V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Ecosystem and Environmental Quality and Management including Weather and Climate

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
104	Protect Soil from Harmful Effects of Natural Elements	6%		10%	
111	Conservation and Efficient Use of Water	9%		10%	
112	Watershed Protection and Management	9%		10%	
121	Management of Range Resources	13%		15%	
123	Management and Sustainability of Forest Resources	7%		10%	
132	Weather and Climate	12%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
134	Outdoor Recreation	7%		0%	
135	Aquatic and Terrestrial Wildlife	8%		5%	
136	Conservation of Biological Diversity	5%		5%	
141	Air Resource Protection and Management	6%		5%	
205	Plant Management Systems	5%		5%	
403	Waste Disposal, Recycling, and Reuse	6%		5%	
605	Natural Resource and Environmental Economics	2%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	0.0	14.0	0.0
Actual Paid Professional	15.0	0.0	14.6	0.0
Actual Volunteer	1.7	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**
470000	0	646549	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
470000	0	646549	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1430572	0	3677783	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Designed and conducedt research

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

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

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

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

Submitted grant proposals

Continued to develop Mesonet weather-related decision tools including but not limited to OK-FIRE system for wildland fire management, plant disease prediction modeling knowledge and operational weather-based tools, new Cattle Comfort Index (developed by animal scientists in Nebraska) combines heat and cold stress into a single model for multiple livestock species combined with Oklahoma Mesonet data will be made available on a statewide basis in Oklahoma.

Conducted Poultry Waste Management Education

Weather and climate education for the general public and agricultural sector was conducted through weather reports on TV through OSU SUNUP, online video/audio tutorials, printable information and fact sheets, email newsletters, educational programs, seminars and workshops.

Statewide daily estimates of plant available water in the top 80 centimeters of the soil profile were available through the Oklahoma Mesonet website.

Educational materials and programs were developed to inform clientele on how available water in the soil profile impacts cropping and ecosystem decision management to improve risk management.

The Oklahoma Mesonet introduced a new "Agriculture" website section that provides statewide and farm local perspectives to risk management and decision support weather-based tools.

Evapotranspiration is being investigated as a broad measure of plant environmental stress. The Oklahoma Mesonet provides a statewide system that can be used to ground truth satellite evapotranspiration modeling. Research at OSU will provide the foundation for modeling plant biomass based on rainfall, soil moisture, and evapotranspiration that can be used in ecosystem and grazing management.

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

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

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?

Dr. Doug Hamilton has three webpages on the eXtension anaerobic digestion website. "Types of Anaerobic Digesters" is the number one page on the site with 1,641 unique visitors in 2013. Average time on page for "Types of Anaerobic Digesters" is 5:06; however, in the 3rd quarter of 2013, 444 visitors spent an average of 10:57 minutes on the page. Hamilton added another webpage in 2013. Making Sense of Smells was added to the "Waste to Worth Conference" site. Since it became public in fall of 2013, 22 unique visitors have used the site, spending an average of 10:01 minutes viewing the material.

Dr. Hailin Zhang became a Became a member of the Drinking Water and Human Health Community. He participated in a webinar titled: Safe drinking water before, during and after a disaster. The webinar had 70 participants on the day it was broadcast and many viewers afterwards.

With collaborators from 4 universities, 2 federal agencies, and 2 NGOs, we launched the Prescribed Fire Community of Practice within eXtension. There have been 59 articles and 58 FAQs made available in the CoP, with 72 technical experts participating.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	11600	152300	1069	37000

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

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	17	108	125

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2013	75

Output #2

Output Measure

- Manuscripts submitted for consideration of peer-reviewed publication

Year	Actual
2013	133

Output #3

Output Measure

- Extension conferences, workshops and training sessions

Year	Actual
2013	191

Output #4

Output Measure

- Research and Extension reports and fact sheets

Year	Actual
2013	221

Output #5

Output Measure

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

Year	Actual
2013	15

Output #6

Output Measure

- Weather-based decision support tools made operational and delivered through Oklahoma Mesonet websites for use on computer and mobile devices.

