piloting the new EDEN Family Preparedness curriculum in eight counties across the state. Focus groups were held with residents, local organizations, and community leaders, including law enforcement and fire protection, social services providers, and county commissioners. These focus groups revealed that families are not adequately prepared for disasters for reasons including financial uncertainty, lack of motivation, age, and lack of time.

OCES educators are employing novel techniques to help Oklahomans prepare for disasters, including teaching consumers to shop in their own homes and prepare disaster kits from items already on hand; and encouraging communities to hold drives to collect donated items for disaster kits. Consumers will also be encouraged to identify a safe place in or near their home where they can take shelter before emergency conditions arrive and stay until danger has passed.

Results

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

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

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
608	Community Resource Planning and Development	2%		100%	
806	Youth Development	98%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	65.0	0.0	0.0	0.0
Actual Paid Professional	95.7	0.0	0.7	0.0
Actual Volunteer	56.6	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
2140000	0	2327	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2140000	0	2327	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
8965000	0	12869	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

30 - VMS - Recruit, orient and train adult volunteers to serve as club and project club leaders and to assume leadership on committees who plan and coordinate local and county activity and events.

30 - CMS - Increase the number of 4-H project clubs or project groups within community clubs.

20 - LCD Impact Team - Recruit and train teams of youth and adults, who work in partnership to identify, organize, conduct and evaluate a service learning project which will benefit the community.

27 - EE Impact Team - Provide training and materials for initiating and maintaining teams of youth and adults committed to sharing and promoting environmental education concepts through service learning.

30 - OMK - Train and recruit educators and volunteers to create public awareness of issues affecting military families.

28 - STEM - Provide training and materials for initiating and maintaining teams of youth and adults committed to sharing and promoting STEM concepts through service learning.

30 - All other - Establish, develop, and maintain new and ongoing youth development programming, events, and support materials.

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

3. How was eXtension used?

Within the Companion Animals and STEM areas specialists have served to develop a community of practice and have served as expert reviewers. A new community of practice related to Environmental Education is currently being developed. The eXtension link was added to the Oklahoma 4-H website. Two specialists participated in an eXtension conference and one served as an "Ask an Expert" contact for Shooting Sports and Prescribed Fire community of practice. An eXtension training was conducted for County Extension Directors.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7050	0	544605	0

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

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	158	2	160

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Web-delivered curriculum - lessons developed and tested

Year	Actual
2012	125

Output #2

Output Measure

- Educational trainings offered for volunteers and staff

Year	Actual
2012	345

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Certified participants will manage local programming
2	Caring and qualified adults will prepare youth for successful lives as community leaders and contributing citizens
3	The number of active 4-H project clubs and project groups.
4	Project curriculum in support of Mission Mandates
5	Youth will develop a well rounded understanding of mental and emotional health obtained through project work and activities which encourage healthy life style choices - camping, recreation, shooting sports, fitness, safety, hobbies and creative pursuits through the arts.
6	Youth and adults work in partnership to identify and solve/resolve community needs and environmental issues through an organized and executed plan of action.
7	Youth will learn to make healthy lifestyle choices through the use of curricula and educational materials.
8	Increased number of collaborations with youth organizations
9	Participant teams will Increase knowledge of Oklahoma natural resources and environmental stewardship.
10	Participants in livestock programs will focus on 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.
11	Participants will increase knowledge and awareness of STEM technologies and career opportunities.
12	Participants will increase knowledge and awareness of plants and soil systems.
13	Increase knowledge and awareness of entomology.
14	Companion animal programs will focus on animal welfare and human-animal interaction.
15	Military families receiving support through 4-H partnerships will increase their use of local support networks

Outcome #1

1. Outcome Measures

Certified participants will manage local programming

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	49783

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Positive Youth development occurs when volunteers are properly oriented and equipped with appropriate tools to serve as positive role models. Volunteer adults and teens sever as positive role models and mentors and lead 4-H clubs, thus allow 4-H to reach more youth than could be achieved by paid staff alone.

There is a growing body of research showing that youth who feel safe, valued and connected to caring adults are more likely to be positive about life, engaged in school and emotionally healthy; they also are less likely to participate in destructive or delinquent behavior (Ferber et al. 2005). Additionally, in a recent study of Positive Youth Development by Tufts University, 4-H youth that participate in programs that incorporate the Five Cs: Competence, Confidence, Connection, Character, and Caring when compared to other youth were:

-Two times more Likely to spend time exercising or being physically active;
-Two times less likely to engage in drug use;
-Two times less likely to use cigarettes or drink alcohol
-Nearly two times more likely to attend college (Lerner et al. R. 2012).

It is almost certain that most 4-H Volunteers and 4-H Educators consider Positive Youth Development as their top priority for 4-H clubs and groups. However, many 4-H Volunteers have not received in depth training on what elements are needed to foster positive youth development or the skills needed to ensure they provide those elements.

What has been done

Due to an emphasis on certified volunteers working with youth with an emphasis on Positive Youth Development, a survey was conducted among youth participants from selected counties in the state. 425 youth completed surveys related to Positive Youth Development and overall indicated that they were performing well in school, making good health choices and overall felt good about themselves. Overall the youth were civically engaged with a desire to make the world

a better place and they were concerned about the welfare of their peers.

Results

A group of 205 4-H program participants, ages 9-12 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 56% female and 44% males and most lived in rural areas or small towns. Most had been in 4-H for only 1-2 years and most were in grades 4-6. The majority were white (59%) with Native Americans being the second most represented group at 20%.

In the PYD section the youth were asked to compare themselves to their peers and determine if they identified with a positive or negative attribute. The survey found that the 4-H members generally (90% of them) felt they had a lot of friends. They also tended to be happy with their height and weight and were overall "happy" with themselves most of the time. Most did not feel they were necessarily better than their peers at sports but were usually more dedicated to doing well at their school work, but did not perceive that they were less inclined to make bad choices at times. Furthermore, of those in the survey:
87% said that all in all I am glad I am me
76% feel it is important to make the world a better place
73% felt it was quite to extremely important to take responsibility for their actions when they make a mistake or get in trouble
64% enjoy being with people who are of a different race than themselves.
83% said that when they see someone being taken advantage of, "I want to help them".
86% said that when they see someone being picked on "I feel sorry for them".
85% indicated that if they see another person who is hurt or upset, "I feel sorry for them".
69% of the student (89% in public school) said they feel they get a lot of encouragement at school.
83% indicated they feel useful and important in their family
64% of the respondents said the adults in their town make me feel important.
85% said they feel their friends are good friends.

A group of 217 4-H program participants, ages 13 - 19 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 59% female and 41% males and most lived in rural areas or small towns. Most had been in 4-H for 5 or more years and most were in grades 8-12. The majority were white (61%) with Native Americans being the second most represented group at 19%.
In the PYD section the youth were asked to compare themselves to their peers and determine if they identified with a positive or negative attribute. The survey found that the 4-H members generally (93% of them) felt they had a lot of friends and were doing well in school.
They also tended to be generally "happy" with themselves most of the time, but were not necessarily content with their looks. Most did not feel they were necessarily better than their peers at sports but were usually more dedicated to doing well at their school work, but did not perceive that they were less inclined to make bad choices at times. Furthermore, of those in the survey:
89% said that all in all I am glad I am me
70% feel it is important to make the world a better place
76% felt it was quite to extremely important to take responsibility for their actions when they make a mistake or get in trouble
63% enjoy being with people who are of a different race than themselves.
74% said that when they see someone being taken advantage of, "I want to help them".
81% said that when they see someone being picked on "I feel sorry for them".
78% indicated that if they see another person who is hurt or upset, "I feel sorry for them".

63% of the student (88% in public school) said they feel they get a lot of encouragement at school.
80% indicated they feel useful and important in their family
-59% of the respondents said the adults in their town make me feel important.
-84% said they feel their friends are good friends.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Caring and qualified adults will prepare youth for successful lives as community leaders and contributing citizens

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	4762

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth development programs prepare young people to meet the challenges of adolescence and adulthood through a structured, progressive series of activities and experiences. In turn youth develop social, emotional, ethical, physical and cognitive competencies.

What has been done
County, district and state staff recruit, orient, train, utilize and manage adult volunteers who provide leadership to local, county, district and state programming. Extension professionals work in partnership with volunteers to develop the human, social and political capitol of young citizens.

County Extension educators reported well over 23,000 contacts where youth and adults were involved in citizenship activities or projects.

Results

4-H Youth Development addressed the broader developmental assets which all children and youth need - such as safe places (880 4-H clubs and 227 project clubs) and activities (1000+ 4-H events); opportunities for developing good physical and mental health (24,382 youth); marketable skills (43,000 youth); and opportunities for service and civic participation (133,521 volunteer hours of service). Valued at $17.49 per hour for their time that is a $2.3M contribution.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

The number of active 4-H project clubs and project groups.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1107

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Record book evaluations indicate that fewer 4-H members are doing work in projects for a sustained period of time. As a result they may be experiencing a decline in life skill development. Furthermore, positive youth development research has shown that youth gain the greatest benefit from an experience when there is long-term contact with a caring and significant adult.

What has been done
Training was done in all 4 Extension Districts for staff regarding their own professional development. Curriculum In-service was conducted for 68 professional educators along with nearly 300 certification and other training sessions for staff and volunteers.

Results
There were over 40,000 youth involved in 880 community clubs and 227 project clubs in 2012. While there was a goal increasing enrollments and the number of clubs, which was not realized, there continues to be progress in better managing 4-H project and club work. A new 4-H enrollment system is nearly fully implemented which will allow specialists to better communicate with volunteers and parents about specific 4-H opportunities. It will also allow county staff to more

effectively sort membership data and to send specific content information to youth enrolled in specific projects. It is hoped that by doing so we will see increased participation and future growth in the number of project clubs operating in the counties. This is important because research has shown that the best opportunities for positive youth development occur when youth have long term relationships with caring and significant adults.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Project curriculum in support of Mission Mandates

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
OCES has a goal of providing current research based information to its program users.

What has been done
4-H training was offered for volunteers, staff, and members related to the Health, STEM and leadership mandates via staff in-services, conferences, and workshops

Results
A curriculum, Get Fit 4 Life, was developed . There are 9 lessons and have been used extensively by staff and volunteers and was part of the curriculum used by educators and reported in the Health Outcome (Outcome 5).

Over 2,000 youth participated in Healthy Living projects as a result of programs supported by the a Walmart Healthy Living grant. Display and hands-on activities were conducted at OCES Day at the Oklahoma Youth Expo and Septemberfest, both are opportunities to promote 4-H.

Summer camps were conducted related to the science topics for staff, volunteers and youth. Grant were offered to county staff in science and health related topics.

Over 1000 4-H contacts were made to volunteers, staff and members using new 4-H curricula.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Youth will develop a well rounded understanding of mental and emotional health obtained through project work and activities which encourage healthy life style choices - camping, recreation, shooting sports, fitness, safety, hobbies and creative pursuits through the arts.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	63

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research indicates that youth who spend constructive time out of doors, engaged in physical activity and use their minds for creative pursuits and problem solving demonstrate stronger mental and physical health.

The rural state of Oklahoma averages more than 14 ATV-related deaths each year and ranks between 15th and 20th in the nation in ATV fatalities over the past few years. Oklahoma also has one of the nation's highest rates of injury for those 16 and under. Close to 90% of ATV crashes in Oklahoma occur with drivers under age 16 driving an adult sized ATV. Over the past four years 347 patients were admitted to the OU Medical Center Trauma One Hospital alone with ATV-related injuries. Recent research demonstrates that children under the age of 16 continue to suffer a disproportionate share of injuries. They do not wear a helmet or proper riding gear and they fail to receive formal ATV training.

An extensive body of literature has demonstrated that targeted safety education can result in behavior change that translates to fewer injuries. The Oklahoma State University Cooperative

Extension Service, through the 4-H Youth Development Department and the Oklahoma 4-H Foundation along with ATV Ride Safe Oklahoma, is committed to the development and delivery of a quality statewide 4-H ATV Safety education program.

What has been done

Oklahoma 4-H conducted at least 63 state level events, workshops and or encampments that had an education goal of improving participant health. Some had a physical health component, some emotion or social impact, and others were primarily safety oriented.

Events include: state shooting sports events, day camps, State 4-H Roundup; reached over 25,000 youth. Additionally about 30 county or multi-county camps were conducted, reaching over 60,000 youth.

Oklahoma State University 4-H Youth Development was a key partner in the development of ATV Ride Safe Oklahoma. This joint initiative is led by Oklahoma State University Cooperative Extension Service 4-H Youth Development, The Children's Center, and Trauma One Injury Prevention at OU Medical Center. The goal is to provide safety education and injury prevention information as related to all-terrain vehicles (ATVs). Other partners include the Oklahoma State Department of Health, Oklahoma Safe Kids, Tulsa Safe Kids, Oklahoma Farm Bureau, Oklahoma Emergency Medical Services for Children and other local/community organizations.

A team of 16 educators were trained to conduct in school short courses on ATV safety as well as more in-depth hands-on rider course. ATVs continue to be a leading cause of head injuries and deaths to adolescents and youth. Oklahoma assumed leadership for the National 4-H ATV education and grant program in 2012 from National 4-H Council. As a result Oklahoma is providing support to 9 other states in the ATV safety effort

Results

In a survey of over 800 adolescents, youth who participated in 4-H healthy living programs were inclined to know and implement good health and safety practices.

Preliminary work by Oklahoma State University Cooperative Extension Service 4-H Youth Development and support from the above organizations has established the foundation for an ongoing dissemination of high impact educational materials and programs designed to reach children and families in communities where ATV use is common. These efforts, which include both classroom and critically important practical training, specifically target subpopulations that are at particularly high risk for ATV injury and have the potential to have meaningful impact on the knowledge, attitudes and behaviors of ATV users in Oklahoma.

Oklahoma State University currently has 17 trained educators that are ATV Safety Institute licensed instructors to deliver the ATV Safety Institute ATV RiderCourse in each of our four statewide OSU Extension districts. We are in the process of identifying and training an additional 8 ASI Instructors. As you are aware, the 4-5 hour ASI ATV RiderCourse conducted by licensed ATV Safety Institute Instructors offers youth (in class sizes of four to eight students based on age) an opportunity to increase their safety knowledge and to practice basic riding skills in a controlled environment under the direct supervision of a licensed Instructor. The RiderCourse includes pre-ride inspection, starting and stopping, quick turns, hill riding, emergency stopping/swerving and riding over obstacles. Participants also learn about protective gear, local regulations, places to ride and environmental concerns.

Since the implementation of our program in the late spring of 2012 we have reached over 4,200 youth with two or more hours of classroom ATV safety education, 626 plus youth have completed the ATV Safety Institute's online ATV Safety E-Course, 400 plus youth have completed the national 4-H Treadsylvania ATV Safety online educational game and 300 plus youth have received their ATV Safety Institute RiderCourse Certification by completing the 4-5 hour hands-on ATV Safety Institute RiderCourse program taught by our OSU licensed ATV Instructors. Oklahoma had 11 4-H youth participate in the 2012 National ATV Safety PSA "Do the Ride Thing Contest" receiving four of the nine national awards. Our ATV Ride Safe Oklahoma team has seen over 220,000 youth and adults at events such as the Oklahoma Sports and Health Festival, Septemberfest at the Oklahoma Governor?s Mansion, Oklahoma State Wildlife Department Expo, state FFA Convention, state 4-H Youth Roundup, state Injury and Prevention Conference, state Agricultural/Farm shows and state and county fairs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

Youth and adults work in partnership to identify and solve/resolve community needs and environmental issues through an organized and executed plan of action.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	260

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Stakeholders value programs that involve youth and adult partnerships that address real life community needs. Local youth have mapped storm shelters, illegal dumpsites, and established gardens to improved the quality of life for citizens

What has been done
Counties identified needs related to health and wellness, environmental needs, and infrastructures. At least 11 counties created community gardens and farmer?s markets. Over

$70,000 in mini-grants were provided to implement local programs. Fourteen teams of youth and adults (260) at the county and club levels identified needs related to health and wellness, the environment, as well as community and county infrastructures. Eleven county teams/60 participants created community gardens.

