OSU Sustainability Research (Adapted from FY16 Research Abstracts)

Sustainability research explores environmental aspects combined with an examination of social and/or economic factors; addresses a sustainability challenge; or furthers our understanding of the interconnectedness among environmental, social and economic systems. N = 107

Department(s)	Title, Abstract, & Sponsors	Principal Investigator Project Director
Agricultural Economics	**Economics of Oklahoma Crop and Livestock Production Systems and Land Use** The objective is to determine the economic consequences of agricultural crop and livestock production alternatives for Oklahoma. Impacts of alternative practices and systems on expected net returns, variability of returns, and input requirements will be determined. Compatibility of the alternative production practices with conventional practices, resources, and institutional constraints, and potential external costs will be considered. Determine the economic and institutional feasibility, producer impacts, with respect to expected net return, production and financial risk, and rate of return on resources, of alternative crop and livestock production systems compared to existing ones, and determine environmental tradeoffs between alternative and contemporary crop and livestock production systems. (2824) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Francis Epplin
Agricultural Economics	**Resiliency of Socio-Economic Behavior and Policies to Protect Natural Resources and the Environment under Climate Variability in Oklahoma and the U.S.** The general objectives of the proposed research project are to study the resilience of economic institutions to address natural resource and environmental issues of policy interest to Oklahoma and the nation, and to contribute to developing the theoretical and empirical literature on managing change and risk for managing natural resources such as land, water, and ecosystems in the face of changing temperature and water regimes and to analyze the determinants of adoption of conservation and environmental mitigation practices for shaping sustainable and resilient water and land management policies, pricing, and institutions. (2852) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Tracy Boyer
Agricultural Economics	**Marketing and Delivery of Quality Grains and BioProcess Coproducts** Consumers are increasingly demanding high-quality, safe wholesome foods. At the same time, environmental and safety restrictions have reduced the availability of certain chemicals to control insects. As biological and chemical scientists and entomologists are developing alternative methods of insect control, there is a need for economic analysis and optimization to identify the most cost-effective of these alternatives so that increases in food costs can be minimized. (2879) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Brian Adam
Agricultural Economics	**Evaluating the Role of Small and Mid-Size Farms and their Impacts in Local and Regional Food Systems** Small and medium-size farms have identified a niche in the U.S. food system; their competitiveness may come from developing marketing savvy, innovative distribution models, and novel partnerships with other food system partners	**PI/PDs:** David Shideler Agricultural Economics: Merritt Taylor

	and new forms of governance instead of focusing on technical or scale efficiencies. Simultaneously, the diversity, focus and number of 'local food' development initiatives across the country are common in several aspects, and one is the primary motivation for this project: the belief that economic development benefits can be derived from more localized food system linkages and activity. This project addresses the priorities of the Small and Medium-Sized Farms program area. (2913) **Sponsor:** Oklahoma Agricultural Experiment Station	Colorado State University: Dawn Thilmany, Becca Jablonski
Agricultural Economics	**Selection and Location of Cost Effective Management Practices in Oklahoma Watersheds** This proposed research will focus on selecting and locating the most cost effective best management practices (BMPs) to reduce sediment and nutrient loading in selected Oklahoma watersheds. Mathematical optimization techniques such as nonlinear and genetic programming will be used to control watershed and instream simulation models to determine the most effective combination on land surface and instream BMPs to reduce sediment and nutrient loading from individual watersheds. Studies in other watersheds have shown that cost effective selection of BMPs can reduce the cost of given sediment and nutrient reductions by as much as 60 percent when compared to conventional targeting. (2944) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Art Stoecker
Agricultural Economics	**Rural Community Economic Resilience in the Face of Changing Food Systems, Mining and Climate Variability** The proposed research will explore the concept of economic resiliency in the context of three trends facing Oklahoma communities: changing food systems, oil and gas development, and climate variability. The research will identify how rural Oklahoma communities will be impacted by these three trends. In particular, the research will focus on how various forms of capital, using the Community Capitals framework, contribute or detract from local economic resilience. This will enable the researcher to identify policies and tools for local and state decision makers to build economic resiliency in rural Oklahoma. (2947) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Dave Shideler
Agricultural Economics	**Economic and Environmental Impacts of Oklahoma Agricultural Production and Agricultural Technology** Although it is difficult to conduct a fully comprehensive evaluation of any emerging agricultural production system, the state-of-the-practice analysis tools have demonstrated their utility in providing producers, researchers, and decision makers with beneficial information on the impacts of new agricultural technology. Future research will provide even more the basis for initiating comprehensive analysis, particularly as more seamless integration between economic and environmental analysis is achieved (Plucknett et al.; Hildebrand; McConnell and Dillon). (2948) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Jeff Vitale
Agricultural Economics	**Costs, Benefits, and Risks of Alternative Insect Management Strategies in Food Processing and Grain Storage Facilities** Consumers desire wholesome, insect-free foods. Meanwhile, because of consumer preferences and regulations insecticide options are increasingly limited. In order to improve the ability of food providers to respond to these conflicting challenges, costs benefits, and risks of alternative insect control methods, including integrated pest management approaches, will be	**PI/PD:** Brian Adam