Year	Actual
2013	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of poultry producers and poultry litter applicators acquiring initial waste managment certification and number maintaining certification
2	Number of animal waste analyses conducted for land application of beef, dairy or swine waste.
3	Number of animal waste analyses conducted for poultry litter application
4	Number of users accessing website designed to deliver information about water policy, conservation and efficient use
5	Number of downloads of Extension fact sheets and related education materials
6	Number of enrollments in conservation-related land management programs
7	Land area restored in Oklahoma through invasive/encroaching species removal
8	Land area restored in Oklahoma through prescribed fire or other practices
9	Access by users of Oklahoma Mesonet computer and mobile device weather and climate data and tools
10	Wildlife exposure to aflatoxins through supplemental feeding
11	Bird collision mortality at U.S. wind facilities
12	Assessing Functions and Ecosystem Services Provided by the Wetlands Reserve Program in Oklahoma
13	Assessment of current and future states of Oklahoma forests with respect to biomass and carbon sequestration.
14	Prescribed Burn Associations

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
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the mid-1990s, water quality concerns related to elevated phosphorus (P) concentrations in northeastern Oklahoma watersheds (Eucha Spavinaw and Illinois River) have been the focus of regional and national attention, resulting in increased regulation and litigation. The subsequent 1998 Oklahoma Registered Poultry Feeding Operations and Poultry Waste Applicators Certification Acts required all poultry production operators and poultry waste applicators to complete an initial nine-hour series of Poultry Waste Management Education (PWME) sessions followed by annual continuing education. Responsibility for developing educational materials and providing the training required by the Acts was conferred to Oklahoma Cooperative Extension Service. In 2013, the PWME Program continued to provide the required training, addressing water quality concerns associated with improper or excessive land application of poultry litter. Over 499 people participated in the program during 2013.

What has been done
Between January 1, 2013 and December 31, 2013, Cooperative Extension Educators offered the initial nine-hour training sessions four times, educating 62 people as poultry operators or poultry waste applicators. Initial PWME sessions cover basic training on regulations, water quality, animal waste management plans, nutrient management, soil sampling and spreader calibration procedures, conservation practices and poultry litter commerce. A total of 2,648 people have received certificates of completion since the program began in 1998. Continuing education classes encompass training on environmental protection needs and the latest knowledge and practices for poultry litter nutrient management. Over the past year, 437 individuals attended continuing education.

OCES developed the OK Litter Market www.ok-littermarket.org website to assist with the transfer of poultry litter to areas of need and away from nutrient surplus areas. The website, which includes a current database of litter buyers, sellers and service providers, assists substantially in

promoting the transfer of poultry litter out of Eastern Oklahoma to more distant areas of the state with nutrient-deficient soils.

A second website, www.poultrywaste.okstate.edu was added as an information resource to producers and applicators, providing current class schedules, regulatory information and educational publications related to animal waste management and water quality.

The Poultry Litter Nutrient Management Guide was developed in 2011 and has become a vital resource for individuals seeking information about litter use as a fertilizer. It is available via download from www.poultrywaste.okstate.edu.

Poultry Practices, a biannual publication with timely articles directed toward poultry producers and poultry waste applicators, was expanded during 2013 to include more material and currently reaches more than 1,000 recipients at each distribution.

Results

A recent study from researchers at the University of Arkansas highlights water quality improvements within the Illinois River watershed. Researchers examined in-stream P concentration data spanning from 1997 to 2009 within the Illinois River watershed. Results showed that flow-adjusted P concentrations have been decreasing since 2003 in the Illinois River at Arkansas Highway 59, at Watts, Oklahoma and further downstream at Tahlequah, Oklahoma. These decreases are tied to the reductions in waste water treatment effluent P, which occurred in 2002. However, changes in agricultural management practices are also likely responsible for P reductions and include: exporting the majority of poultry litter outside nutrient sensitive watersheds, implementation of best management practices, strict regulations related to land application of manure and mandatory manure management education for poultry producers and manure applicators. The PWME program continues to assist producers by providing outreach efforts addressing each of these practices.

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
2013	669

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
2013	389

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	7027

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water management is crucial to human health and well being, agricultural and industrial productivity, and management of natural resources.

What has been done
Improvements to the website include creation of audience-specific and industry pages addressing food processing and energy development, a revised waste management page, new QR code, and streamlined navigation.