Youth in Murray, Texas and Washita Counties have established farmers? markets.

Results
Educators have indicated an increase in visibility of OCES, members have gained new knowledge and skills in problem solving. Additional examples related to STEM included in Outcome #11

A group of 217 4-H program participants, ages 13 - 19 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 59% female and 41% males and most lived in rural areas or small towns. Most had been in 4-H for 5 or more years and most were in grades 8-12. The majority were white (61%) with Native Americans being the second most represented group at 19%.

On a series of questions related to environment and resource management, the respondents tended to identify with some practices that were environmentally friendly or responsible. They indicated their families tended to recycle their trash, and as teenagers they turn the water off when brushing their teeth and many said they drink from a glass or a reusable bottle. While they indicated they had an appreciation of things in nature like forest and the outdoors many said they did not give much thought to these things and did sometimes throw trash on the ground.

Also, over 90% of the youth reporting on a Youth Engagement Attitude and Knowledge (YEAK) survey indicated:
-an increase in knowledge when problem solving
-an ability to collect information and use past knowledge
-and expressed their own ideas when problem solving.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

Youth will learn to make healthy lifestyle choices through the use of curricula and educational materials.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	12241

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma ranks as the 47th least healthy state with factors such as obesity, smoking, substance use, and risk factors associated with family breakdown. According to the 2007 State of the State Report, Oklahomans are below average or failing in several indicators of good health. As a State, our citizens tend to not eat enough fruits and vegetables each day. Many citizens are overweight or obese; get little or no physical activity and too many Oklahomans use tobacco. Diabetes, high blood pressure, high blood cholesterol, stroke, heart disease, asthma, lung cancer - these are all negative consequences of the unhealthy lifestyles Oklahomans are living.

What has been done
In 2011-12 through a Walmart Foundation grant 36 projects were carried out related to Health. One of those was the 4-H Food Showdown which is exploding in popularity. In 2012 the first state contest was conducted in Food and Agriculture Products Center at OSU with 11 qualifying teams competing. Training related to curricula was provided for educators, volunteers and members in: Food Showdown, Health Rocks, Bullying, Fuel-up to Play 60, Farm to You, Kids Cows and More, and Hobbies and Collectables.

Results
Within the Health project areas, when 217, 13+ year olds were asked to compare themselves against peers they indicated that they did not always practice the things they knew. The respondents said they often did not like to eat fruits and vegetables but prefer foods/drinks higher in fat, sugar and salt. Yet most indicated they like to each dairy products like milk, cheese and yogurt.
As is true of most teens, this group was heavily engaged in social media and would prefer that over planning and preparing food, indicating that they sometimes have trouble balancing healthy choices of good food and drink choices, physical exercise, developing hobbies and making good social decisions.

In a larger survey of Oklahoma youth involved in a 4-H Council / Walmart Healthy living grant project, of 800 surveyed, over 90% initiated they had learned how to make better health choices as a result of being involved in 4-H programs related to for foods, nutrition and health.

In a similar survey of 217 teens involved in 4-H, ages 13 - 19 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 59% female and 41% males and most lived in rural areas or small towns. Most had been in 4-H for 5 or more years and most were in grades 8-12. The majority were white (

61%) with Native Americans being the second most represented group at 19%.

In the PYD section the youth were asked to compare themselves to their peers and determine if they identified with a positive or negative attribute. The survey found that the 4-H members generally (93% of them) felt they had a lot of friends and were doing well in school.

They also tended to be generally "happy" with themselves most of the time, but were not necessarily content with their looks. Most did not feel they were necessarily better than their peers at sports but were usually more dedicated to doing well at their school work, but did not perceive that they were less inclined to make bad choices at times. Furthermore, of those in the survey:
89% said that all in all I am glad I am me
70% feel it is important to make the world a better place
76% felt it was quite to extremely important to take responsibility for their actions when they make a mistake or get in trouble
63% enjoy being with people who are of a different race than themselves.
74% said that when they see someone being taken advantage of, "I want to help them".
81% said that when they see someone being picked on "I feel sorry for them".
78% indicated that if they see another person who is hurt or upset, "I feel sorry for them".
63% of the student (88% in public school) said they feel they get a lot of encouragement at school.
80% indicated they feel useful and important in their family
59% of the respondents said the adults in their town make me feel important.
84% said they feel their friends are good friends.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

Increased number of collaborations with youth organizations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All youth serving agencies have similar goals to reach as many youth as possible and with decreased resources all must work together to maximize their impact and reach without program duplication.

What has been done
Working with Red Earth Inc. in the development of environmental/science based lesson plans tied to Native American Culture; established 4-H mentoring projects with three tribes and with the Latino agency, a master volunteer conference was conducted in the Oklahoma City metro to strengthen volunteers for various youth serving agencies, worked with 5 military installations, Continued to work with FFA, public schools, and YMCA and Scouts.

Results
Over $300,000 in grants were obtained through the dept of juvenile justice for mentoring programs in six sites. Through the companion animal program efforts new collaborations have been established or enhanced with the Veterinary Medicine College, the Oklahoma City and Tulsa Zoos. We have also collaborated with Oklahoma State University athletic department and the University of Oklahoma athletic department on game days and the Oklahoma State University Wellness Center.

We worked with the Oklahoma City Latino Agency, Schools in Calvin, OKC, Stonewall, Stuart, Broken Arrow, Riverside Indian, Cherokee Emersion, along with the Cherokee, Chickasaw, Creek, and Choctaw Nations in mentoring programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

Participant teams will Increase knowledge of Oklahoma natural resources and environmental stewardship.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Participation in competitive events is proven to increase life skills such as decision making and critical thinking while enhancing teamwork and cooperation.

The 4-H natural resource programs are designed to assist young people in personal development, the establishment of personal environmental ethics, and the exploration of life-long vocational and avocational activities. The program uses experiential learning and positive interactions with youth and adult role models to help young people develop self-concept, self-assurance and a positive self-image.
The content provides a framework of knowledge and skills for lifetime participation in recreation, hobbies and careers related to shooting sports and wildlife. Core concepts stress safety, ethical development, personal responsibility and life-time recreational skills.

What has been done
?The outcome to determine an increase in participant knowledge was not realized. A survey was done but the number of responses was not large enough to be meaningful; however, work with families on the economic impact of the Shooting Sports has the potential for future impact assessment in 2013-14.

-A study was begun to determine the economic impact of 4-H shooting sports events on the Oklahoma economy. Looking as a series of state-level events, participant families are asked to list the cost of travel, supplies, meals, etc associated with participating in an event.
-Training was provided in Forestry, Shooting Sports, Wildlife, Range, Water, Homesite and Land judging,
-While most of the youth involved in SS would likely not become delinquents, however some may be inclined to become involved in at risk behaviors if not involved in programs that encourage discipline and positive role models. The estimated cost to keep one juvenile delinquent housed in a correctional facility is close to $55,000 per year. In a survey of youth and families in Texas, the estimated cost for a youth to participate in 4-H shooting sports was about $4,320 a year.
-Nearly 1000 youth competed in one or more state-level shooting sports contest. Each of these youth had received a minimum of 8 hours of instruction before competing.

Results
Preliminary economic impact data for one event indicated that off the families who participated in the survey (about 50% of all who actually competed in the event) spent over $22,000. This was a value of $76 per person. This was the smallest of the 12 state-level shooting sports events, indicated that they total impact will be very significant.

Over 30 4-H youth represented Oklahoma at national contests in Shooting Sport, WHEP and forestry. 46% of the youth who attended the WHEP contest were involved in service learning projects engaging them in their communities.

Over 5,400 youth are enrolled in the Shooting Sports and they need trained volunteers to instruct them regarding safe use of sporting arms, environmental ethics, and sportsmanship. In 2012, 68 new volunteers were trained and began working with youth in clubs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #10

1. Outcome Measures

Participants in livestock programs will focus on 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.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	13000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth need to learn acceptable animal husbandry practices, to demonstrate 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.
What was done

What has been done
Collaborating with the Oklahoma and National Pork Councils educators continued and expanded the use of the Pork Quality Assurance Plus (PQA Plus) youth education and youth certification program; and work was done by state staff and the National Pork Board for a revised PQA curriculum with an emphasis on animal welfare.
In collaboration with the Oklahoma Beef Council a new Youth Beef Quality Assurance curriculum is being developed and will be implemented for 4-H and FFA in 2013.
A new veterinary science curriculum is being developed.
A group of 205 4-H program participants, ages 9-12 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 56% female and 44% males and most lived in rural areas or small towns. Most had been in 4-H for only 1-2 years and most were in grades 4-6. The majority were white (59%) with

Native Americans being the second most represented group at 20%.

Within the Agri- Science project areas, when 9-12 years olds were asked to compare themselves against peers:
-They more often knew food comes from the farm to the dinner plate. They better knew how to take good care of their pets and/or livestock by feeding them and meeting their other needs
-Within these age groups, most were setting goals but have not thought much about trying to reach a goal.
-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.
-Most also had dreams of going to college.

A group of 217 4-H program participants, ages 13 - 19 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 59% female and 41% males and most lived in rural areas or small towns. Most had been in 4-H for 5 or more years and most were in grades 8-12. The majority were white (61%) with Native Americans being the second most represented group at 19%.

-Within the Agri-Science project areas, when teens were asked to compare themselves against peers, they more often knew food comes from the farm to the dinner plate but about as many teenagers know food comes from the grocery store but aren't sure how it got there.
-Most of the teenagers think it is important to take care of things in nature and some teenagers know how to take good care of their pets and/or livestock by feeding them and meeting their other needs, about half of the respondent teenagers don't really care much or have not thought much about the needs of animals.
The teens said they tended to identify with teenagers who do not see much need in knowing any science. Most had given little thought to how things work and find learning more boring. About half of the teens said they tended to set goals and about half did not; however, most like to keep records or know what they have done. Furthermore they plan to go to college and get a degree.

Results
Approximately 7000 youth 8-18 years of age in both 4-H and FFA programs were certified in the PQA Plus program as part of their county pork project and enabled them to show at the Oklahoma Youth Expo and the Tulsa State Fair. As a result of this program there has been a decrease in stress related deaths in exhibition animals and a more marketable meat product.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #11

1. Outcome Measures

Participants will increase knowledge and awareness of STEM technologies and career opportunities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	49

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 STEM.
What has been done?
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 STEM.

What has been done
Oklahoma's main vehicle for educating youth about science, technology, engineering, and math has been the 4-H STEM Institute. For 2012, this program included, digital media, robotics, iGreen (Environmental Projects, and Alternative Energy. The STEM Institute was designed to train teams of youth and adult in the use and application of technology. These teams were then charged with the tasks of applying their technology specialty to a community service project or the development of a special project club. Once their project is established or complete the team was then expected to go teach other youth about their program and their technology.

Results
Digital Media (4 Counties, Jackson, Latimer, Payne, and Washita)
Four teams of youth and adults were trained in digital media. These teams were expected to create digital media with the intent of creating awareness of an issue affecting youth.

Geospatial projects are about teaching youth how to think spatially. This is done by training them in GPS/GIS. Once trained, the teams of youth and adults are expected to apply the GIS technology. Comanche county mapped their local Holiday light display their map is being used to

by the light committee to plan next year's event. The group plans to map next year's light trail and share it with the public.

The STEM Robotics training is designed to help groups of youth and adults begin their own robotics clubs to teach engineering to participating youth. From the 2012 training four new clubs were started and the educational programs of 5 previously existing clubs were enhanced.

TechXcite is a recently developed Engineering curriculum that is designed for middle school aged students. OK4-H was fortunate to receive a sub-grant from Duke University to pilot these materials. 12 Counties enrolled in the program with a total of 30 sites of a minimum of 18 students each. In 2012 these groups were formed and have begun pilot testing the program. Further program development and evaluation will be conducted in 2013.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #12

1. Outcome Measures

Participants will increase knowledge and awareness of plants and soil systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	14578

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Plants are vital to life on earth. They improve air and water quality, control erosion, provide food and medicine for animals, and have great aesthetic value as well. Children involved in plant science projects increase their agricultural literacy and generally become healthier through physical activity and increased knowledge of healthy eating.

What has been done

The OSU Department of Horticulture and Landscape Architecture and the OSU Department of Plant and Soil Sciences have facilitated plant and soil education for youth in Oklahoma through many activities, productions, and programs. Both departments have sponsored residential academies for youth to experience career-related activities in the plant sciences, hosted judging contests at the state fairs, provided workshops for youth and adults at conferences across the state, and have visited individual classrooms and youth groups throughout the state. Activities in 2012 include:
Presentations about Junior Master Gardener (JMG) - Oklahoma Environmental Education Expo (OKC Zoo), Encylomedia (State Dept of Education), Career Tech, Ag in the Classroom state conference (OKC)
College/Career day presentations - Stillwater Area Career Fair, OSU Up-Close, Payne County Career Paths Expo
Educational workshops - 50-hour Junior Master Gardener day camp at OSU Botanic Garden, 8-hour JMG, OKC, 2 workshops at State 4-H Roundup
Presentations to Youth - Richmond Elementary (Stillwater, OK), Outdoor Day in Mitch Park with Edmond middle schoolers, Women in Science conference for Oklahoma female youth (Science Museum Oklahoma). Kids Kows and More - 2 days Tulsa and 1 day Stillwater, Ag Day at the Capitol, H2O Water Festival, Outdoor Day Sangre Ridge Elementary , Nature Camp (Stillwater) 2-Ag Days Moore Elementary, Grandparent University.
Productions - 1 episode for "Oklahoma Gardening" TV show
Contests - FFA Career Development Events (nursery/landscaping, agronomy), Oklahoma State Fair, Oklahoma/Arkansas State Fair (Ft. Smith, AR), Tulsa State Fair
Residential Camps "Tomorrow's Undergraduates Realizing the Future (Camp TURF)" - 2 weeks of career-related activities for 25 first-generation college students from Oklahoma high schools), Plant Science Academy

Results
There was an increase in the number of registered Junior Master Gardener groups over previous years (12 new groups in 2012, 8 new groups in 2011, 5 new groups in 2010; 1 new group in 2009).

There was an increase in the number of 4H youth participating in the Oklahoma State Fair horticulture judging contest 58 in 2012, 47 for 2011; 42 in 2010; 38 in 2009).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #13

1. Outcome Measures

Increase knowledge and awareness of entomology.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	300000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Entomology education has a vital impact on agriculture, human and animal health, and preservation of the environment.

What has been done
200 presentations to over 300,000 people allowed the opportunity to observe, study, and directly interact with these animals can have a life-long impact on patrons including: 1) increasing awareness of the vital roles all animals play in the environment and ecological cycles on Earth, 2) breaking down irrational myths and fears commonly held regarding these animals, and 3) fostering a feelings of stewardship, influence, and personal responsibility that will make them better citizens and more caring people.

Results
Each year, many thousands of Oklahomans are educated on the truth and myths surrounding arthropods through the Insect Adventure program.
Participants in the Insect Adventure experience a great reduction in fear regarding the important group of animals called arthropods

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #14

1. Outcome Measures

Companion animal programs will focus on animal welfare and human-animal interaction.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	7039

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research studies show that pet ownership can have a positive impact on the quality of life of children by facilitating exercise, teaching responsibility/ compassion and promoting self-esteem.

What has been done
In order to facilitate leadership ideas into the companion animal program the Amazing Small Animal Program (ASAP) teen leader program was developed. This provides a strong base of support and idea sharing as well as providing the youth significant learning experiences and leadership opportunities. Teen leaders planned and conducted a statewide event, a 4-H Pet Fun Day with 75 youth participating.
Trainings have been provided to county educators, 4-H volunteers and daycare providers in proper care of pets and utilizing the pets as a tool for teaching children life skill development. Additionally, children have been given opportunity to show their competence at working with their pets at multiple events such as dog shows, pet fun days and rabbit shows.
A new small and companion animal parent survey has been developed and is under IRB review.