	estimated. The focus is on grain storage and food processing facilities. Especially in the food processing industry, limited economic analysis of insect control has been published, especially analysis that considers the risks of alternative strategies. Partial budgeting and economic engineering will be used to analyze costs. (2977) **Sponsor:** Oklahoma Agricultural Experiment Station	
Agricultural Economics	**The Economics of Water Use, Recreation and Wildlife Management in Oklahoma** This project measures the economic value and economic impacts of water and wildlife in Oklahoma. There is a critical need for economic information about natural resources, which provide essential inputs into local and regional markets, and directly affect individuals' wellbeing. To date, however, little socioeconomic data has been collected on water uses and wildlife management in Oklahoma, and hence the value of these resources and the effect that conservation and management can have on that value. This project is conducting several surveys to measure demand for water and wildlife resources. Summary data and analysis will be presented to resource managers through reports, and important findings will be published in peer-reviewed journals. (2997) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Richard Melstrom
Animal Science	**Assessment of sustainable cattle systems** Cattle release enteric methane (CH4) emissions from their mouth that result due to fermentation processes in their stomach (rumen). Capturing and measuring these emissions is of interest, because CH4 is a greenhouse gas and represents a loss of feed energy. We have constructed, validated, and created an animal training/sampling protocol for a ventilated head box system to measure CH4 emissions from two beef or dairy cattle simultaneously. The research addresses NIFA's priority science area of Climate Change, specifically the challenge of mitigating and adapting to climate change. (2903) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD**: Sara Place
Animal Science	**Dietary Manipulation to Reduce Nutrient Excretion and Gaseous Emissions from Swine** The swine industry represents a major source of agricultural income in Oklahoma and the United States. Concerns over water and air quality associated with swine production facilities are topics of considerable debate. Therefore, methods to reduce the amount of nutrients and odors produced from swine facilities are needed. The first line of defense against nutrient excretion and gas generation is source control or the nutrients entering via the diet. The goal of this research is to determine the effects of dietary strategies on nutrient excretion and gaseous emissions from swine facilities. (2813) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD**: Scott Carter
Animal Science	**Supplementation and management strategies to improve productivity and sustainability of Oklahoma grazing systems** This study examines the effect of varying doses of two commercially-available ionophores on growth rate of stocker cattle. Stocker steers are fed a supplement containing 0 to the maximum approved dose of either monensin or lasalocid. These ionophores are used extensively in cattle grazing systems, and finding the optimum dose will improve efficiency and cost effectiveness for Oklahoma ranchers. Additional objectives also examine supplements	**PI/PD:** Ryan Reuter