Results

Number of visitors to the website has nearly doubled in every year since 2009.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of downloads of Extension fact sheets and related education materials

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of enrollments in conservation-related land management programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
104	Protect Soil from Harmful Effects of Natural Elements
112	Watershed Protection and Management
121	Management of Range Resources
133	Pollution Prevention and Mitigation
136	Conservation of Biological Diversity
205	Plant Management Systems

Outcome #7

1. Outcome Measures

Land area restored in Oklahoma through invasive/encroaching species removal

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	25000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Within the past decade land managers in Oklahoma wanting to convert Old World Bluestem fields to native grassland dominated fields did not have a good understanding of the techniques necessary to complete the task, nor did they have anyone to whom they could be referred.

What has been done
Today, OSU scientists, in collaboration with others, have determined a fire and herbicide regime that, to date, is the most effective, thus reducing the amount of herbicide used and the cost to the producer. We also helped land managers (private, non-profit, and government agencies) realize the difficulty in re-establishing native plant species in sites that had been previously dominated by Old World Bluestems.

Results
This knowledge helped save them thousands of dollars on purchasing native seeds to reseed

those sites. Additionally, this program produced and trained students who now are working as invasive species scientists in multiple state and federal agencies, furthering the influence of the research program. Cooperative Extension representatives in natural resources, entomology and plant pathology, weed science, and horticulture have increased their sharing of information about invasive species through the Oklahoma Invasive Plant Council, the Oklahoma Botanic Gardens, SUN-UP, and the Oklahoma Gardening series. These programs have promoted increased knowledge concerning the ecology and management of invasive species in Oklahoma and increased awareness of the importance of avoiding the use of invasive species in various land management practices.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

Land area restored in Oklahoma through prescribed fire or other practices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	500000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Eastern redcedar (Juniperus virginiana) is one of the most widely distributed trees in Oklahoma and surrounding states, and it has been encroaching in areas previously characterized by fire-dependent grassland and savanna. Eastern redcedar encroachment converts grasslands to shrublands, greatly reducing the value of the land for grazing and native wildlife habitat. Dense groves of eastern redcedar also threaten life and property as they represent a significant wildfire hazard. The current area covered by Eastern redcedar in Oklahoma is estimated beyond 4.5 million hectares and it is projected to be 6.3 million hectares by 2013.

What has been done
During 2012-2013 Oklahoma State University Extension personnel led a multi-state effort of 11 resource professionals to create a Prescribed Fire Community of Practice (CoP) within eXtension. This CoP was officially launched to the public in 2013. Currently there are 72 members who have contributed 58 FAQs and 59 articles related to prescribed fire. This CoP will serve as a clearing house of knowledge for prescribed fire and highlights the leadership that OSU-NREM provides in the fire ecology discipline. Much of the content on the CoP is from research generated at OSU. The site also provides a mechanism to advertise workshops and field days that OSU and our collaborators carry out.

Results
From our work with prescribed burn associations (PBA) we currently have 18 PBAs in Oklahoma representing 34 counties, with over 350 members managing over 1.1 million acres of land.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	724416

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 provides farmers and ranchers weather-based risk management tools and information in a number of formats, including: website for desktop and tablet, iPhone app, Android app, and mobile website for other cellphone platforms.

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 verified, research-quality weather data are used to maintain a wide spectrum of weather and agricultural decision support products made available for computer and mobile devices.

The challenge in implementing weather-based agricultural management includes: providing intuitive decision-support tools, enhancing mobile device information delivery, expanding grower weather knowledge, and simplifying weather data display. These challenges are further complicated by agriculture?s need for forecast, current, and climate perspectives in supporting farm and ranch management decisions.

What has been done
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 online data and models. The Oklahoma Mesonet data has supported various agricultural and ecological research projects. 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. Android and iPhone apps provide 5-minute weather, forecast, and radar information, wherever the user has mobile network access. Ongoing extension/outreach efforts inform growers about available products and introduction to weather-based farm management tools via farm show exhibits, educational presentations, television, web tutorials, and printed materials.

In 2013 efforts focused on Mesonet weather product education. Educational presentations and National Weather Center tours provided information to traditional and non-traditional audiences.

An assessment was made of OSU extension publications for weather and climate information. The assessment included what weather or climate information was presented and how extensive topic discussions were in these publications. This lays the groundwork for what needs to be developed to fill weather and climate education gaps.