Results
75 volunteers, 20 educators and 50 day care providers received training on animal-human interactions. 89% of parents polled at the quad-county rabbit show indicated that involvement with small animal projects helped their children become better citizens. A training was conducted for new volunteers working with 4-H Dog Project clubs.
Youth and state 4-H programs have resulted in projects such as Humane Shelter Support through the making of toys, treats and blankets, participation in therapy dog programs, pet first aid, heartworm prevention, pet dental health and canine dog bite prevention as well as various ideas for local club meetings.
This group of teens provides new and fresh ideas for the program. This year they planned and conducted the first ever Oklahoma 4-H Pet Fun Day which included educational displays, knowledge bowls, collections for humane shelters, rabbit care workshops and dog training classes. Through this event 4-H ASAP members were able to practice their leadership skills through planning and organizing the event as well as teaching multiple workshops.

4. Associated Knowledge Areas

KA Code	Knowledge Area

806 Youth Development

Outcome #15

1. Outcome Measures

Military families receiving support through 4-H partnerships will increase their use of local support networks

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2373

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Oklahoma National Guard amongst other branches are facing numerous and frequent deployments with 3,500 troops left in 2011 having been the largest deployment since the Korean War affecting individuals from all 77 counties. Military service members are deploying by the thousands at Ft. Sill and Tinker AFB annually. Military Kids that are affected by deployment are over looked and often put off as delinquent children, as a reaction to deployment stress in the school system, in rural counties, and urban communities. Raising awareness and keen sense of vigilance to the sensitivity of the issues facing military kids is important as to build a stronger, more focused, fighting military force and resulting in a safer America.

What has been done
A Speak Out Military Kids camp was conducted to empower military teens to express their stories and raise awareness of the issues facing military kids. RSG trainings and informational briefings were conducted to educate the Oklahoma communities and develop vigilance and understanding to develop support during the deployment cycle. A fund raising initiative with Frontier City and White Water Bay resulted in $300 to the 4-H Foundation to be used for military kid support. Presentations were conducted to 4-H youth while preparing and fostering connection to military kids through the Hero Pack project.

Results
During 2012 the 4-H military partnership and the OMK initiative has reached 1,650 children and from the 4-H club grant allowed the opportunity to reach an aggregated total of 723 military children. Currently, there is a 4-H club on each activity duty installation to include McAlester Ammunition Depot, Fort Sill Army Post, Tinker Air Force Base, Vance Air Force Base, and Altus Air Force Base. A total of 1200 Hero Packs were assembled and distributed. All totaled youth focused programs were conducted reaching a total of 900 military related individuals.

Other Agencies involved as local partners with OMK: American Legion, State Dept of Education, Boys and Girls Clubs, Army and Air National Guard, Active Day Army Garrison Staff, Army Reserve, Navy Reserve, Air Force Reserve, Oklahoma National Guard.

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

In 2010 4-H Oklahoma 4-H implemented a new 4-H enrollment system called ACCESS 4-H. While the new system will in time improve the accuracy of 4-H enrollment data it is anticipated that there will fluctuations over the first couple of years due to enrollment corrections and adoption of a new reporting system.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

There was not a statewide 4-H evaluation done in 2012; however, several program evaluations were done as reported for various outcomes. Currently with new issues teams several tools are being tested for future use by field staff to consider the impact of 4-H. Currently 16 new web-based tools are under IRB review for use with 4-H members, volunteers and parents. These tools will measure Positive Youth Development and specific subject matter. The measures are part of the new NIFA 4-H Common Measures.

Within the **Health project areas**, when **217, 13+ year** olds were asked to compare themselves against peers they indicated that they did not always practice the things they knew. The respondents said they often did not like to eat fruits and vegetables but prefer foods/drinks higher in fat, sugar and salt. Yet most indicated they like to each dairy products like milk, cheese and yogurt.

As is true of most teens, this group was heavily engaged in social media and would prefer that over planning and preparing food, indicating that they sometimes have trouble balancing healthy choices of good food and drink choices, physical exercise, developing hobbies and making good social decisions.

In a larger survey of Oklahoma youth involved in a 4-H Council / Walmart Healthy living grant project, of **800 surveyed, over 90%** initiated they had learned how to make better health choices as a result of being involved in 4-H programs related to for foods,

nutrition and health.

In a similar survey of 217 teens involved in 4-H, ages 13 - 19 years old, were asked to respond to a series of questions related to Positive Youth Development and some project related questions. The youth were 59% female and 41% males and most lived in rural areas or small towns. Most had been in 4-H for 5 or more years and most were in grades 8-12. The majority were white (61%) with Native Americans being the second most represented group at 19%.

In the PYD section the youth were asked to compare themselves to their peers and determine if they identified with a positive or negative attribute. The survey found that the 4-H members generally (93% of them) felt they had a lot of friends and were doing well in school.

They also tended to be generally "happy" with themselves most of the time, but were not necessarily content with their looks. Most did not feel they were necessarily better than their peers at sports but were usually more dedicated to doing well at their school work, but did not perceive that they were less inclined to make bad choices at times. Furthermore, of those in the survey:

89% said that all in all I am glad I am me

70% feel it is important to make the world a better place

76% felt it was quite to extremely important to take responsibility for their actions when they make a mistake or get in trouble

63% enjoy being with people who are of a different race than themselves.

74% said that when they see someone being taken advantage of, "I want to help them".

81% said that when they see someone being picked on "I feel sorry for them".

78% indicated that if they see another person who is hurt or upset, "I feel sorry for them".

63% of the student (88% in public school) said they feel they get a lot of encouragement at school.

80% indicated they feel useful and important in their family

59% of the respondents said the adults in their town make me feel important.

84% said they feel their friends are good friends.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 9

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	15%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
202	Plant Genetic Resources	7%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		10%	
204	Plant Product Quality and Utility (Preharvest)	0%		5%	
205	Plant Management Systems	55%		15%	
206	Basic Plant Biology	0%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	3%		10%	
212	Pathogens and Nematodes Affecting Plants	6%		10%	
216	Integrated Pest Management Systems	14%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.5	0.0	2.0	0.0
Actual Paid Professional	2.0	0.0	2.0	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**
45000	0	92109	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
45000	0	92109	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
200000	0	398952	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The turfgrass development and management team continued the breeding and development activities on straight species and interspecific hybrid bermudagrass. Over 750 internal experimental bermudagrass lines were evaluated from our program in 2013 as well as 160 experimental lines each of zoysiagrass, bermudagrass, St Augustinegrass and 80 lines of seashore paspalums were evaluated by our program in a Specialty Crops Research Initiative cooperate 5 state project. We advanced 5 of our lines screened for drought resistance as well as assisted 4 other breeding programs in advancement of their bermudagrass, zoysiagrass, St Augustinegrass and seashore paspalum lines for more intensive testing in 2013 for drought and salinity resistance. This testing and developmental activity will result in turfgrass products that will have improved abiotic and biotic stress resistance/tolerance. We continued research to identify new and refined integrated management practices such as reduced risk herbicides and pesticide adjuvants. Educational materials were developed featuring improved integrated management products and practices. We continued intensive and effective educational programming to audiences in Oklahoma and Arkansas concerning basic and advance turfgrass management practices. Research and extension activities related to improved efficiency of water application and runoff were provided. Rational decision making based on the combination of science, perception and sound public policy are being made by the turf industry and the public at large. Resultant adoption of integrated turfgrass management strategies remains very high (>94%). We anticipate positive environmental impacts are taking place due to our focused research and intensive training efforts.

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13805	0	0	0

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

Patent Applications Submitted

Year: 2012

Actual: 1

Patents listed

Forage bermudagrass plant named 'Goodwell'.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	3	4	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer-reviewed journal articles manuscripts submitted

Year	Actual
2012	8

Output #2

Output Measure

- Number of final stage experimental bermudagrasses sent to national testing phase in the NTEP bermudagrass trial
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of turf/roadside vegetaion management workshops conducted

Year	Actual
2012	33

Output #4

Output Measure

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

Year	Actual
2012	1753

Output #5

Output Measure

- Experimental turfgrass lines screened for drought resistance

Year	Actual
2012	560

Output #6

Output Measure

- Turfgrass diagnostics conducted

Year	Actual
2012	75

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	New varieties appearing in the Oklahoma sod trade for the first time
2	New turf varieties used by the Oklahoma golf course industry
3	Number of turfgrass manager participants intending to adopt improved turf management practices
4	Water conservation and water quality in turfgrass
5	Development of turf bermudagrasses with improved shade tolerance

Outcome #1

1. Outcome Measures

New varieties appearing in the Oklahoma sod trade for the first time

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since its invention, Tifway hybrid bermudagrass has provided an outstanding lawn and sports field surface in the southern US. Few grasses could rival its visual appeal and functional value. However, Tifway lacks appropriate winter hardiness, so its use across the transition zone (the merger area between subtropical and temperate climate zones) has been limited due to potential of winter kill. A cold hardy hybrid bermudagrass having both the visual and functional characteristics of Tifway yet having superior cold hardiness, has been sought by turfgrass managers for decades. Until recently, only OSU's Patriot hybrid bermudagrass offered quality approaching that of Tifway while having superior cold hardiness.

What has been done
The Oklahoma State University Bermudagrass Breeding and Development Team has been working since 1986 on development of both seeded and vegetatively propagated bermudagrasses having outstanding winter hardiness and improved visual and functional quality. During that time superior cultivars in the form of Yukon, Riviera, and Patriot were developed and released to the turfgrass industry. In 2003 a round of super high quality OSU experimental hybrid bermudagrass lines entered a 9 year trial at Stillwater, OK, going head to head with the industry standard, Tifway. Winter tolerance, quality, color, texture density, sod strength, divot injury and traffic tolerance were assessed during this trial. Two superior lines, OKC1119 and OKC1134 emerged as elite performers against Tifway under Oklahoma conditions and were selected in 2007 for competing in the final stage 5-year long National Turfgrass Evaluation Program bermudagrass test.

Results
The OSU cultivars Latitude 36 (OKC1119) and Northbridge (OKC11134) emerged as top performers in the 2007-2012 multi-state NTEP bermudagrass trial. These lines were licensed to

Sod Solutions, LLC who has since licensed nine sod producers of the OSU products during the 2011 and 2012 time period. In 2012 two sod producers in Oklahoma began production of the two new OSU hybrid bermudagrasses having both visual and functional quality equaling or exceeding Tifway and winter tolerance exceeding Tifway.

As licensed sod producers of Latitude 36 and Northbridge bermudagrass expand their acreage in production, consumers will at last be able to purchase bermudagrass that truly has the traditional visual and functional appeal of Tifway but having cold tolerance exceeding that of Tifway and on par with OSU's Patriot bermudagrass. Transition zone turfgrass managers won't have to play visual appeal against winter hardiness since these characterizes are wrapped into a single package by the name of Latitude 36 and Northbridge bermudagrasses from Oklahoma State University.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #2

1. Outcome Measures

New turf varieties used by the Oklahoma golf course industry

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of turfgrass manager participants intending to adopt improved turf management practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012	1648

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
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Water conservation and water quality in turfgrass

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to a survey from the 2000 National Water Quality Inventory of the United States Environmental Protection Agency, 39, 45, and 51% of the rivers, lakes, and estuaries, respectively, in the United States are not clean enough to support uses such as fishing and swimming. One of the major factors that leads to widespread and significant water body problems is eutrophication, which involves a reduction of oxygen in water usually caused by excessive nitrogen (N) and phosphorus (P).

What has been done
The Oklahoma State University Runoff Research Site was completed in 2001 and updated to accept filter materials in 2011. Runoff collection trenches were filled with steel slag, a byproduct of steel manufacture, to test the slag's ability to filter P from runoff. The P concentrations in pre-filtered and post-filtered runoff were compared during 14 simulated and natural runoff events in 2012.

Results
Trench filters filled with steel slag removed and sequestered 19% of the P that entered in runoff. A model developed using flow through tests in a laboratory and verified by data collected from the trench filters suggested that the filters could accept 183 mg kg-1 P before being spent (saturated to the point where they no longer removed P) and would remove 9% of the P added to the filter over the life of the system.

Trench filters filled with steel slag are a reasonably inexpensive means for removing P from surface runoff. Increasing the effectiveness of a filter is simply a measure of increasing the amount of slag added to the filter. With further development and commercialization, trench filters and other slag filters provide a means for removing P from runoff before it enters surface waters.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
205	Plant Management Systems

Outcome #5

1. Outcome Measures

Development of turf bermudagrasses with improved shade tolerance

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bermudagrass is a very important forage and the most important turfgrass in the southern US. Its massive root and rhizome system provides excellent soil erosion resistance and its fine turf characteristics provide good aesthetic value. It also relatively drought resistant compared with other grasses and can provide a dense perennial cover with or without irrigation. However, it has poor shade tolerance cannot provide aesthetic or functional value on shaded sites.

What has been done
The Oklahoma State University turfgrass team has conducted research concerning light and shade effects on turf for many years. In 2008 we began research to select common bermudagrass varieties that would tolerate low light conditions with the intention of developing improved cultivars for use on moderately shaded sites.

Results
Our development process resulted in three unique bermudagrass lines being advance for late stage testing. Lines OKS-2011-1 and OKS-2011-4 will be entered into the National Turfgrass Evaluation Program (NTEP) Trials in the US for the period 2013 - 2018. Line OKS-2011-3 will undergo further internal development to improve seed yield, fine turf characteristics, and shade tolerance.

Research indicates that OKS-2011-1 and OKS-2011-4 are excellent seed producers in comparison with commercially available fine turf common bermudagrass cultivars and may be made available for licensing to producers as early 2014. Both selections have improved fine turf characteristics and shade tolerance compared with the common bermudagrasses currently available and will provide producers and consumers with improved choices for seeding lawns and other turfgrass areas.

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)

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

Severe drought compromised three roadside weed control trials being conducted for the OK Dept of Transportation by our program. Despite the use of water tankers, inadequate water could not be delivered to actual roadside median trials as the drought continued through year 2. Drought conditions proved highly useful in conducting turfgrass

drought resistance screenings on 560 experimental lines of turf bermudagrass, zoysiagrass, seashore paspalum and St. Augustinegrass. Golf course construction remains relatively stagnant in Oklahoma so installation of new varieties is limited as far as new course construction is concerned. Introduction of new or better adapted varieties is principally limited to fall reseeding efforts of creeping bentgrass and the occasional introduction of new bentgrass cultivars. Problems with development of new purchasing contracts for state agencies limits the ability of certain state agencies from purchasing new combination drift control/spreader adjuvants found to provide equal or superior performance to older, more expensive and problematic
products.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Participants at our turfgrass short courses, conferences, field days and workshops are surveyed by paper copy for opinions and adoption of integrated turfgrass management (ITM) practices. Overall adoption of the ITM practices as a whole is greater than 94%. ITM includes the use of newer or better adapted turfgrass cultivars/species, more effective and or reduced environmental risk pesticides as well as appropriate or improved timing of existing ITM practices.

Key Items of Evaluation

Written post-educational session surveys. Adoption of new or improved turfgrass cultivars, adoption of an improved management practice, adoption of a new, improved pesticide or adjuvant.

V(A). Planned Program (Summary)

Program # 10

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%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	0.0	1.0	0.0
Actual Paid Professional	14.0	0.0	3.0	0.0
Actual Volunteer	7.1	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
350000	0	137732	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
350000	0	137732	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1400000	0	761869	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Strategic planning training and strategic planning for communiites, infrastructure planning, community service plans, medical facilities and services planning, training of county elected officials,

engineering and manufacturing consulting, community economic development studies, community leadership and agricultural leadership development, and entreprenuership 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?

Most of our programs had very limited use of eXtension. E-commerce modules from eXtension are used when relevant, as are ideas on entrepreneurship programming.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	108106	2180593	3510	10000

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	3	5	8

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of community services plans completed

Year	Actual
2012	98

Output #2

Output Measure

- Number of education modules completed

Year	Actual
2012	2

Output #3

Output Measure

- Number of county officer training courses conducted

Year	Actual
2012	53

Output #4

Output Measure

- Number of manufacturing firms receiving applications engineering assistance

Year	Actual
2012	82

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	Leadership Class Graduates Actively Participating in Community or Industry - Leadership Wagoner County
8	Leadership Class Graduates Actively Participating in Community or Industry - Payne County Connections
9	Improving Local Government - County Training 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
2012	1424

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The PRIDE and related employee training programs teaches front line employees good customer service habits and communication skills. This is important in attracting and retaining a customer base - hence maintaining and/or increase jobs, business income and increase community sales tax revenue.