	containing fat for their ability to reduce methane emissions and carbon footprint of grazing cattle. Reduced methane emissions should simultaneously improve the amount of food produced while lessening the environmental impact of food production from Oklahoma grazing lands. (2987) **Sponsor:** Oklahoma Agricultural Experiment Station	
Animal Science	**Microbial Ecology of Soils Treated with Animal Manure** The long-term objective of this project is to better understand the population dynamics of soil microbial ecosystems in response to manure amendment. We also study the contribution of manure to establish and propagate antibiotic resistance in soil. Microbial population fluctuations are evaluated by high throughput sequence analysis of eubacterial DNA from soil samples that are continuously treated with animal manure for a 15-year time period and samples collected annually. The effect of manure amendment to both soil bacteria and manure derived bacteria would be studies. We also aim to determine the presence and prevalence of antibiotic resistant organisms in these soils by quantitative analysis of antibiotic resistance genes and antibiotic residues in the soil. (2989) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Udaya DeSilva
Biomedical Sciences	**Impact of Environmental Toxins on Biological Systems** These projects examine low-level heavy metal and/or pesticide exposure on: 1) neural development, measured by changes in dopamine transporter [expression, trafficking, and function], dopamine release/uptake and the activity/function of the D1-like and D2-like dopamine receptors and 2) toxin-related estrogenic activity (metalloestrogens such as cadmium and organochlorine pesticides) and their impact on the development of breast cancer. We are examining intracellular mechanisms (p53, caspase, etc.) which are responsible for the regulation of cell grow and differentiation and how environmental agents can alter the cell cycle leading to abnormal growth and tumor development. **Sponsor**: Intramural Funding	**PI/PD**: David R. Wallace
Biosystems and Agricultural Engineering	**Engineering Solutions for Agricultural Air Quality Issues** This project will address current and future critical air quality issues facing U.S. agricultural production operations and processing facilities and establish a highly interactive research program that addresses agricultural air quality compliance-related issues, with an emphasis on particulate matter. The objectives are: 1) Develop scientifically sound agricultural air quality emission factors, 2) Develop and evaluate abatement technologies and/or management practices for controlling agricultural emissions, and 3) Develop and evaluate technologies and/or methodologies for measuring, characterizing, and classifying agricultural emissions. This proposed project incorporates an established national working group with the expectation to address the current and future air quality issues in the state of Oklahoma. (2822) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Michael Buser
Biosystems and Agricultural Engineering	**Investigation of the Long-term Viability of Rainwater Harvesting for Supplementing Water Supplies and Stormwater Management in Oklahoma** This project will: 1) investigate the occurrence and potential for soil accumulation of organic compounds in rooftop runoff, 2) characterization of the first flush from rooftop runoff, 3) redesign and automate the rainwater harvesting first flush diverter, 4) investigate the impacts of widespread	**PI/PD:** Jason Vogel

	rainwater harvesting on in-stream flows in rivers and streams in Oklahoma, 5) design a web-based tool that utilizes Oklahoma Mesonet data for optimal, site-specific designing of rainwater harvesting systems, and 6) investigation of the effects of climate change on rainwater harvesting system design in Oklahoma. The results will be presented in refereed journal articles, in extension fact sheets, at state and national conferences, and communicated to the public at extension workshops. (2832) **Sponsor:** Oklahoma Agricultural Experiment Station	
Biosystems and Agricultural Engineering	**Utilization of the Eastern Redcedar for Biofuel Production** This project seeks to develop technologies to convert Eastern red cedar into biofuels, particularly ethanol and butanol. Pretreatment processes to breakdown lignin and hemicellulose and remove volatile oil in the wood are being developed and compared with one another based on sugar yields. Enzymatic hydrolyses of pretreated wood and fermentations of the sugars produced to produce butanol and ethanol are also being tested. The effects of the oil on hydrolysis and fermentation are being studied as well. Results from the supported research are being disseminated through research journals, undergraduate and graduate courses, meetings with Oklahoma government officials, and presentations at international meetings. (2845) **Sponsor**: Oklahoma Agricultural Experiment Station	**PI/PD**: Mark Wilkins
Biosystems and Agricultural Engineering	**Stream/Riparian Zone Interactions: Sediment and Nutrient Transport to Streams** Conjunctive management of surface and ground water has become increasingly important as water supply and water quality issues intensify. The goal of this research is to improve our understanding of surface and ground water interactions and the impact of this interaction on contaminant fate and transport. This research will improve the understanding of the role of subsurface water in the erosion of soil on steep streambanks, gullies, and embankments, and (2) improve our understanding of the role of vegetation on erosion and stability of hillslopes. Controlling sediment loading to surface water is important for the protection of human health and freshwater ecosystems; this sediment loading must be addressed through improved scientific understanding of riparian management strategies. (2895) **Sponsors:** USDA/NIFA, NSF, US EPA	**PI/PD:** Garey Fox
Biosystems and Agricultural Engineering	**The Science and Engineering for a Biobased Industry and Economy** This project will develop methods to use plant biomass to produce alcohols that can be used as both fuels and as chemical feedstocks. Pretreatment technologies using plant-degrading fungi are being developed to make biomass more amenable to enzymatic hydrolysis while reducing the environmental impact of biofuel and biochemical production. Also, various fermentation organisms are being employed to consume sugars produced from enzymatic hydrolysis of plant biomass and produce various products that are of value to the energy and chemical sectors, such as ethanol, n-butanol and hexanol. Results from the supported research are being disseminated through research journals, undergraduate and graduate courses, and presentation at international meetings. (2898) **Sponsor**: Oklahoma Agricultural Experiment Station	**PI/PD:** Mark Wilkins
Biosystems and Agricultural Engineering	**Development of advanced thermochemical conversion technology through devolatization and co-pyrolysis of biomass feedstocks with natural gas** This year, we focused on pyrolysis of eastern red cedar, a native invasive species of Oklahoma. Pyrolysis, thermal conversion of solid biomass into	**PI/PD:** Ajay Kumar