Base programming and web design for the new Wheat First Hollow Stem Advisor were done to bring this online for testing in December 2013.

2013 followed a year of major change for agriculture models within the Mesonet. In August 2012, the Mesonet Agweather website was replaced with an Agriculture section within the Mesonet.org website. A Cattle Comfort Advisor, using solar radiation, wind, and relative humidity to adjust air temperature, replaced traditional cattle heat and cold stress models. Plant Available Water maps were added that estimate soil column water in inches. Mesonet Long-Term Averages Maps and Graphs were created to provide interactive tools that can be used to assess any Mesonet data set by days, months or years against 15-year averages.

Results

The informal feedback from the Oklahoma agricultural community continues to be very complimentary of the Oklahoma Mesonet. Farmers and ranchers turn to the Mesonet to monitor rainfall and soil moisture. To minimize drift hazard, they use the Mesonet Drift Risk Advisor. Monitoring soil temperature has taken on increasing importance with the dramatic climb in seed costs. Growers monitor current and forecast relative humidity to determine good times to bale hay or harvest crops.

An estimated 60% of agriculture producers and 80% of industry professionals in Oklahoma are using smartphones. This makes the Mesonet Android and iPhone apps important tools for delivering the latest weather information to those in the agriculture community. Close to 70% of the people we visit with at farm shows ask us to show them how to download the Mesonet apps on to their smartphone or mention they already have the app.

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 Mr. Hodges 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 used weather information on the older Mesonet Agweather 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. Mr. Brigham used the radar on the Mesonet Agweather website to track a tornadic storm cell and direct a crew in the path of the storm to a safer location.

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 did not include the Mesonet value to livestock producers for that year.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Wildlife exposure to aflatoxins through supplemental feeding

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Upland game bird hunting is a multi-million dollar industry that is steeped in tradition. Arguably the most popular quarry is Northern Bobwhite (quail), but a long-term, idiopathic decline in populations across the species' range has eroded hunting opportunities for quail and raised concern for its long-term persistence. Many hypotheses have been evaluated to explain the quail decline, which has been determined to be the most persistent and rapid of any North American

bird species. Habitat loss and fragmentation appears to play the most prominent role in the decline, but research suggests that other factors contribute as well, and land managers are interested in anything they can do to improve conditions for quail.

One potential source of mortality for quail comes from poisoning via aflatoxins, a family of secondary metabolites produced by fungi in the genus Aspergillus. These fungi can grow on a wide variety of cereal grains and produce the deadly aflatoxins. The FDA regulates aflatoxin concentrations in foods destined for consumption by humans and livestock. For example, interstate transport of grains exceeding 20 ppb of aflatoxin is prohibited. There is, however, no standard for wildlife feed so grain sold as "bird seed" or "wildlife feed" can often far exceed the safety standards in place for humans and livestock, thereby exposing wildlife that consume those grains to aflatoxin poisoning. We were concerned with the possibility that quail are exposed to aflatoxins through the consumption of grain intentionally set out to attract quail or through accidental exposure through the far more common practice of setting out grain to attract white-tailed deer. We additionally sought to determine characteristics of feeding operations that are the most likely to result in aflatoxin development on supplemental feed.

What has been done

We investigated a potential route of exposure to aflatoxin through a series of field trials in which camera traps were deployed at bait stations designed to attract deer. Baited solely with piled, whole corn, we found that quail used bait stations for deer in autumn and winter, with greater reliance on the supplemental food in winter. Although absolute rates of visitation to bait piles were low in comparison to other wildlife species, relative to the population size (very low for quail in the study area) the exposure rate is likely to be significant.

The primary aim of this work has been a laboratory investigation of the conditions that promote aflatoxin development on grain that has been supplied to wildlife. We considered grain type (whole corn or milo), temperature, moisture, duration of environmental exposure, and disposition (i.e., whether the grains are scattered or piled). Beginning with grains from which no aflatoxin could be detected, we found that aflatoxins developed on nearly all samples by the end of the 4-week trails. In some cases, aflatoxin concentrations far exceeded limits allowable for humans and livestock, as well as levels known to be detrimental to quail. Milo was much less likely to develop lethal concentrations of aflatoxin than was corn, and only when piled and wet did aflatoxin concentrations rise to dangerous levels on milo. From this research, we have identified themes that will be developed into best practices for wildlife feeding. We recommend that milo be offered instead of corn, that it be spread instead of piled, and that it be collected and discarded if unconsumed after four weeks.