What has been done
During 2012 over 1,000 Oklahomans received PRIDE and PRIDE related employee (customer service) training. This number includes OCES Educators, business owners, managers and other front line works. The PRIDE program is being presented in Spanish to the Hispanic business community. 50 Hispanic entrepreneurs received training in customer service during 2012. The PRIDE Customer service program was modified and a curriculum developed suitable for training youth (4-H/FFA) who are involved in frontline customer service.

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
2012	348

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Of the over 5000 manufacturers in Oklahoma, approximately half are located in rural areas and are extremely important to their local economies. The loss or downsizing of even one of these wealth-generating small or mid-sized companies can have devastating consequences for the host and surrounding communities. These rural firms 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 rural manufacturers, the College of Engineering, Architecture and Technology and the Division of Agricultural Sciences and Natural Resources at Oklahoma State University work in partnership to provide technical assistance through the Applications Engineering program. Since 1997, Applications Engineers have been deployed in the state in collaboration with the Oklahoma Cooperative Extension Service and the Oklahoma Manufacturing Alliance to provide on-site engineering assistance.

Results
In order to receive engineering assistance the client must agree to a post-project impact assessment. This impact assessment is done using procedures developed by the National Institute for Standards and Technology for the Manufacturing Extension Partnership. 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 2012, the Applications Engineers client projects resulted in increased sales of more than $48.0M, while retaining an additional $8.9M in sales that would have otherwise been lost. Further, the expertise provided by our engineers created cost savings of $5.6M, and avoided additional costs estimated at $5.4M. With 163 new jobs created and 60 jobs retained, our projects provided an additional $16.8M to the state?s economy. Finally, we invested over $7.5M in new plant facilities and equipment, for a total economic impact of $92.3M.

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
2012	114

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Affordable Care Act requires not-for-profit hospitals to conduct a community health needs assessment once every three years.

What has been done

In conjunction with the Oklahoma Office of Rural Health, OCES leads communities through this process by working with the hospital to hold a series of community meetings. A wide cross-section of community members attend, and work through several issues related to the hospital's role in the community. This includes developing an understanding of the economic impact of the local hospital, distributing a survey (with both paper-based and electronic versions available) related to health care concerns in the community, discussing current health trends and areas of concern using publicly available data, and using all of these items to develop a plan for the future. The process typically includes 4-5 meetings over a 6-7 month period, and depends on a wide array of community involvement. These assessments are often followed up with requests for feasibility studies related to health services, such as whether it is economically feasible to support a kidney dialysis center in the community or bring in another local doctor.

Results

In 2012, OCES helped 8 communities in Oklahoma complete this process. Many more not-for-profit hospitals are required to complete the process in 2013 (or they will face penalties from the IRS). Oklahoma was the first state to develop a process for leading hospitals through this needs assessment, and the process has been adopted by several states since its initiation. Feedback from the program suggests that the hospitals involved are extremely appreciative of the process, and that they have experienced improved community support as a result. Several hospitals contacted private firms to get an estimate of how much they would charge to take them through this process, with an average cost projection of $10,000 - $20,000. For many rural hospitals this cost is prohibitive, but the assessment is now required by law. OCES helps fill this void by offering our program at no cost to the hospitals.

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
2012	81

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Small businesses in rural areas tend to struggle to establish a market presence and compete in today's economy.

What has been done
During 2012, the Oklahoma State University e-commerce program provided training to over 155 small businesses on how to plan, effectively set up, and promote their websites, which can help address these issues. Of the 2012 participants, ratings for all relevant e-commerce workshops were quite high. Our most popular workshop continued to be the Search Engine Optimization (SEO) program. As more small business owners are becoming familiar with setting up a website, their focus has turned to SEO, or getting their website found on the web. We conducted 8 workshops on SEO during 2012 to a total of 90 participants. Response to the SEO workshops has been extremely positive. About ¾ of all participants had a website before this workshop. After the training, 94% of respondents planned on increasing their web efforts, and 95% indicated that they would be changing the way they marketed their website. We also offered 4 workshops more geared to those business owners without websites, and our "Websites 101" class was attended by 40 different people. We also held 3 workshops targeted towards individuals or small businesses that might want to consider selling online via an online storefront (Amazon or Ebay) instead of building a site themselves.

Results
These half-day, hands-on sessions are positively impacting rural businesses as evidenced by success stories of former attendees. These include those who used simple template-based software programs used in the workshops to set up their own websites (such as www.pineislandrvresort.com in Miami or www.choatesautorepair.com in Ada), incorporated new techniques such as Facebook ads to draw traffic to their site (visit Rhonda's Flowers (Idabel) on Facebook for an example), or made successful changes to their own site (for example, Pryor author Carol Round altered her website www.carolaround.com to begin to collect data on where her visitors are coming from and send them monthly newsletters. Further, anecdotal evidence suggests that the improved advertising offered by a website can increase small business sales anywhere from 20% to over 200%. With average sales of $150,000 (which was the average displayed in a small business report by Mississippi State in 2007) this implies that the e-commerce program increased the revenue of small businesses in Oklahoma by between $4.2M and $42.0M during 2012.

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
2012	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
Retail Trade Analysis continues to be a popular Extension program, providing eight communities with data useful to evaluating their retail development programs and creating new retail opportunities.

Results
For example, Tommy Kramer, Executive Director of the Durant Industrial Authority, requests the reports annually to identify and target new retail establishments for Durant, OK. Particular successes he has had involving this data was securing new, national retail chains like Hibbett Sports and Rue 21 clothing store.

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
2012	96

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma Ag Leadership Program (OALP)empowers and develops emerging agriculture and community leaders. This is very important because members of OALP are strong advocates for Oklahoma agriculture and rural issues.

What has been done
During 2012, 21 participants in Class XV spent 16 days and 26 participants in Class XVI spent 12 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.

Results
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. One member of Class XV is now serving as the Associate Commissioner of the Oklahoma Department of Agriculture, Food and Forestry and another member of this class is the Assistant Vice President for Academic Affairs at Northeastern Oklahoma A&M College. One member of Class XVI is now the Vice President of Organization and Membership at Oklahoma Farm Bureau.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #7

1. Outcome Measures

Leadership Class Graduates Actively Participating in Community or Industry - Leadership Wagoner County

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Faced with significant growth in the region, with the presence of an unique and special natural resource in Lake Fort Gibson for recreation and quality of life, and a strong sense or personal and community identity in the communities of Wagoner and Coweta as well as the rural areas, committed community leaders of Wagoner County need to learn processes and develop strategies to positively embrace "the community" on a larger scale than their town or city. This program introduces and uses a collaborative leadership process to directly address important issues.

What has been done
Leadership Wagoner County is a monthly leadership development program for adult professionals living or working in Wagoner County, Oklahoma. We provide monthly training for a class of 25-30 participants. Our training focus is three-fold: leadership skill development, public policy process engagement, and relevant issues awareness. We strive to not only develop better leaders, but also inspire potential leaders to serve in those roles for their communities and their business.

Racial, gender, age, geographic, educational and professional diversity has always been encouraged in the class-selection process. Training focuses on three major areas: leadership skill development (i.e., public speaking, conflict resolution, etc.), public policy process involvement (local, state and federal government). Training is accomplished through a series of monthly workshops from August through April over a one-year period, for a total of about 72 hours of training. Training sessions are held in a variety of locations around Wagoner County.

Results
Of the 127 alumni to date, over 90 percent are involved in hundreds of local, state, and national and community organizations. Over 50% serve on various boards of directors, and over several are in elected or appointed public positions, including the local chamber of commerce, school boards, city councils and county government.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #8

1. Outcome Measures

Leadership Class Graduates Actively Participating in Community or Industry - Payne County Connections

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A major issue in Payne County is that community leaders across our six communities have very little interaction with each other and their respective communities. They do not fully understand either the strengths or the weaknesses of the entire county. Payne County Connections, the county leadership class, addresses both leadership development and community capacity by giving leaders from all 6 communities an opportunity to meet and develop relationships as well as to learn about factors impacting the county as a whole.

What has been done
Although their program actually started back in September 2011, Class 2 of Payne County Connections, graduated 18 leaders in April 2012. Class 3 is currently underway (start date Sept 2012) and will graduate 12 leaders in April 2013.

Results
The following outcomes have been identified from Class 2.

-Class 2 pointed to "connections" as the greatest impact of the program. As one participant wrote, "I no longer think of Stillwater as my community - I think of Payne County as my community."
-Another participant expressed the idea that it could take a number of years before the full impact of PCC is felt. They wrote, "The impact of PCC will be felt as the program grows and more classes are held, developing a network of citizens dedicated to their local communities with a broader knowledge of the county."
-There was some agreement that the program has an immediate economic impact in that the increased exposure to business and restaurants increases local sales. As one person said, "My family will visit other areas [of Payne County] more often now." She particularly emphasized that her family was visiting new restaurants in the county.

Class participants included individuals from the Cushing City Council as well as the Ripley City Council. Over the course of the program, the participants were introduced to the Mayor of Perkins, the Mayor of Stillwater, a Payne County Commissioner, a state Representative, and a state Senator. Because of these connections, as one participant wrote, "It [PCC] increases our ability to network and have community sponsored events, influence legislation, and share regional ideas."

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #9

1. Outcome Measures

Improving Local Government - County Training Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
County officials and their staffs regularly change dues to election outcomes, personnel flow, and economic conditions. Likewise state and federal programs and regulations aslo change reguraly as do accounting and financial concepts. The County Training Program (CTP) helps train county officeers and their staffs so that their efforts will be efficient and legal.

What has been done
More than ninety percent of short-course participants completing post-course evaluations rank the training as good or excellent. A similar percentage of participants in three hour workshops provide the same ranking. At the semi-annual meetings of our oversight commission, the Commission on County Government Personnel Education and Training, multiple audience members voice strong support for the training and testify to the high value it has had for themselves and other county officials. No audience members have reported any negative impacts or displeasure with the training programs. Finally, following the November elections, several newly elected officials have attended orientations and short-courses.

In September 2012 six morning workshops were offered at the County Officers and Deputies Association of Oklahoma semi-annual meeting, with topics ranging from Economic Development and County Government to Fraud Prevention and Internal Controls. Over 300 attendees received CEU credit for these workshops, including over 100 county commissioners.

Another output during 2012 was the production of the County Government: Government Closest to the People - DVD.

Results
Evaluations by attendees of the County Officers and Deputies Association of Oklahoma semi-annual meeting were overwhelmingly positive. Quantitative impacts such as changed behavior or dollar amounts are not available. The most obvious benefit is that Extension and OSU personnel showed their relevance to every day issues being encountered by county government.

The DVD project received the Regional and National awards of the National Association of Community Development Extension Professionals in the category of Educational Technology - Team Award. Extension personnel in several states have asked "How did you produce it? We would like to do something like this." Two specific cases are Rod Clouser in Florida and Melinda Grismer of Indiana. Grismer asked permission to use our DVD as Indiana's model.

County elected officials report using the DVD when making presentations to civic organizations and to schools. In several instances, county elected officials and county extensions educators have provided the DVD to schools. Upon hearing of the DVD some schools have requested copies. More than 1000 of the DVDs have been distributed.

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

For the County Training Program, the fiscal year 2013 (FY '13) appropriation is $307,166 (the same as FY '12). This is reduced from $400,000 in FY 09, $372,000 in FY '10 and $330,000 in FY '11. These reductions are reducing programs, travel, publications, hence, outcomes and impact.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The impact of the Application Engineer 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 2012, the Applications Engineers client projects resulted in increased sales of more than $48.0M, while retaining an additional $8.9M in sales that would have otherwise been lost. Further, the expertise provided by our engineers created cost savings of $5.6M, and avoided additional costs estimated at $5.4M. With 163 new jobs created and 60 jobs retained, our projects provided an additional $16.8M to the state's economy. Finally, we invested over $7.5M in new plant facilities and equipment, for a total economic impact of $92.3M.

For e-Commerce, surveys delivered immediately after each workshop validated the content and also provided input for related topics of interest for rural businesses. Evaluation results have been very positive for all "Website 101," "Introduction to PayPal," "Getting Your Business Found on the Internet," and "The Ins and Outs of Online Storefronts" workshops. Future workshops will continue to include suggestions from previous surveys and will seek to address hot e-commerce topics, such as Google advertising, Facebook advertising, and Web 2.0 techniques.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Global Food Security and Hunger - 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	10%		10%	
202	Plant Genetic Resources	2%		5%	
205	Plant Management Systems	12%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	14%		20%	
212	Pathogens and Nematodes Affecting Plants	6%		20%	
213	Weeds Affecting Plants	7%		5%	
215	Biological Control of Pests Affecting Plants	9%		5%	
216	Integrated Pest Management Systems	35%		20%	
601	Economics of Agricultural Production and Farm Management	4%		5%	
901	Program and Project Design, and Statistics	1%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	2.0	0.0
Actual Paid Professional	10.0	0.0	5.0	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**
265000	0	187544	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
265000	0	187544	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
957000	0	1037403	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct targeted research on pest status, suppression and IPM approaches
Develop and deliver IPM programs to stakeholders
Develop pesticide applicator education and pesticide information
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?

NaWe contributed to school IPM eXtension

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4022	28401	0	0

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

Patent Applications Submitted

Year: 2012
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	13	14	27

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Stakeholder assessment

Year	Actual
2012	1

Output #2

Output Measure

- IPM schools, conferences and workshops

Year	Actual
2012	34

Output #3

Output Measure

- Pesticide applicator education schools and workshops

Year	Actual
2012	36

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Peer reviewed research publications and extension publications

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	27

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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

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
2012	87500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Winter wheat is grown on 5.5 million acres in Oklahoma for pasture, grain and dual purpose (pasture + grain). Hessian fly has become a prominent pest due to the widespread planting of fly-susceptible wheat varieties. Traditional "fly free" planting dates that were developed in the 1930's appear to be ineffective. Estimates of yield loss suffered by Hessian fly infestations can reach five bushels per acre, when a susceptible variety is infested with an average 1 fly per stem per acre.

What has been done
A Hessian fly screening program (lab and field) was instituted to evaluate new winter wheat releases through the Oklahoma State winter wheat breeding program. Two resistant varieties of winter wheat "Duster" and "Centerfield" were released in 2006. Additional varieties, "Billings" (released in 2009), "Ruby Lee" (released in 2011), and "Gallagher" (released in 2012), are also partially or fully resistant to Hessian fly. In addition, entomologists began evaluating the seasonal emergence of Hessian fly using a recently developed pheromone to better understand its interaction with winter wheat.

Results
Oklahoma wheat producers planted nearly 1.3 million acres to "Duster" and "Billings" in 2012. Duster has been rapidly adopted by Oklahoma wheat growers, changing from 0.3% of acres planted in 2008 to more than 22% of acres planted in 2012, becoming the most planted variety in Oklahoma. Billings was planted in 1.7% of Oklahoma wheat acres in 2012. Of that, a minimum of 5% or 65,000 acres were planted in areas where Hessian fly was documented to be a serious problem in the 2 years previous to 2012 resulting in an estimated $1.73 million in yield savings. In 2011-12, researchers were able to begin to characterize emergence patterns for Hessian fly in Oklahoma.

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 #3

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
2012	2476

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Urban pests are usually unwanted and uninvited house guests, Homeowners, schools and commercial businesses spend more than $255 million in pest control each year for general pest control in Oklahoma.

What has been done
The Oklahoma State Pesticide Safety Education Program offers educational programs targeted at pesticide applicators for certification in General, Structural, Stored Grain, and Ornamental and Turf pest control. Program content includes the use of IPM approaches for managing pests and applying pesticides in a responsible, safe and legal manner. Many programs are held at the Pinkston Educational Facility for Structural and Urban Pest Control. Programs include specific workshops related to pesticide application for initial certification or re-certification for licensure, as well as Extension programs that offer content qualified for Continuing Education Units (CEU's).