	liquid fuel intermediate, solid char and gaseous products, is one promising approach to use red cedar. The objective of this study was to investigate effects of eastern red cedar wood zones (heartwood and sapwood), pyrolysis temperature (450 and 500 °C) and pyrolysis types on distribution and composition of pyrolysis products. In fast pyrolysis conditions, the products were dominated by anhydrous sugars, phenols and guaiacols. The total yield of lignin-derived compounds from heartwood was higher than sapwood at 500 °C but not significantly different at 450 °C. In slow pyrolysis conditions, acetic acid and furfural were the two most abundant species in bio-oil. (2921) **Sponsor:** Oklahoma Agricultural Experiment Station	
Biosystems and Agricultural Engineering	**Improving Gasification Conversion Systems in the Production of Bioenergy, Biofuels, and Bioproducts** The overall goal of this project is to address key issues that limit commercial application of OSU developed biomass gasification technologies. The primary issues are gasifier scale-up, materials handling and producer gas cleaning. Based on an interest expressed by a company to license and use the OSU patented downdraft gasifier in a self-contained renewable electricity generation unit, the research focus will be on gasifier scale-up. As gasifier reactor size increases, input and outputs also increase. For most feedstock inputs, this increase provides an opportunity to increase feedstock particle size, which should decrease the degree of preprocessing and corresponding power, saving time and reducing costs. (2937) **Sponsor**: Oklahoma Agricultural Experiment Station, Oklahoma State University	**PI/PD:** Raymond L. Huhnke
Biosystems and Agricultural Engineering	**Development and Testing of Filter Media to Improve Water Quality in Urban and Agricultural Stormwater Runoff** Pollutants in stormwater runoff continue to be a significant cause of the degradation of rivers and streams in the US. Bioretention cells, which filter stormwater before it reaches streams, are an increasing popular technology to address the problem. This project seeks to quantify long-term pollutant sorption and transformations in bioretention cell filter media. In addition, it will identify and quantify the performance of new filter media additives that will increase filter media sorption and/or transformations of pollutants. (2957) **Sponsor:** USDA, USEPA	**PI/PD:** G. Brown
Biosystems and Agricultural Engineering	**Developing Management Strategies for Subsurface Drip Irrigation in the Oklahoma Panhandle** This project investigates the challenges that agricultural producers face as the adoption of subsurface drip irrigation (SDI) systems increases in the Panhandle due to growing water scarcity. The objectives are to study the yield and water productivity of main agricultural crops (corn, sorghum, wheat) under: 1) Different levels of irrigation, namely 50%, 75%, and 100% of full water requirement, 2) Variable distances between drip tape and crop row, ranging from zero to 15 inches in 3 inch increments. Irrigation scheduling is performed using a commercial software and numerous sensors are installed to monitor water movement and crop canopy water stress. (2965) **Sponsors:** Oklahoma Agricultural Experiment Station, USGS 104b	**PI/PDs:** Saleh Taghvaeian Plant and Soil Sciences: Jason Warren
Biosystems and Agricultural Engineering	**The Science and Engineering for a Biobased Industry and Economy** I have started a Life Cycle Assessment program at OSU BAE in which we are now able to produce environmental impact assessment studies for almost any product or process. This LCA effort has focused mainly on biofuel and	**PI/PD:** R. Frazier