This project was conducted by Leah Dale and Tim O'Connell in the department of Natural Resource Ecology and Management (NREM) at Oklahoma State University, with significant assistance from Adam Gourley of the Oklahoma Agricultural Experiment Station (OAES) and Ryan Lerch from the Oklahoma Department of Agriculture, Food and Forestry (ODAFF).

Results

Field trials and greenhouse studies in this project took place exclusively on lands and in facilities managed by the OAES, and with administrative support from the Oklahoma Cooperative Fish and Wildlife Research Unit in NREM. We are specifically collaborating on this project with the Oklahoma Department of Wildlife Conservation (ODWC).

During 2013, we delivered poster and oral presentations of this work to a dedicated workshop for the ODWC, to the Kansas Natural Resources Conference, and to the Oklahoma Ornithological

Society. The information has thus been shared with a wide spectrum of wildlife professionals, researchers, and interested private citizens in Oklahoma, Texas, and Kansas.

To date, the relevance of the study information has been regional in the Southern Plains. This region is a stronghold for remaining populations of Northern Bobwhite as well as a region in which supplemental feeding for deer is a common and widespread practice. As information from our study disseminates, we expect it to spur changes in the way people choose to provide supplemental food to wildlife and ultimately reduce a potentially important cause of mortality in quail.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #11

1. Outcome Measures

Bird collision mortality at U.S. wind facilities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wind energy is a promising alternative to fossil fuels, but the impacts of wind facilities on wildlife remain unclear. Previous estimates of bird collision mortality at wind turbines do not distinguish between old generation lattice turbines and new generation monopole turbines (which now comprise the vast majority of U.S. turbines). Additionally, wind facility-scale correlates of collision rates have not been investigated. We derived an estimate of bird mortality for U.S. monopole turbines. In addition, we examined how bird mortality varies among different turbine sizes and across broad regions of the U.S. as a way to assist broad-scale decisions about where to develop wind energy and what types of turbines to install.

What has been done
We published the results of our analysis, which was based on the novel approach of combining bird collision mortality data from 60 previously conducted studies that span the U.S. Our general

findings were that annual collision mortality at U.S. wind turbines is estimated to be between 140,000 and 328,000 birds, that per turbine morality rates increase greatly with increasing turbine height, and that mortality varies across broad U.S. regions, with lowest mortality in the Great Plains.

We delivered an oral presentation of these findings at a national working group meeting (USGS Wind Energy Impacts Assessment Methodology Working Group), and a paper was published in the international peer-reviewed journal Biological Conservation.
Data compiled for this analysis are also being used in collaboration with USGS ecologists to understand species-level risks of bird-turbine collisions. Data are also being linked to a recently released USGS map and database that includes locations and specifications for every U.S. wind turbine; this will allow for identification of turbine-level correlates of mortality.

A research grant has been awarded by USGS to conduct follow-up research to assess correlates of bat collision mortality, to contribute data to efforts assessing impacts of turbine collision mortality on bat population dynamics, and to assess biases associated with data used in the above analyses.

Results
Our results will be used by the U.S. Fish and Wildlife Service in their planning and risk prioritization process for migratory and non-migratory birds. In addition findings from the completed analyses and follow-up studies will be used by the U.S. Geological Survey to develop their methodology for addressing the impacts of onshore wind energy development in the U.S.Additionally, we expect that our finding of relatively low rates of bird-turbine collision mortality in the Great Plains region may inform broad-scale siting decisions for future wind energy developments. These decisions will have ecosystem-scale implications related to patterns of land use.

Our completed and continuing research will have national impact, as illustrated by the use of our findings by federal agencies, including the U.S. Geological Survey and the U.S. Fish and Wildlife Service. In addition, given rapid wind energy development in Oklahoma and the southern Great Plains, these results may be of particular interest and use in this region.