These programs allow certified applicators to continually improve their knowledge of IPM and safe use of pesticides.

Results
As of December 2012, 2476 applicators from Oklahoma, Kansas, Missouri Colorado, New Mexico and Texas were certified in General Pest Control and other pest management sub-specialties.

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 #4

1. Outcome Measures

Increase in percent of growers with knowledge of and adoption of Glance n Go aphid sampling procedure in wheat

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat is grown on more than 19,000,000 acres each year in Colorado, Kansas, Nebraska, Oklahoma and Texas. Annual losses from greenbug vary from $500,000 to $130 million and annual losses from Russian wheat aphid range from $400,000 to $10 million. Various Web 2.0 technologies are available to provide up-to-the-minute advice to producers for management of wheat production and pest management.

What has been done

We surveyed 339 growers from these Great Plains states as a pre-survey. Of these, 83% were comfortable using a computer, 65% use Internet farming websites and only 25% use Web 2.0 applications to learn more about wheat production. Less than 14% had ever heard of the iWheat website. In 2012, more than 140 producers and agricultural professionals were introduced to the iWheat website. The demonstration helped them access the site using their smart phones, and showed them how they could scout their fields for green bugs, and get an instantaneous recommendation for treatment decisions. Efforts will continue to provide education on the use of iWheat with follow-up surveys that document the adoption of iWheat tools by Oklahoma stakeholders and the impacts of that adoption to stakeholder's wheat production.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

Integrated Pest Management Saves Money for Oklahoma Winter Canola Growers

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	877000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Canola is a potentially valuable rotation crop for Oklahoma wheat growers. It allows them opportunities to manage difficult grassy weeds such as Italian ryegrass, and cheat while providing them with an additional cash crop. Harvested acreage in Oklahoma has grown from 41 acres in 2002 to over 150,000 acres in 2011-2012 worth ca. $55.8 million. However, insect pests (aphids and caterpillars) regularly infest winter canola throughout winter and spring causing economic damage. In 2012, approximately 15% of the canola acres in Oklahoma were infested with variegated cutworms threating yield losses of nearly 675,000 bushels.

What has been done
Entomologists developed a workable treatment threshold for control for variegated cutworms, and provided it to producers and crop consultants through various media outlets, including the Plant and Soil Science newsletter. Through field scouting and timely sprays, Oklahoma canola producers prevented an estimated 10% yield loss in infested acres.

Results
The timely extension recommendations helped producers save an average of $39 per acre in yield potential. This resulted in $877,000 in potential yield savings in the 2011-2012 canola crop.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Oklahoma Ranchers Get Help With Horn Fly Management

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oklahoma beef cattle production is worth annually $2 billion. Horn flies can cause an estimated $8.5 million loss of production each year. Horn flies are managed primarily by the use of ear tags that are impregnated with an insecticide. In recent years, Horn flies have developed resistance to several of the commonly used insecticides used in ear tags.

What has been done

OSU researchers and extension personnel conducted a result demonstration over 2 years evaluating the combination of patch-burn grazing and rotation of insecticide active ingredients in ear tags for management of horn flies. Ear tags were deployed only after the economic threshold of 200 flies per animal had been reached.

Results

OSU researchers demonstrated that the combination of patch-burn grazing, combined with rotation of insecticide in ear tags can delay buildup of horn fly populations from reaching the economic threshold of 200 horn flies per animal. This strategy allows producers to deploy ear tags at a later time using less chemical inputs. Research has shown a net savings of $5.03/head is likely from this system. It seems reasonable that this system is applicable and feasible for use on operations representing approximately at least 25% of the 1.7 million head of cattle in Oklahoma. The benefits from this system thus could be over $2.1 million per year to Oklahoma producers and a diminished use of chemical inputs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 12

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	13%		5%	
212	Pathogens and Nematodes Affecting Plants	12%		50%	
213	Weeds Affecting Plants	10%		0%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%		35%	
903	Communication, Education, and Information Delivery	55%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	3.0	0.0
Actual Paid Professional	0.3	0.0	3.0	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**
15000	0	123307	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
15000	0	123307	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
50000	0	682079	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

*Establish the **Oklahoma National Institute for Microbial Forensics and Agricultural Biosecurity**, a multi-disciplinary unit to support and address issues of crop and food biosecurity, and their impacts.

*Conduct **scientific research** targeted specifically towards plant pathogen forensics, sociological impacts of terrorism, and other areas of agricultural biosecurity

***Develop an academic "track"** 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

Offer a short course on microbial forensics to prepare State educators, diagnosticians, researchers, extension agents, students and postdocs, producers and first detectors/responders

Develop an **undergraduate course in Agricultural Biosecurity**

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	100	45	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	17	17

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU faculty and staff affiliated with the new Oklahoma Center for Agricultural Microbial Forensics Biosecurity

Year	Actual
2012	40

Output #2

Output Measure

- Number of grant/contract proposals submitted in agricultural microbial forensics and biosecurity

Year	Actual
2012	40

Output #3

Output Measure

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

Year	Actual
2012	17

Output #4

Output Measure

- Workshops to develop the discipline of plant pathogen forensics, train "first responders", and state and national stakeholders

Year	Actual
2012	3

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 forensics-relevant journal articles published
3	Percentage of agricultural producers, handlers and processors employing at least one new (to them)practice to enhance biosecurity

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A biological attack on United States crops, rangelands or forests could have severe impacts. Biocrimes, perpetrated for economic gain, are even more likely. Preparedness requires a strong national security plan that encompasses microbial forensics and criminal attribution. However, U.S. crop producers, consultants and agricultural scientists, unaccustomed to the possibility of intentional pathogen introduction, traditionally focus disease management strategies on prevention, rapid eradication or long-term management. New information, technologies and resources in microbial forensics (human, livestock and plant) are needed to enhance the nation?s preparedness and responsiveness to plant health emergencies.

What has been done
Scientists make presentations to technical groups to advise of research advances and as educational programs.

Results
(1) OSU researchers developed and automated a coding method that captures the results of the commonly used microbial DNA fingerprinting method, Amplified Fragment Length Polymorphism (AFLP), in a portable format that is both reliable and highly discriminatory. The method will be of value for the attribution of pathogenic organisms that might be used in a biocrime.
(2) Bioinformatics research focuses on dealing with large-scale sequencing data, developing novel algorithms and converting them into useful knowledge and products. NIMFFAB bioinformaticists developed two prediction systems for the community. AP-iNET (http://bioinfo.okstate.edu/AP-iNET/) is useful for predicting genome-wide host-pathogen interactions in the model system Arabidopsis-Pseudomonas syringae. This system will be extended to agricultural host-pathogen interaction systems to support the improvement of agricultural productivity, e.g. by reducing yield losses due to pathogens. Another tool, LigPred

is useful in the discovery of novel biomass degrading enzymes. This system could identify and classify "unknown" lignin related enzymes into any of the 50 functional classes of lignin based on EC number. LigPred, which works on full length as well as metagenomic samples, is already actively used by researchers and bioenergy community worldwide.
(3) A new polymerase chain reaction (PCR) protocol for specific detection of a fungal plant pathogen, Fusarium proliferatum, was developed and validated to forensic standards for delivery to the National Bioforensic Analysis Center, Department of Homeland Security.
(4) Bioinformatic pipelines were created for use on mock sample genomic databases to simulate nucleic acid sequencing (454 format) of plant pathogens. Electronic probes (e-probes) were designed and used for BLAST database searches. They were validated with sequencing data sets containing genome sequences of plant pathogenic viruses, bacteria and fungi. Representatives of all pathogen groups were detected in metagenomic samples containing mixed microbial and plant sequences when the pathogen reads were 1.34% or greater.

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
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Number of forensics-relevant journal articles published

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Important national research and policy initiatives in homeland security have engendered a need for additional personnel, trained and experienced in fields such as microbial forensics and food safety. A new national priority for enhanced food safety requires novel diagnostics, advanced traceback capabilities in the event of foodborne disease outbreaks, and mitigation strategies has

been set. Federal agencies, such as FDA, CDC, USDA, and private fresh produce industries are all impacted.

What has been done

Results

(1) Greater national attention is now directed towards understanding routes of contamination of fresh produce, including wildlife and insects. In efforts to understand the factors involved in vector competence of human pathogens, OSU researchers compared transmissibility of two human foodborne pathogens, E. coli O157:H7 and Salmonella enterica, using two filth fly species and determined that E. coli was transmitted 10-15 x the level of Salmonella. They also observed bacteria like organisms on 100 percent of the tarsi and labellae of blow flies exposed to both Salmonella and E. coli O157:H7.
(2) NIMFFAB, in conjunction with American Phytopathological Society, hosted the Human Pathogens on Plants Workshop in February 2012. Over 100 university, government, and industry representatives attended this 3 day conference. Attendee survey tools indicated changes in both knowledge and attitudes, attributable to the workshop (% agreement after workshop/% change from pre-workshop survey): awareness of cross-disciplinary research (94/10); interest in collaboration with other discipline (94/3); aware of key research areas (55/28); familiar with FSMA (77/24); familiar with FDA efforts (88/10); know two other professionals within discipline (91/11); know two other professionals outside of discipline (95/25); opportunities for new collaborations (88/3); annual conference is best way to network (87/8); annual conference is best way to exchange knowledge (87/5); poster sessions increased my knowledge (95/4); themed sessions were effective (90/2).
(3) The recent Listeria outbreak in cantaloupe, and previous associations of melons with Salmonella food poisoning motivated OSU researchers to study the interaction of Salmonella with a common melon plant pathogen. They found that the mesocarp of a low percentage of cantaloupe fruits that developed from flowers inoculated with Salmonella Poona (SP) alone, or from those receiving SP-Erwinia tracheiphila (Et) mixtures, were PCR positive.
(4) OSU researchers also found that inoculation of fruit rind cracks with SP-Et, but not SP alone, caused water-soaked lesions on fruits and SP was recovered from the mesocarp of 17% of co-inoculated fruits.
(5) Researchers concluded that the presence of the cucurbit bacterial wilt pathogen, Erwinia tracheiphila (Et), influenced SP survival on or in the blossoms or fruit. Salmonella population increased by 39% and 45% from the initial inoculum level on SP only and SP+Et inoculated blossoms even though the flowers had dehisced. Et inoculated into the flower was later detected in fruits and stems. Inoculated flowers fell prematurely, some fruit rinds had watersoaked lesions and plants wilted and died.
(6) Within the Food Safety research group in NIMFFAB, the research of Ph.D. student Dhiraj Gautam was completed and one Masters student (Chris Timmons) graduated and thesis was published.
(7) Our research on E. coli 0157:H7 and Salmonella reveals the nature of human pathogen - plant interaction. Whether the bacteria can be disseminated by insects, colonize plant surfaces, invade interior plant tissues, move systemically, increase in titer, and persist are critical to assuring safe produce.
(8) Five food safety research papers were submitted and accepted or published.

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
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Percentage of agricultural producers, handlers and processors employing at least one new (to them)practice to enhance biosecurity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Important national research and policy initiatives in homeland security have engendered a need for additional personnel, trained and experienced in fields such as microbial forensics and food safety. The Bureau of Justice Statistics (BJS) recently identified an increasing backlog of forensic casework due to a shortage of forensic analysts. The BJS's call for 20% more traditional analysts is compounded by the additional need for analysts in the newly emerging sub-disciplines of microbial and agricultural forensics. In addition, there is a need for those in federal agencies, Cooperative Extension, and law enforcement, to receive training specifically related to response in a plant health emergency, and to practice their respective roles and responsibilities.
Note: Most of the OSU faculty and staff on the Agricultural Biosecurity Team have appointments with high percentages in research. The metrics required for the NIFA report involve documentation of changes in methods, practices, suppliers, etc. through surveys, personal contacts, etc. In the past, research personnel have not used surveys to measure and document such changes. Although many of the Ag Biosecurity team members have plans to use such surveys in conjunction with extension/outreach activities, we do not have such results for 2012.

What has been done

Results

(1) The course, ENT/PLP 2143, "Global Issues in Agricultural Biosecurity and Forensics" was taught for the third time during the spring of 2012. The aim is to introduce undergraduate students to the fundamental components of an effective agricultural biosecurity system by

providing insights and practical understanding about how all components of a biosecurity system operate and integrate, facilitating the understanding of the relevance of the sciences involved in agricultural biosecurity and microbial forensics. This course provides broad information to a variety of majors, but also serves as a springboard for students considering careers in agricultural biosecurity, microbial forensics, related research, or roles in agricultural biosecurity agencies. Areas covered are:

a. Scientific and political definitions of biosecurity in its broad sense, to include microbial forensics, bioterrorism, biowarfare, biosafety, invasion biology, emerging pathogens, and invasive species.

b. Quarantine, response and surveillance.

c. Detection, diagnostics and forensics technologies.

(2) The course, ENT/PLP 5560 "Human Pathogens on Produce" was taught for the first time by Dr. Li Maria Ma. The aim of this course was to introduce graduate students to concepts of food safety microbiology as it applies to the unique situations encountered by human pathogens intersecting with plants. A combination of field site visits, lecture, and discussion, graduate students get the latest food safety information and exposure to practices that prepare them for careers in food safety and food biosecurity.

(3) One workshop on primer design was presented at Oklahoma State University to research scientists affiliated with Pioneer International. The goal of the three day workshop was to teach researchers how to design more specific primers for more sensitive detection of pathogens. A similar workshop was held in Venezuela.

(4) A successful Bioinformatics workshop was held in August 2012 that combined efforts of R. Kaundal (ICREST) with those of the Bioinformatics Certificate Program and Entangled Genomes. Research scientists, post-docs, and graduate students benefitted from expertise from iPlant researchers to learn the latest techniques in next generation sequencing and bioinformatics analysis.

(5) The 2nd 4-H Summer Camp was held at Oklahoma State University in June 2012; attendance included 16 teenaged 4-H youth and six Extension Educators. Evaluation forms from both adults and teens were extremely positive.

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

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

(1) Increased restrictions on the ability of foreign nationals to work on certain biosecurity-related (and dual use) projects funded by federal security agencies has affected the ability of some NIMFFAB faculty to work on these projects and also has led to our stated preference for U.S. citizens when bringing faculty members, graduate students and postdocs into our programs.

(2) A number of high-profile food-borne pathogen outbreaks occurred in 2012, continuing a multi-year trend in the increase of foodborne illnesses, including Listeria monocytogenes, E. coli 0145, and Salmonella in various fresh fruits and nuts. As a result, food safety was again named as one of the major S&T focus areas for the Obama administration (and a priority for the White House Office of Science & Technology Policy). Further, food safety also was named as one of the five major Emphasis Areas for 2012 NIFA proposals. These factors place NIMFFAB food safety researchers in a position to take advantage of potential new funding streams.

(3) Significant cuts in Federal spending on biosecurity resulted in a change in our Memorandum of Understanding with the National Bioforensic Analysis Center. AlthoughNIMFFAB remains an official "Spoke Laboratory" of the NBFAC we are not currently receiving funding from them for specific research or deliverables. It is hoped that ourprojects can be picked up again when funds become available.

(4) The new Food Safety Modernization Act mandates that the FDA develop new regulatory policy on food contamination by human pathogens, intensifying the agency's desire for targeted research to provide the scientific foundation for new regulations and focusing more USDA and NIH funding attention on food safety research.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NIMFFAB was awarded 3rdplace in the 2012 **OSU President's Cup Award for Creative Interdisciplinary Research.**

Key Items of Evaluation

The School of Forensic Sciences received a renewal of our accreditation from the American Academy of Forensic Sciences (2012-2017). Included among the items evaluated

was the overall quality of graduate student research, for which the School of Forensic Sciences was congratulated.