Evidence of the local, regional, and national impact of this work is provided by the coverage of our Biological Conservation paper by numerous media outlets, including at least 8 Oklahoma newspapers, Oklahoma websites and radio stations, regional newspapers (The Journal Record, The High Plains Journal), and national outlets (Smithsonian.com, American Bird Conservancy, National Geographic, NPR affiliate in Los Angeles, California).

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #12

1. Outcome Measures

Assessing Functions and Ecosystem Services Provided by the Wetlands Reserve Program in Oklahoma

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Because of the ecological and economic benefits provided by wetlands, many state and federal agencies along with public and private organizations throughout the U.S. have worked together to reverse the decline in wetland acreage. One program that has played an important role in reversing the loss of wetlands in the U.S. and providing important benefits to private landowners is the Wetlands Reserve Program (WRP), which was established by the 1990 Farm Bill. The WRP is a voluntary program administered through U.S. Department of Agriculture?s Natural Resources Conservation Service (NRCS) that encourages private landowners to protect, restore, and enhance wetland ecosystems through enrolling eligible lands in permanent easements, 30-year easements, and wetland restoration cost-share agreements. Since implementation of the WRP in 1990, >7,800 WRP projects have been developed on >600,000 ha in the U.S. (NRCS 2009). In Oklahoma, 205 projects and approximately 25,000 ha of wetlands have been enrolled in the WRP since 1996. Many of these projects involve restoration of wetlands on agricultural lands deemed marginally productive.

Although the WRP has contributed significantly to increasing the overall wetland acreage in the U.S., it is not clear how effective it has been at restoring fully functional wetlands that provide ecosystem goods and services that are comparable to reference wetlands. Given the extensive nature of the WRP as well as the cost of the program (e.g., Oklahoma was allocated $10 million for the WRP in 2010), it is imperative that wetland restorations established under the WRP increase and sustain wetland functions on the landscape. Currently, few efforts have been made to evaluate the efficacy of the WRP at restoring wetland functions and services that are necessary to maintain sustainable wetland ecosystems. The focus of this research has been to monitor and evaluate the functions and services provided by WRP wetlands in Oklahoma to assist the NRCS in meeting their mission as well as assist landowners with recommendations to better

enhance their WRP wetlands.

What has been done
We have continued monitoring the progress of WRP wetlands throughout the state and report our findings to NRCS and private landowners. We scheduled wetland training sessions with NRCS personnel and private landowners throughout the state in 2013, but widespread drought forced the cancellation of these events. We are planning to conduct the training sessions in 2014. We recently received funding from the NRCS to evaluate the use of prescribed fire to reduce occurrence and abundance of invasive plants in WRP wetlands and enhance growth and establishment of preferred wetlands plants. This research will be initiated in 2014.

Results
The NRCS has begun modifying some of their restoration and management practices (e.g., employing moist-soil management, time drawdowns to create optimal conditions for wetland plant establishment, and incorporating prescribed burning into management guidelines) of WRP to better enhance the functions and services provided by these wetlands. Our reports have been used by NRCS and private landowners to better track the development of these restorations.

State and federal natural resource agencies and private landowners are the target audiences for this project. Results from these projects will allow government agencies such as Natural Resource Conservation Service, Oklahoma Department of Wildlife Conservation, Oklahoma Conservation Commission, Oklahoma Water Resource Board, and U.S. Environmental Protection Agency to better manage and conserve natural resources and develop sound conservation and management strategies. Specifically, this work will provide guidance to these agencies as the state begins implementing its Wetland Conservation Program. Moreover, this research emphasizes the important instrument the WRP program is at meeting the federal government?s mandate of ?no net loss? of wetlands nationally. Finally, information from this work will provide guidance to private landowners about the important functions of wetlands and the guidance on how to better protect these valuable resources.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

<u>Outcome #13</u>

1. Outcome Measures

Assessment of current and future states of Oklahoma forests with respect to biomass and carbon sequestration.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Methods for assessing current and future states of Oklahoma forests are needed for many purposes, including assessment of stored carbon. We enhanced data collection in a series of permanent forest growth plots to develop improved methods for inventorying biomass in Oklahoma and U.S. forests.