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Global Food Security and Hunger - 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	40%		60%	
602	Business Management, Finance, and Taxation	25%		10%	
603	Market Economics	15%		10%	
607	Consumer Economics	5%		10%	
610	Domestic Policy Analysis	15%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	0.0	3.0	0.0
Actual Paid Professional	5.0	0.0	2.0	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
160000	0	61421	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
160000	0	61421	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
500000	0	339752	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research based information developed

Decision aids developed that assist farm and agribusiness managers in improved decisions

Educational programs conducted that improve the management skills of farm and agribusiness managers

Farm and agribusiness managers are able to better understand economic consequences and make more informed decisions

2. Brief description of the target audience

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

3. How was eXtension used?

Team member Phil Kenkel was a founding member and recently elected vice-chair of the Cooperatives Community of Practice in eXtension which was launched in October of 2010 as part of National Cooperative Month. During 2012 he developed a new section of the COP for Grain and Farm Supply Cooperatives and created four publications for the new section. Dr. Kenkel also chaired the peer-review panel that reviews and edits publications and material for all areas of the COP. He also chairs the finance area of the COP and have developed a number of publications which are under peer review will come out in
2013.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5199	518604	34	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	33	23	56

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

Year	Actual
2012	35

Output #2

Output Measure

- Number of software decision analysis aids developed

Year	Actual
2012	3

Output #3

Output Measure

- Number of manuscripts submitted to refereed journals

Year	Actual
2012	49

Output #4

Output Measure

- Number of farm income tax managment schools conducted

Year	Actual
2012	11

Output #5

Output Measure

- Number of economists trained at other universities to deliver packer-feeder workshops and classes

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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
2012	2100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Frequent changes in Federal and Oklahoma State Tax Laws create a need to keep tax preparers informed of the impact of the changes and how to best help their clients utilize the tax planning and management opportunities available in the current tax laws. These tax schools are designed to update tax preparers about new laws and regulations covering farm, non-farm business and individual taxpayer issues.

What has been done
This program has been conducted for the past 47 years. It has grown from a one-day seminar to its present form of two days per location for the fall Farm and Business Tax Institutes and the summer Tax Clinic. The combination of all the schools allows a preparer to get the full 40 hours of CPE/CLE as required by state. Topics covered range from presentation of new tax laws and their implications, agricultural issues, business issues, tax planning opportunities, professional ethics, retirement, and social security to name a few. Twelve two day sessions are conducted each year with two of these in the summer and ten in the fall and two one day special topics courses. Total 2012 attendance for the schools was approximately 2,100 tax preparers in 11 workshops. Certified public accountants make up 46 percent of the attendance, 27 percent are tax preparers and bookkeepers, 10 percent are enrolled agents, 2 percent are attorneys, and the remaining 15 percent come from a variety of backgrounds. These tax preparers file roughly 80 percent of the farm returns for taxpayers in the state of Oklahoma.

Results
High quality, professional instruction is provided to make continuing education credit available for Certified Public Accountants, Enrolled Agents, and Tax Attorneys. Many of those attending have stated that they have been coming to these programs since they began. Participants filed more than 37,645 Federal farm tax returns and 255,428 Federal non-farm tax returns as reported by the participants in the most recent program evaluations. Most of the tax preparers that attend are

from Oklahoma however there have been preparers from Kansas, Texas, New Mexico, Arkansas, Florida, and California attending the program in order to maintain their Oklahoma accreditation.

This is roughly 65 percent of the total farm returns filed in Oklahoma. A recently added question asked the participants 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 estate planning tools. The participants were asked specify a value per return they filed which averaged just slightly greater than $80.00 per return. Therefore using the number of participants willing to provide this information (roughly 25% of the participants) and the average number of returns completed by this group annually (250 returns) the value of the tax schools is over $10,000,000 for 2012.

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)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	150

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The board of directors of an agricultural cooperative has responsibility for strategic decisions and for safeguarding the organizations assets. Agricultural cooperative board members are producers who are elected by the membership to serve with only token remuneration. In recent times, all board members, including cooperative board members are under intense scrutiny. The incidence of legal proceedings against board members has increased dramatically. These litigations are typically initiated by owner (member) groups and they focus on the competency and diligence of the board. The severe repercussions from errant business decisions and the intense scrutiny of board member competency have created a critical need for educational programs.

What has been done

In response to the critical need to improve the competencies of cooperative board members the Oklahoma Credential Cooperative Director (OCCD) program was created. The OCCD program involves two days of training on finance, legal responsibilities, parliamentary procedure, effective meeting management, strategic planning and other related topics. In designing the OCCD curriculum, board of director training material from across the U.S. was examined. OCCD instructors include OCES faculty as well as industry experts including bankers, auditors, attorneys and consultants. The OCCD program is delivered simultaneously at a central location and via two-way interactive video at eight remote locations across Oklahoma.

The OCCD program was initiated in November of 2001 Since its inception, the program has been offered eleven times (spring and fall) with nine advanced sessions. Over 3,600 directors have attended the Credentialing sessions and over 1,500 directors have returned for advanced training.

Results

The directors completing the OCCD program have a better understanding of financial management and the legal roles and responsibilities of the board of directors and are able to make better business decisions and to safeguard the assets of their cooperative organizations. Currently there are over 150 Credentialed directors representing 44 cooperatives and over 150 more directors who are progressing through the credentialing training. Over 400 directors from 37 separate cooperatives have attended an advanced session. Twenty cooperatives have achieved the status of having every board member credentialed. The typical Oklahoma cooperative includes 1,500 or more farmer members and organizational assets of over $10 million. The OCCD program impacts thousands of Oklahoma producers by enhancing the board?s ability to manage and safeguard cooperative assets

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics

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
2012	71

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production management, business planning, risk management and marketing are major issues for the beef producers who comprise Oklahoma's #1 agricultural industry.

What has been done
David Lalman, Animal Science, and Damona Doye developed a comprehensive educational program in cooperation with Animal Science, Plant and Soil Science, Vet Med, Biosystems and Ag Engineering . The OSU Master Cattleman Program was launched in 2004 with the objective of enhancing the profitability of beef operations and the quality of life of beef producers by equipping them with vital information on many aspects of beef production, business planning, risk management and marketing. The educational curriculum is based on the Oklahoma Beef Cattle Manual. PPTs and lesson plans are available to educators via the Master Cattleman website. Producers must complete 4 hours in each of 6 subject matter areas plus an additional four hours of instruction or special projects. Local Extension educators plan and organize the Master Cattleman educational series and select the specific curriculum offered.

Results
71 producers were certified under the OSU Master Cattleman Program in 2012

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 specialty crop producers and goat producers improving farm management and/or financial management skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production management, business planning, risk management and marketing are major issues for meat goat producers. Meat goat production is an important enterprise for small and medium scale farmers and for those beginning a farming operation.

What has been done
The Oklahoma Meat Goat Boot Camp is a three day camp that uses the combination of classroom exercises and hands-on instructions about the different production practices involved in a meat goat operation. Production practices include but are not limited to ear tagging, castrating, tatooing, hoof trimming, electric fence building, forage testing, forage production, farm business planning, nutrition, ration balancing, FAMACHA, determining fecal egg counts, herd health practices, kidding, neonatal care, reproduction and pregnancy determination using ultra sound. Class size is small to facilitate teacher-participant interaction.

Results
50 producers from 5 states participated in the meat goat boot camp in 2012. The participants knowledge and understanding of a wide range of production issues including: parasite management and control, record keeping, general herd management including herd health, herd nutrition, forages and forage production systems, marketing and business planning were measured by administering tests before and subsequent to the training. Average test scores improved from 58% correct to 80% correct. While it is difficult to place a dollar value on the knowledge gain, it is obvious that the educational program increased the efficiency and profitability of the participants operations.

The overall value of this program is best determined by using the producer's own estimation of the average value ($/head) gained from the workshop, the average number of goats per participant and the total number of participants. By this estimation the value of the OSU Meat Goat Boot Camp was $689,430.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Wind Energy Leasing Issues

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Due to significant, rapid development of wind power leasing programs by a number of developers, stakeholders have been confronted with numerous issues related to wind energy leasing agreements. As of requests from such stakeholders, OCES county extension educators and other agency personnel have requested programming regarding these concerns.

What has been done
Programmatic response: programs providing basic education with respect to wind power and renewable energy and guidelines for lease evaluation were devised and presented. Over 3.000 producers attended 40 workshops held at various locations in Oklahoma in 2012. As a result of the training the individuals are better able to understand and negotiate wind energy lease arrangements.

Results
To better understand the impact of this education, an example would be in order. A typical wind energy contract can provide in excess of $7,500 per year to the landowner with only one turbine. Some of the more wind-dense areas of Oklahoma can support up to four turbines per quarter-section (160 acres) of land and generate sufficient electricity to support annual payments of approximately $10,000. Thus, the successful negotiation of a wind energy lease can have significant economic impacts for landowners. At the $7,500 single-payment level, a 30 year lease agreement (typical for many Oklahoma leases) would have a total lifetime payout of $225,000 (NPV of $147,003 at 3% discount rate) and a $10,000, four-turbine parcel would have a total lifetime payout of $1.2 million (NPV of $784,018 at 3% discount rate).

4. Associated Knowledge Areas

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

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

Two years of sever drought have changed some programming emphasis.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

2012 Meat Goat Boot Camp

Of the 50 participants, this was the first extension program that 37 had attended. When asked to rank the topics that were the greatest of value to them the top five sessions were:
FAMACHA Eye Scores and Fecal Egg Counts
Parasite Life Cycle Management
Goat Nutrition
Hay Evaluation
Birthing and Neonatal Care
83% of the participants plan to adopt one or more of the production practices discussed at the workshop. Pre-test scores averaged 17.0 with a standard deviation of 3.84 and a range from 2-25 correct. Post test scores averaged 23.3 with a standard deviation of 3.25 and a range from 14-29 correct. This test shows a 37.1% increase in knowledge gained from the workshop.
There were five questions that showed an increase in knowledge of over 100%.
When the pre and post test questions are grouped by subject matter there are seven subject matter groups. Below are those subject matter groups and the change in knowledge gained for each group.

- Marketing - 114.55%
- Nutrition - 83.61%
- Forages - 49.18%
- Parasite Control - 37.8%
- General Herd Management - 24.57%
- Business Planning - 18.52%

- Record Keeping - -10.59%

Oklahoma State University Tax Schools

Oklahoma State University Tax Schools provide a quality tax education experience for income taxpreparers. Participants in these schools have indicated on the evaluation form that they file approximately 1.5 million Federal income tax returns which include about 55,500 Federal farm returns. The participants were asked specify a value per return they filed which averaged just slightly greater than $80.00 per return. Another question on the evaluation asks the participants to tell us why the select to attend the OSU tax schools. More than 20 percent indicate that they like the quality of instruction, 17 percent indicate the quality of the materials, and 16.5 percent like the depth and variety of topics covered. Participants often indicated more than one reason for attending.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Global Food Security and Hunger - Sensor-Based Technologies for Agricultural and Biological Systems

☐ Reporting on this Program

Reason for not reporting

While important work in this area continues, the team has decided that planning and reporting will be done through other teams, in particular the Crop Enterprises Planned Program.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	2.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct research into nutritional and pest management needs of wheat, corn, cotton, native, improved pasture, and turf grass in relation to sensed properties. Conduct research into animal grazing system to optimally manage plant and animal subsystems. Conduct research to invent and improve

sensors and control systems for agriculture production and processing systems. Conduct research to create decision support systems incorporating sensors into plant and production systems.

2. Brief description of the target audience

Crop and livestock producers, food processors, input suppliers, equipment manufacturers, limited resource producers, producers in developing nations..

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	9	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Training sessions and demonstrations for use of new technologies and applications

Year **Actual**

2012	0

Output #2

Output Measure

- New technology applications

Year	Actual
2012	0

Output #3

Output Measure

- Number of trained extension personnel using hand-held sensors with producers

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Commercialization of hardware/instrumentation
2	Number of producers adopting and practicing sensor-based technologies
3	Number of acres where sensor-based technologies are applied

Outcome #1

1. Outcome Measures

Commercialization of hardware/instrumentation

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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
{No Data}	null

Outcome #2

1. Outcome Measures

Number of producers adopting and practicing sensor-based technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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
{No Data}	null

Outcome #3

1. Outcome Measures

Number of acres where sensor-based technologies are applied

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Other (commercialization opportunities)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 15

1. Name of the Planned Program

Sustainable Energy - Bio-Based 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%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	4.0	0.0
Actual Paid Professional	1.0	0.0	9.0	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
20000	0	369922	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
20000	0	369922	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
200000	0	2046236	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Project proposals: **53**
- Technical presentations: **118**
- Technical papers: **10**
- Journal articles (indicate which are Extension or Research):
  - Research: **33**
  - Extension: **4**
- Patent Applications Submitted and/or Awarded (List complete citation of awarded patents.): **2 provisional patents submitted**
- Products taken to commercialization by industry: **0**
- Educating producers on production and harvesting practices: **50 educational videos**
- Educating producers on contracting crops for use in bioenergy: **0**

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

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	19	0	0	0

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

Patent Applications Submitted

Year:	2012
Actual:	2

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	4	33	37

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Journal Articles

Year	Actual
2012	33

Output #2

Output Measure

- Technical papers and presentations

Year	Actual
2012	128

Output #3

Output Measure

- New processes developed

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Products/processes taken to commercialization by industry
2	Harvesting and Logistics
3	Biochemical Conversion Technologies
4	Thermochemical Conversion Technologies
5	Modeling and Economics

Outcome #1

1. Outcome Measures

Products/processes taken to commercialization by industry

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The production of biofuels has increased due to rising energy prices, the desire for less dependence on foreign oil, and favorable government policies. Most current ethanol plants in the U.S. are corn-based, but in the state of Oklahoma corn production is not a major agricultural activity. However, perennial grasses and annual forages in this state have shown to be viable renewable biomass feedstocks. Switchgrass, a plant native to Oklahoma, has been deemed one of the best options as a sustainable feedstock to support a biorefinery.

An inventory of expressed genes in switchgrass tissues (expressed sequence tags or ESTs) will provide an important tool for assembling the complex switchgrass genome sequence. These ESTs also provide a source of markers for developing high density genetic maps. Such maps will be valuable for marker-assisted breeding to accelerate the pace of switchgrass cultivar development. Identifying expressed genes in particular tissues that contribute to key traits, like tillering, will provide the genomic tools for manipulating the trait for increasing biomass of switchgrass.

Improving biomass yield is a major target trait for biofuel plant species. However little progress has been made to date, because biomass production is a highly complex trait and the relevant genes/factors that control this trait have not been identified. Our research discovered that miR156 negatively regulates the expression of SPL transcription factors in plants and this regulation is required to promote vegetative phase transition to reproductive phase. By manipulating miR156 levels, such phase transition can be inhibited, thus plants will remain in a vegetative phase that, in turn, will contribute for biomass enhancement.

What has been done

Feedstock Development

Affymetrix gene chip analysis using a high and low tillering line has led to the identification of

nearly 2,000 genes that are differentially expressed in these tissues.
In collaboration with the Zengyu-Wang?s lab at the Noble Foundation, we engineered overexpression of miR156 in switchgrass.
We have been studying the mechanism of leaf blade outgrowth orchestrated by the homeobox transcription factor STF in the model plant Medicago truncatula. We are now one step ahead in identifying this gene as a repressor and revealing its repressor domain(s). This is a major step in defining the mechanism of STF function at the molecular level. WOX genes have been categorized into three clades: ancient, intermediate, and modern/WUS, based on phylogenetic analysis. A functional basis for this classification was not established. Using the classical bladeless lam1 mutant of Nicotiana sylvestris as a genetic tool, we examined the function of the Medicago truncatula WOX gene, STENOFOLIA (STF), in controlling leaf blade outgrowth. We found that fusion of either the WUS-box or an exogenous repressor domain to members of intermediate and ancient WOX clades results in a gain-of-function ability to complement lam1 blade outgrowth. These results suggest that modern clade WOX genes have evolved for repressor activity by acquisition of the WUS-box.
In an effort to determine how STF represses its target(s), we identified protein-protein interacting partners by yeast two-hybrid screens as we planned. One of these interactors is found to be TOPLESS (TPL). TPL is one of two co-repressors known in plants. We found that deletion of the WUS box and STF box of STF, which are required for repressive functions, abolishes interaction with TPL. We have narrowed down the interaction domains to single amino acid residues in each of these two domains. This finding suggests that the repressor domains are important perhaps for recruiting the co-repressors. To test if TPL is a critical factor that interacts with the repressor domains in determining the function of STF, we fused the full-length TPL to the truncated form of STF lacking the repressor domains and transformed it into the lam1 mutant. We found that this fusion construct complements lam1, suggesting that the function of the repressor domains indeed is to recruit TPL. Since TPL is known to interact with the auxin signaling machinery, this exciting discovery also discloses the connection of STF to the phytohormone auxin. In addition, we have also identified the actual STF target that is repressed by the STF/TPL repressor complex. This transcriptional repressor complex and its target clearly define how a meristem-like function is maintained for cell proliferation at the adaxial-abaxial junction of the leaf primordium.

Feedstock Production
To verify sweet sorghum yield potential under various environmental conditions, field trials have been conducted around the state. In addition, agronomic studies have been completed to determine the effects of fertilization, staggered planting dates, row spacing, and irrigation requirements on sweet sorghum quantity and quality.

Results

Feedstock Development
We have identified five key regulatory genes that can be useful for increasing tiller number in switchgrass.
By overexpressing miR156 in switchgrass, it was shown that tiller numbers are increased by 5-6 folds, which increases biomass production by 80-100%.
Transformation of STF into switchgrass using the maize ubiquitin promoter resulted in increased plant height, leaf size, and stem thickness, indicating that the pathway is functional in monocots as well. Interestingly, these switchgrass transgenic plants accumulate approximately two-fold (95-97% more) total biomass based on fresh weight and dry weight measurements at maturity, suggesting that STF-related master transcriptional regulators may hold the key to biomass feedstock improvement in C4 grasses. These transgenic plants also produce more soluble sugars per unit biomass compared to the controls. To our knowledge, this is the best success in switchgrass biotechnology to date. This demonstrates that our approach is valid and STF can be

used to manipulate biomass in annual and perennial dedicated biofuel crops. However, these transgenic lines have not been tested in the field due to regulatory hurdles.

The key results obtained from our STF research are:
-STF acts as a transcriptional repressor for its major function in leaf blade development.
-Two conserved domains at the C-terminal domain of STF protein, WUS-box and STF-box, mediate the repression function of STF.
-STF interacts with corepressor TOPLESS via its WUS-box and STF-box domains, and this interaction is critically required for leaf development.
-STF expression in switchgrass increases total biomass by approximately two-fold under greenhouse conditions. So, we have produced transgenic switchgrass plants that show 95% improvement in biomass yield over control transformed lines derived from the same callus.

Feedstock Production
Policy makers and researchers are concerned about the potential impacts of bioenergy crop production on water resources. This has been a focus of our field and modeling studies since 2010. Because bioenergy and water resources are typically studied by different science disciplines, dissemination of scientific information has been hindered. To address this problem, Ochsner organized a special symposium at the ASA, CSSA, and SSSA International Annual Meeting in Cincinnati, OH on Oct. 21-24, 2012. The symposium was entitled "Impacts of Bioenergy Crops on Water Quantity and Quality," and included invited keynote speakers from the disciplines of agronomy, hydrology, biosystems engineering, and climatology. This symposium resulted in increased awareness of research needs and activities related to the bioenergy-water nexus. Growing awareness of these needs is indicated by the fact that this topic area was one of two priority areas identified by USDA and DOE for the 2013 BRDI funding opportunity.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Harvesting and Logistics

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma State University was awarded a USDA Biomass Research and Development Initiative (BRDI) in 2009. The project objective was to develop practices and technologies necessary to ensure efficient, sustainable, and profitable production of cellulosic biomass. Using large-scale feedstock production research fields, the economic and environmental sustainability of switchgrass, mixed-species perennial grasses, and forage sorghum will be evaluated. Feedstock quality and logistical performance characteristics will be assessed under various harvest, handling, and storage scenarios. Production and logistic economic models will use the data produced from the large-scale experiments to determine if an integrated landscape vision of diversified species can provide a flow of feedstock throughout the year to a cellulosic biorefinery at a cost that will enable cellulosic biofuel to compete with gasoline.

What has been done
The harvesting field work on the BRDI project was completed in February 2013. Currently only basic and preliminary results are available. In 2010, the harvesting studies include a total of: 93 acres of forage sorghum; 638 acres of switchgrass; 492 acres of mixed grass. During the 2010 season, 618 bales of forage sorghum, 637 bales of mixed grasses, and 1,677 bales of switchgrass were produced.
The Oklahoma drought continued into 2012 and significantly impacted the total number of acres harvested. In the Panhandle the mixed grass and roughly half the switchgrass acres were a complete loss. In 2012, about 440 acres of switchgrass at four locations - 145 acres of sorghum at two locations, 116 acres of switchgrass in Chickasha, OK, 16 acres of mixed grass in Chickasha, OK, and 133 acres of mixed grass at two locations - were harvested. During the 2012 season, 754 bales of forage sorghum, 167 bales of mixed grasses, and 970 bales of switchgrass were put up as part of the project.

Results
The following are preliminary outcomes/observations for the BRDI harvesting, handling, and storage project:

Commercial equipment is available to harvest, package and provide in-field transportation and bale stacking, but there is room for improvement.

Forage sorghum can be naturally dried in the field and baled in Oklahoma with proper conditioning and cooperating weather conditions. Dry down times can be as little as five days under optimum conditions

Better bales are produced when forage sorghum is properly conditioned. Bales made from forage sorghum with minimal mechanical conditioning are difficult to construct, have a higher failure rate, and are often misshapen.

Older stands of high yielding switchgrass are extremely difficult on equipment tires.

In-bale moisture variability is a major issue, assuming biorefineries are going to purchase biomass based on dry weights.

Rotary disk blades dull faster when harvesting switchgrass after the first freeze as compared to before the first freeze.

Optimal harvesting would include three windrowers for every high density baler and four balers for every Stinger loader. The Stinger can handle between 100 to 150 bales per hour when moving the bales to the edge of the field.

Raking is not generally required for harvests after a freeze in switchgrass and mixed grass, unless it is economically feasible to combine windrows prior to baling.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Biochemical Conversion Technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Currently, high capital costs and technological obstacles are hindering the development of a viable biorefinery industry. Challenges in the biochemical conversion route include high cost of pretreatment and enzymes and lack of microorganisms that can efficiently co-ferment C5 and C6 sugars. In comparison, the major challenges for the hybrid conversion technology are mass transfer limitations due to low gas solubility in the medium, low cell productivity, enzyme inhibition and the high cost of fermentation medium. As such, advancing the knowledge base in various

aspects of the conversion processes to make them sustainable and profitable is essential, which are the goals of this research program.

Methods to capture and store renewable energy sources that cannot respond to power demand are needed. In addition, ways to capture and utilize CO2 from industrial processes will become more important to mitigate climate change. Our team is using a unique bacterium, Clostridium carboxidivorans, which feeds on H2 and CO2 to provide a solution to both of these challenges. C. carboxidivorans can produce ethanol, butanol, and hexanol from CO2 and H2. H2 can be generated from water by using renewable electricity (wind and/or solar power) and CO2 can be captured from power plants or other industrial sources. Ethanol is currently used as a biofuel, and butanol and hexanol are used in the chemical industry; butanol is a gasoline substitute and can be converted to jet fuel and hexanol is a jet fuel substitute.

Wind power is expanding throughout the world, including Oklahoma. Wind power has great potential for reducing our carbon footprint and providing rural landowners revenue, but a key problem is that it cannot provide baseline power. In other words, wind power production is not tied to power demand, so if more power is needed at certain times, one cannot increase power production by making the wind blow more. Also, if demand is reduced, one can't shut off the wind. In order to stabilize the peaks and valleys due to wind power's variability, a type of energy storage system is necessary to store energy when it is produced at a faster rate than it is consumed. A group of students and faculty at OSU have proposed using excess wind energy to generate H2 using water electrolysis. Anaerobic bacteria would consume the H2 and CO2 from and industrial source and produce ethanol. The team has named the process BioWinol.

Wheat, microalgae, and oilseeds present good potential for establishment of local biorefinery systems which would produce a number of bioproducts for local consumption and exports. Establishment of new and successful manufacturing sectors requires innovative product concepts and process development.

What has been done

Clostridium carboxidivorans has been identified as a bacterium that can effectively produce ethanol from CO2 and H2 in our studies. Also, a nutrient media was developed for the process. We have successfully used a hollow fiber membrane to diffuse gas into our medium. The membrane has been shown by other researchers to increase mass transfer rates by 20-fold over traditional stirred tank reactors. Also, we used a pH control to boost cell production. We successfully produced ethanol, n-butanol, and n-hexanol from CO2 and H2.

We are developing novel biocatalytic conversion processes for production of n-butanol and other chemicals. This technology has the potential to produce butanol with yields 20% higher than traditional ABE technology. We have submitted an invention disclosure on this technology to OSU Technology Development Center (TDC). The University Intellectual Property Screening Committee unanimously agreed and recommended that OSU retain rights to this invention. The TDC office is assessing our invention patentability and market potential.

Low cost wheat, microalgae, and oilseed processing techniques have been developed and optimized. These processes are environmentally benign and easy to operate. Hence, they can be adapted by small processors in the state. It might also be possible that these products could be commercialized by farmer's cooperatives.

Sweet sorghum activities this past year include the following:

Completed installation of a farm-scale dewatering/distillation system

Developed an economic feasibility template for use by potential sweet sorghum processors around the country

Assisted in establishing the Sweet Sorghum Ethanol Association for sharing knowledge and experience related to sweet sorghum ethanol

Results

For the biochemical conversion technology, the projected economic impact of the biorefineries to the local communities in Oklahoma can be over $1 billion per year and create over 400 direct jobs. To realize this benefit, the novel biocatalytic conversion process for butanol production should be implemented at significant levels. Ample opportunity exists for such undertaking. For example, it is estimated that 315 million gallons per year of butanol produced in 10 different facilities would be required to satisfy 25% of the 1.26 billion gallons of jet fuel used by the Navy each year.

We found that the hollow fiber membrane reactor (HFR) can provide sevenfold and twofold more gas transfer than the continuously stirred tank reactor (CSTR) and trickle-bed reactor (TBR), respectively. These findings are critical in designing reactors suitable for biofuels and chemicals production from syngas. We filed an invention disclosure on a novel method that significantly sustains culture activity, gas uptake and improves selectivity for ethanol production during synthesis gas (also called syngas) fermentation in CSTR. Syngas substrates such as carbon monoxide (CO), hydrogen (H2), and carbon dioxide (CO2) can be converted using microbial catalysts in our novel process to alcohols, organic acids, and other chemicals. Our process works with gases containing CO, H2, CO2 and N2 produced from various sources and can be applicable in various reactors.

The BioWinol process can effectively store wind energy while sequestering CO2. We envision industrial sources of CO2 using this process to sequester CO2 while producing valuable fuels and chemicals. This scenario would greatly benefit from any cap and trade system that might be implemented by governments.

Interest in sweet sorghum as a feedstock for biofuel production has grown exponentially in the past several years. Sorghums could provide an opportunity for this region of the country to become more involved in renewable fuel development and production, which would result in tremendous economic gains for rural America.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Thermochemical Conversion Technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Developing biomass conversion technologies for production of fuels that are compatible with petroleum infrastructure is crucial for reducing dependence on imported petroleum resources. These compatible fuels, also called "drop-in" fuels, can be produced using thermochemical conversion routes such as gasification. Biomass gasification technology is available to commercialize in near-term for converting biomass into fuels, chemical and power. Syngas, generated from biomass gasification, is a very well-known building block needed to produce many fuels and chemicals such as methanol, ethanol, ammonia, and hydrocarbons. However, Challenges in removal of contaminants, especially tars, from biomass-generated syngas continue to hinder commercialization efforts in biomass gasification.
Most combustion-based commercial systems such as burners, boilers, incinerators, furnaces, and combustors are designed for specific high energy imported fossil fuels. Generation of environmental pollutants, such as NOx, SOx, and dioxins, is linked with excessive use of these hydrocarbon fuels.

Thermochemical biomass gasification-based producer gas is considered as a viable renewable-type alternative to fossil fuels that allows for reducing energy costs and emissions in industrial systems and power plants. Biomass producer gas used in an integrated combined cycle process is one example offering great potential for enhancing the use of biomass in electricity generation, since it can substantially improve the efficiency of electricity production.

What has been done
We have focused on synthesizing and evaluating catalysts derived from biochar, a byproduct of biomass gasification. Three catalysts - original biochar, biochar-derived activated carbon, and biochar-derived activated carbon with acidic surface - were synthesized. Experiments were

carried out in a fixed bed tubular catalytic reactor at temperatures of 700 and 800°C using toluene as a model tar compound to measure effectiveness of the catalysts to remove tar. Steam was supplied to promote reforming reactions of tar.

Bench-top studies investigated natural gas co-firing with two model producer gas mixtures, one each representative of switchgrass and forage sorghum downdraft gasification, respectively, using a bench-scale air-swirled burner unit. Several tests have been conducted using our pilot-scale downdraft gasifier-burner setup to investigate technical and environmental performance.

Results

Results showed that all three catalysts (original biochar, activated carbon, and acidic surface activated carbon derived from biochar) were effective in toluene removal with removal efficiency of 69 to 92%. Activated carbon catalysts resulted in higher toluene removal because of their higher surface area, larger pore diameter, and larger pore volume. An increase in reactor temperature from 700 to 800°C resulted in a 3 to 10% increase in toluene removal efficiency. Activated carbons had higher toluene removal efficiency compared to biochar catalysts. Two manuscripts are developed for publication in refereed journals. Results from another project focusing on biochar production showed that biochar properties were significantly dependent on the type of biomass and gasification operating conditions, such as temperature and ratio of air-to-biomass, supplied into the gasifier.

Bench-top and a few pilot-scale producer gas-natural gas co-firing tests on air swirled type burner system indicated the potential for energy savings and emission reduction potential. The NOx level of 54 ppm at 100 % natural gas operation was reduced to 15 ppm for switchgrass model gas mixture and 11ppm for sorghum model gas mixture at 0% natural gas co-firing. With increase in equivalence ratio (ER), NOx and flame temperatures showed direct correlation with ER. It is anticipated that a typical biomass gasifier plant through producer gas co-firing with natural gas will have the potential to save 14,000 cubic feet of natural gas per ton of biomass gasified. A commercial steam boiler of a max of 400 MBH is purchased and efforts are being made to obtain funds for gasifier-boiler technology research.

After full development, the hybrid technology (gasification-syngas fermentation) can provide 35% more ethanol from the same amount of biomass compared to the biochemical conversion technology. If biofuel 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), a projected savings of over $650 million per year can be achieved due to the use of 13.1 million tons less biomass with the hybrid technology. The improvements in the hybrid technology and the resolution of current bottlenecks (mass transfer and medium cost) associated with syngas fermentation will lead to greater opportunities to offset foreign oil needs within the U.S. and present economic opportunities to Oklahoma and the nation.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Modeling and Economics

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The production of biofuels has increased due to rising energy prices, the desire for less dependence on foreign oil, and favorable government policies. Most current ethanol plants in the U.S. are corn-based, but in the state of Oklahoma corn production is not a major agricultural activity. However, perennial grasses and annual forages in this state have shown to be viable renewable biomass feedstocks. Switchgrass, a plant native to Oklahoma, has been deemed one of the best options as a sustainable feedstock to support a biorefinery. The optimal location for the state?s first biorefinery and most probable switchgrass production acres needs to be assessed.

What has been done
A comprehensive linear mathematical programming model was developed to determine the optimal location for the state's first biorefinery and most probable switchgrass production acres. IMPLAN® study area data and industry accounts were adjusted to show how the two activities will impact the study area. Also, given a large agricultural cooperative presence in Oklahoma, the model was modified to show how different ownership structures (i.e., varying levels of cooperative/private ownership) will affect the economic impacts of plant location decisions.