What has been done
Data collection continued on the 25-year remeasurement of over 200 plots in a natural, even-aged, shortleaf pine growth study. We sampled carbon in soils, understory vegetation and the forest floor, as well as in standing trees. We used dendrochronology to correlate ice storm occurrence and other climate data with tree ring data from shortleaf pine forests. We modeled forest growth to weather and climate variables, and to the understory dynamics of shortleaf pine forests. We developed new forest inventory methods for random samples of tree dimensions and, in plantations, by modifying row sampling. In 2013, 2 peer-reviewed journal articles were accepted for publication and 6 were published in the proceedings of professional conferences. We delivered 5 poster and 3 oral presentations at three separate, regional conferences in 2013.

Results
Improved models for growth of the shortleaf pine overstory and understory can help forest managers forecast carbon storage in the forests and the effects of management practices on carbon storage and other outputs of shortleaf pine forests. New sampling techniques that apply importance sampling can lead to more accurate forest sampling that is not subject to bias from volume tables. This can assist inventories for forest carbon storage. New row sampling methods for forest plantations can help to obtain more efficient inventories for these forests, including the carbon stored in these forests.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #14

1. Outcome Measures

Prescribed Burn Associations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The lack of fire has been a major contributor to the increase of woody plant species, especially juniper species, throughout the Great Plains. There are several reasons landowners in this region do not use fire, the main four are liability, lack of knowledge or training, lack of labor and limited amounts of equipment.

What has been done
To address this lack of fire use from local to national levels, we developed prescribed burn associations that enable landowners to safely and effectively conduct prescribed burns and better manage their lands. Since this work began there have been 18 prescribed burn associations (PBA) started in 35 Oklahoma counties, with 350 members statewide. The work initiated in Oklahoma has also spread to Texas, Kansas, Nebraska, Mississippi, and Illinois. A recent (2012) survey revealed 55 PBAs in the Great Plains with three others in Mississippi (1) and Illinois (2). This survey also showed that 27 of the PBAs had safely conducted 1,094 burns on almost 500,000 acres since the late 1990s. OSU NREM has also been instrumental in the development of the Oklahoma Prescribed Burn Association, a statewide organization that has been established to assist existing PBAs and develop new ones in OK. They have partnered with 1 federal agency, 4 state agencies and 4 private groups to establish this organization. This statewide effect in OK has led to establishment of state associations in Texas and Kansas, with Nebraska attempting to start one as well. The increased interest and activity of burn associations has also started a regional group working on PBA issues, the Alliance of Prescribed Burn Associations, with members from OK, TX, KS, and NE. OSU NREM has been invited to speak in other states about the importance and effectiveness of PBAs, these other states include, Missouri, Montana, New Mexico, Florida, and Iowa. We have also sent information about PBAs to 10 other states and two Canadian provinces.

Results

Prescribed burn associations in the Great Plains have safely and effectively conducted 1,094 burns on 500,000 acres of private lands. There are currently 61 PBAs in seven states, with five more states looking to start PBAs. This effort as launched the formation of three state PBAs and a regional alliance.

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

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

Drought continues to have prolonged effects and late 2013 saw the beginning of another droughty period.

This has impacted the interest in drought and weather and climate forecasts. Long-term drought conditions have increased the concern of fire outbreaks.

During this time period there has been political attention on climate issues from both ends of the political spectrum, i.e. climate concerns as an issue to be dealt with and learn about versus climate concerns not important due to lack of respect for the science. This has created debate more focused on whether climate changes are an issue deserving action and resource allocation, rather than how best to handle climate variability through mitigation and/or adaptation.

Lack of a Farm Bill slowed numerous natural resources programs and this may continue post farm bill pasasage.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A recent study from researchers at the University of Arkansas highlights water quality improvements within the Illinois River watershed. Researchers examined in-stream P concentration data spanning from 1997 to 2009 within the Illinois River watershed. Results showed that flow-adjusted P concentrations have been decreasing since 2003 in the Illinois River at Arkansas Highway 59, at Watts, Oklahoma and further downstream at Tahlequah,

Oklahoma. These decreases are tied to the reductions in waste water treatment effluent P, which occurred in 2002. However, changes in agricultural management practices are also likely responsible for P reductions and include: exporting the majority of poultry litter outside nutrient sensitive watersheds, implementation of best management practices, strict regulations related to land application of manure and mandatory manure management education for poultry producers and manure applicators. The PWME program continues to assist producers by providing outreach efforts addressing each of these practices.

Key Items of Evaluation