Results
In the case of the 100% privately-owned scenario, the combined industry output for switchgrass production and ethanol production was estimated at $70 million with a combined employment impact of 556 employees for the region. In the 100% cooperative-owned scenario, there is a combined industry output for switchgrass and ethanol production of $86.1 million, and a combined employment impact of 726 employees in the region. Because of the induced impacts that result from the cooperative membership model, industry output is $16.1 million higher than the privately-owned and employment has 170 more jobs. This information is being extended to community

leaders and will help support funding efforts for bio-refineries.

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

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes

Brief Explanation

Long-term drought conditions for Oklahoma persisted in 2012 and greatly impacted the feedstock production, harvesting, and storage components of this study. However, the severe drought and high temperatures provided an opportunity to understand feedstock production potential under severely limited conditions.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

- 19 experimental cultivars are under evaluation in a regional trial for performance and adaptation.
- Numerous breeding lines were bred and evaluated for their potential in the development of new cultivars in switchgrass for the south central states.
- Proposals - submitted and awarded
- Journal articles published - number and quality
- Seminar and poster presentations

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 16

1. Name of the Planned Program

Childhood Obesity - Human Nutrition and Health

☑ 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	70%		0%	
724	Healthy Lifestyle	30%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	0.0	0.0
Actual Paid Professional	20.0	0.0	0.0	0.0
Actual Volunteer	11.4	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
480000	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
480000	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1900000	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Development of new curricula

• Outreach to families, schools, child care providers, direct assistance, demonstrations, and educational opportunities relating to food, healthy eating, excercise, diet, etc.

• Development of surveys, evaluation tool

• Delivery through classes, One-on-One, News Releases/TV/Radio, Participation in Events, Displays

•Provide training and other staff development opportunities to county educators

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?

Educators were introduced to the eXtension Families Food and Fitness Community of Practice during training and the site references are provided as a resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	110031	0	43105	0

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	1	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Revised online curriculum

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth improving food, nutrition, and/or physical activity behaviors through Healthy Oklahoma Youth Program
2	Number of children and youth exposed to learning leading to improved food, nutrition and physical activity behaviors through Farm to You Program
3	Number of low-income youth exposed to learning leading to improved food, nutrition and physical activity behaviors through Food and Fun for Everyone program.
4	Number of individuals graduating from the Fresh Start: Nutrition & You program which leads to improvements in food, nutrition and physical activity behaviors.
5	Low Income Families Reached through Community Nutrition Education Programs

Outcome #1

1. Outcome Measures

Number of youth improving food, nutrition, and/or physical activity behaviors through Healthy Oklahoma Youth Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	6594

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over the past decade, the percentage of those overweight has steadily increased in Oklahoma. As many as one in five Oklahoma children are at-risk of being overweight or obese; and two-thirds of adults are overweight or obese. Among children and adolescents, overweight increases the risk of type 2 diabetes, high blood pressure, and cardiovascular disease. The health of Oklahoma youth can be improved by increasing knowledge, skills, attitudes and behaviors related to food and physical activity. Overweight, obesity and associated health problems have a significant economic impact. The estimated annual cost of overweight and obesity in the United States is $147 billion. Just a 10% sustained weight loss has been estimated to reduce an overweight person?s lifetime medical costs by $2,200 to $5,300.

What has been done
This comprehensive school wellness program teaches healthy eating and physical activity habits to Pre-K through 5th grade students in low-income schools as designated by the Oklahoma State Department of Education Child Nutrition Program. The program promotes four basic preventative health habits: (1) maintaining a low-fat diet (2) consuming high fiber foods (3) drinking plenty of water and (4) engaging in regular physical activity.

Results
An additional twenty-one school districts were added in 2012 for a total of forty-one participating schools. The cumulative total served by The OrganWise Guys in 2012 was 6,594 youth in approximately 271 classrooms throughout Oklahoma. Based on 2,054 pre-post tests, improvements were reported in the areas of increasing servings of fruit, skim milk and physical activity. Youth also reported decreased consumption of sweets, fat eaten and less screen time.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of children and youth exposed to learning leading to improved food, nutrition and physical activity behaviors through Farm to You Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	22796

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma Cooperative Extension Service (OCES) programs targeting youth populations joined efforts with State agencies and agricultural commodity organizations to offer an interactive educational exhibit linking agriculture as the source of nutrient dense foods and role of these foods to health. The collaborating programs and agencies include OCES Family and Consumer Sciences (FCS), OCES Community Nutrition Education Program (CNEP), OCES 4-H, OCES Ag in the Classroom, Oklahoma State Department of Health WIC Service, and Southwest Dairy Farmers. Exhibit messages are consistent with and enhance the FCS CNEP youth program messages, are research based and consistent with United States Department of Agriculture (USDA) Dietary Guidelines for Americans 2005 and MyPyramid.

What has been done
In 2012 the Farm to You exhibit traveled to 31 counties in Oklahoma, serving multiple school districts within each county. It has also been featured at summer camps, county fairs and community events. During 2012, 22,796 youth experienced the Farm to You exhibit and 1,120 community volunteers supported the educational program.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #3

1. Outcome Measures

Number of low-income youth exposed to learning leading to improved food, nutrition and physical activity behaviors through Food and Fun for Everyone program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3464

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over the past decade, the percentage of those overweight has steadily increased in Oklahoma. As many as one in five Oklahoma children are at-risk of being overweight or obese; and two-thirds of adults are overweight or obese. Among children and adolescents, overweight increases the risk of type 2 diabetes, high blood pressure, and cardiovascular disease. The health of Oklahoma youth can be improved by increasing knowledge, skills, attitudes and behaviors related to food and physical activity. Overweight, obesity and associated health problems have a significant economic impact. The estimated annual cost of overweight and obesity in the United States is $147 billion. Just a 10% sustained weight loss has been estimated to reduce an overweight person's lifetime medical costs by $2,200 to $5,300.

What has been done
The nutrition education program, Food & Fun for Everyone, consists of a series of approximately 6 lessons taught to youth in third and fourth grades in low-income school districts. The interactive learning experiences teach the concepts of MyPyramid food guidance system, the importance of hand washing and eating breakfast every day, as well as appropriate and healthy snacking.

In 2012 more than 3,464 Oklahoma youth participated in the program.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Number of individuals graduating from the Fresh Start: Nutrition & You program which leads to improvements in food, nutrition and physical activity behaviors.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Low Income Families Reached through Community Nutrition Education Programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3432

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma loses an estimated $1.4 billion each year from hunger through illness, increased illness and decreased academic achievement alone.

Among seniors receiving food through Oklahoma's Food Bank System, 45% report having to choose between buying food or paying for medicine or medical care.

In 2010, 24.5% of children under the age of 18 lived in poverty and 1 in 5 children were at risk for being hungry.

In 2010, over 616,000 Oklahomans lived in poverty. The prevalence of low socioeconomic status is associated with poor nutrition habits that contribute to chronic disease including heart disease, cancer, stroke, and obesity.

During 2011, Supplemental Nutrition Assistance Program (SNAP, previously known as the Food Stamp Program) participation increased 9.2% over the previous year and doubled the amount

distributed 5 years ago.

What has been done
Through the Community Nutrition Education Programs (CNEP), OCES has leveraged state monies to provide over $3.08 million (FY12) in federal nutrition education program funds. This funding supports 91 jobs in 38 Oklahoma counties. CNEP is a voluntary program for adults participating in federal food assistance programs as well as impoverished youth in qualifying schools and communities. Program participants learn to feed their families in order to promote good health and to plan and budget their food dollars so their family will not go hungry at the end of the month.

Working through OCES county offices, teaching paraprofessionals known as Nutrition Education Assistants (NEAs) coach participants during weekly lessons to build skills that enable them to stretch their family food dollars, plan and prepare more nutritious meals and increase physical activity. The research-based lessons involve hands-on learning
experiences and can take place in the participant's home or in small group settings.

CNEP educates Oklahoma youth on healthy food choices, safe food practices and physical activity with the purpose of reducing overweight and obesity and the associated risk of related chronic disease.

Results
CNEP staff provided a total of 4,502 hours of nutrition information on healthy eating practices, food preparation and food safety to 18,188 qualifying Oklahoma youth during the 2012 fiscal year.

The majority of enrolled youth (14,887) were taught through school enrichment programs; while 3,301 children received their nutrition education through short term community based programs.

After participating in CNEP, approximately 15% of surveyed youth participants more often consumed low-cost, healthy foods and 9% increased their frequency of hand washing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes

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 # 17

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%		20%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		20%	
206	Basic Plant Biology	0%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
212	Pathogens and Nematodes Affecting Plants	0%		5%	
304	Animal Genome	0%		10%	
305	Animal Physiological Processes	0%		10%	
311	Animal Diseases	0%		5%	
312	External Parasites and Pests of Animals	0%		5%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	0.0
Actual Paid Professional	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	315016	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	315016	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1742518	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 focus 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 applied for/ solicited from national, state and university sources to acquire, maintain and restore support for "Core" facilities that are critical to the research mission of DASNR and Oklahoma State University.
• Proposals will be submitted to attract sufficient extramural support to establish an extramurally funded "Structural Biology" Center at OSU that will stimulate collaborations and research productivity.
• 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 meetings
• 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

2012	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:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	29	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students graduated and post doctoral scientists moving on to full employment.

Year	Actual
2012	32

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Research development knowledge taken to patent or license stage.
2	Research productivity - plant cell wall
3	Research productivity - antibiotic resistance
4	Research productivity - stored grain and grain products
5	Number of invitations that faculty members received to present research findings at universities and colleges, and to national and international meetings

Outcome #1

1. Outcome Measures

Research development knowledge taken to patent or license stage.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

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

Research productivity - plant cell wall

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cell walls surround essentially every plant cell protecting the cells from bursting under their turgor, providing shape to the cells, excluding potential invaders, and controlling the growth of the cells. Plants invest the major fraction of their photosynthate into their walls. The structure of cell walls is not completely understood, especially with respect to how cell walls can enlarge without losing their integrity and how they can be deconstructed to produce sugars for fermentation to produce fuels or chemicals. Thus understanding of the structure of plant cell walls could lead to enhancing plant growth, development of plants with higher resistance to pathogens, and production of plants with more biomass.

What has been done
A. nidulans was found to secrete a wide array of enzymes to degrade the major polysaccharides and lipids by 1 day of growth on sorghum. The data shows simultaneous breakdown of hemicellulose, cellulose and pectin. Changes in the relative abundances of enzymes over the time course that were observed indicate that the sets of enzymes secreted are tailored to the specific substrates available. Our findings reveal that A. nidulans is capable of degrading the major polysaccharides in sorghum without any chemical pre-treatment.

Results
Researchers at OSU are developing a sugar-platform based source of chemicals, consisting of hydrolytic enzymes for the efficient and environmentally friendly conversion of renewable plant biomass for industrial applications. These recent results continue to build on past successes and represent a significant step towards this goal. The set of enzymes produced by A. nidulans that degraded cell wall components in Sorgum stover have been identified, which allow them to be cloned and expressed for the development of more efficient conversion of biomass to fermentable sugars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
206	Basic Plant Biology

Outcome #3

1. Outcome Measures

Research productivity - antibiotic resistance

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wide-spread use of antibiotics on livestock has given rise to increased frequency of outbreaks of disease caused by antibiotic resistant bacteria. The spread of such drug-resistant bacterial species among livestock populations potentially could have a devastating economic impact on agribusiness in the state of Oklahoma. Consequently, there is a need to both characterize the mechanism of developed resistance and develop effective treatments to eradicate the resistant organism.

What has been done
S. aureus strains were isolated from raw milk samples of mastitic and healthy dairy cattle from a Paso Del Norte region dairy and characterized. Molecular epidemiology determined that the 40 S. aureus strains characterized were indeed clonal, meaning they were spreading among the dairy cattle examined. Some strains isolated from cows undergoing antibiotic therapy demonstrated resistance to three or more antimicrobial classes. Roche 454 GS pyrosequencing was used to produce a draft genome sequence of two of the dairy strains, methicillin-resistant strain (MRSA) H29 and methicillin-susceptible S. aureus strain PB32. Analysis of the H29 genome demonstrated its tight relationship to a human MRSA strain, and also revealed why the strain was resistant to penicillins, erythromycin, tetracycline, and ciprofloxacin. Analysis of the PB32 genome demonstrated that this strain was also related to a human MRSA strain.

Results
This work demonstrates the dissemination of human S. aureus strains in cattle and reveals changes to the genome structure of human MRSA that might have been influenced by the introduction and dissemination of these strains in cattle populations. The work also demonstrates the impact that modern NexGen DNA sequencing techniques will be having on identifying the source and cause of outbreaks of infections in live stock that caused by anti-biotic resistant bacterial strains.

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
311	Animal Diseases

Outcome #4

1. Outcome Measures

Research productivity - stored grain and grain products

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The red flour beetle, Tribolium castaneum is a globally distributed major pest of stored grain and grain products. T. castaneum has also been the focus of widespread studies on insecticide resistance. The red flour beetle is now an emerging model organism for the study of insect development, reproduction, nutrition, behavior and physiology.

What has been done
The expression and biological functions of two acetylcholinesterase genes (TcAce1 and TcAce2) of Tribolium castaneum were compared. The two genes were expressed at all developmental stages, albeit the transcript level of TcAce1 was 1.2 to 8.7 fold higher. Silencing of TcAce1 in larvae using RNA interference resulted 100% mortality and increased the susceptibility of larvae to anticholinesterase insecticides. In contrast, silencing of TcAce2 in larvae had no such effects, but delayed insect development and reduced female egg-laying and hatching. These findings demonstrate the major roles that TcAce1 and TcAce2 play in cholinergic functions and susceptibility to anticholinesterase insecticides, versus female reproduction, embryo development, and growth of offspring, respectively.

Results
Ongoing studies at OSU are yielding insights into genes that control insecticide susceptibility and the development and reproduction of a major pest of stored grain and grain products. These findings should allow investigators to develop better environmentally-friendly pesticides to control

grain infestations of this pest. Furthermore, as an emerging model organism, these findings may be extended to the development of more effective methods for the control of additional agriculture pest.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

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
2012	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Virally vectored infectious diseases are not only a hazard to human health, but are destructive to the health of livestock and the agricultural economy. Although immunization of animals with vaccines that are conventionally attenuated viruses helps provide some protections, there are still disadvantages. Therefore, attempts to enhance the immunogenicity of vaccines have been actively sought, among which is the administration of immunomodulatory molecules cytokine IL-18. In fact, treatment of animals with IL-18 has been reported to confer protections against viral infections. IL-18 plays a central regulatory role in host immune response to viral and microbial infections. The biological activity of IL-18 is determined in part by its relative affinity for IL-18 binding protein (IL-18BP) that serves as an antagonist in regulating the activation function of IL-18. The structures of IL-18BP and IL-18R are largely unknown. Thus, here is a great need for better understanding the mechanisms of how IL-18 activates its receptors and how this activation is neutralized by IL-18BP. Work at OSU is beginning to address this gap in our knowledge.

What has been done

Dr. Junpeng Deng was invited to speak about his work on "IL-18 & IL-18BP in autoimmune diseases and poxvirus infection", Johns Hopkins University, School of Public Health.

Results
An invitation to present research results at the prestigious Johns Hopkins University, School of Public Health acknowledges the important contributions that are being made by researchers in the Division of Agricultural Sciences and Natural Resources at OSU to the scientific community at large. Dr. Deng's presented his lab's work on the successful determination of the crystal structure of yabapoxvirus IL18 inhibitory protein and the full characterization of its function. The work revealed a unique inhibitory mechanism by which poxvirus use decoy protein to evade human immune response and paves the way for designing future inhibitors for treatment of viral infection, as well as autoimmune diseases. In addition, it will help in development of treatments and prevention strategies against a number of infectious diseases that target livestock animals and are economically devastating.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The number of manuscripts published increased 128%.

The percentage increases in numbers of graduate students graduated/ postdoctoral associates mentored with training in structural biology and placed/ hired into appropriate professional level positions were 250% and 150%, respectfully.

The percentage increase in numbers of invitations that faculty members received to present research findings at universities and colleges, and to national and international meetings increased 64%.

Key Items of Evaluation