	bioproducts. A large LCA was created to examine catalysts used in biomass pyrolysis for oils. LCA's have also been completed on lignocellulosic fuels creation. Current LCA studies have been performed on center pivot irrigation systems in the Oklahoma panhandle. These studies examine electrical and petro-fuel reductions as well as water savings possible by efficiency improvement recommendations. LCA's on the fuel/energy/water (Nexus) savings reveal significant potentials for irrigation and stressed aquifer sustainability. A student has been hired to specifically study the irrigation LCA issues in upcoming tests. (2966) **Sponsor:** Oklahoma Agriculture Experiment Station	
Biosystems and Agricultural Engineering	**The Science and Engineering for a Biobased Industry and Economy** Alcohols, organic acids and other products can be biologically produced from streams that contains synthesis gas (syngas) made of carbon monoxide, hydrogen and carbon dioxide. Syngas can be produced from gasification of biomass, agricultural residues, coal and municipal solid waste or present in industrial waste gas streams. The syngas is fed to microbial catalysts in a process called syngas fermentation. This research will investigate capabilities of novel microorganisms to produce ethanol, butanol, hexanol, fatty acids and other products. Mass transfer capabilities of various reactor designs for syngas fermentation with a focus to identify reactor designs that increase the alcohol productivity and syngas utilization will be examined. In addition, modeling and process control tools for syngas fermentation will be developed to allow the determination of operating parameters that result in highest productivity and yield. (2967) **Sponsor**: Oklahoma Agricultural Experiment Station, USDA/NIFA	**PI/PD:** Hasan Atiyeh
Biosystems and Agricultural Engineering	**Implementation of In-Stream, Streambank, and Riparian Practices in Conjunction with Upland Practices for Conservation of Water Resources** Typically conservation practices aimed at minimizing sediment loading to streams and reservoirs have focused on upland and riparian erosion control and sediment transport reduction. However, in many watersheds, significant sediment loads originate from streambanks and channels currently in disequilibrium. Channel and riparian conservation practices can be implemented to reduce this erosion in conjunction with upland practices, but little knowledge exists on prioritizing locations and evaluating performance of integrated upland, riparian, and in-stream practices1. This research hypothesizes that watershed-scale biophysical research, socioeconomic research, and outreach activities can effectively identify and encourage implementation of the most cost-effective and ecologically-beneficial combination of upland, riparian, and in-stream practices to reduce sediment loads and improve water quality, thereby conserving resources to meet potentially altered water availability and demand. Research, education, and extension activities will be focused in the Fort Cobb watershed located in southwest Oklahoma, but generalizable to other watersheds, especially those throughout the Great Plains. Research includes process-based modeling of upland and channel erosion with and without conservation practices under various land management and climate scenarios. Preferences of landowners and citizens were surveyed in order to prioritize potential stabilization schemes and determine benefits from upland and/or in-stream erosion control. (2987) **Sponsor:** National Institute of Food and Agriculture	**PI/PDs:** Garey Fox, Daniel Storm, Jason Vogel Agricultural Economics: Tracy Boyer, Larry Sanders, Art Stoecker USDA-ARS Grazinglands Research Laboratory: Jean Steiner, Patrick Starks, Daniel Moriasi

Biosystems and Agricultural Engineering	**Development of Biological Gas Conversion Technology for Renewable Fuels and Chemicals** A crucial step in developing a sustainable biobased economy is establishing viable integrated biorefineries capable of converting biomass feedstocks and waste materials into biofuels, biopower and biobased chemicals. Gasification-syngas fermentation is a hybrid conversion process that involves the conversion of biomass, coal and municipal solid wastes to syngas, primarily containing carbon monoxide, carbon dioxide and hydrogen, followed by the fermentation of syngas to chemicals. To develop a feasible syngas fermentation process, technical challenges associated with high cost of fermentation medium, mass transfer limitations and low productivity should be addressed. This research will investigate production of alcohols (ethanol, butanol and hexanol) and value added products (acetic, butyric and hexanoic acids) from biomass with focus on strategies to enhance alcohol productivity and gas utilization such as reducing gas liquid mass transfer limitations. Syngas fermentation process development and reactor design and control will also be examined. (3005) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA/NIFA	**PI/PD:** Hasan Atiyeh
Chemical Engineering	**Leakage risk assessment for plugged and abandoned oil and gas wells** The primary objective is to develop a methodology for evaluating the quality of the barrier system of a permanently plugged and abandoned well by expressing barrier system quality in terms of leakage probability and potential future leakage rates. Secondary objectives are: Establish a reliability model for the barrier system in a permanently plugged and abandoned well; Develop a leakage calculator for oil and gas escaping the barrier system; Develop a model for long- and short-term pressure forecasting in the well vicinity; Establish uncertainty quantification models for all phenomenological models developed and implement sensitivity analyses to understand critical factors. **Sponsor:** International Research Institute of Stavanger AS	**PI/PDs:** Geir Hareland, Runar Nygaard
Chemical Engineering	**Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO2-Enhanced Oil Recovery Pilot, Anadarko Basin, Texas** OSU, with the cooperation of the Southwest Regional Carbon Sequestration Partnership (SWP), will develop and implement new near-surface and airborne monitoring technologies. The research will focus on the design and deployment of a dense grid of shallow subsurface and surface sensors in combination with low-altitude airborne detection of CO2 and CH4. These technologies will be deployed in the Farnsworth Oil Unit in the Anadarko Basin of the northeastern Texas panhandle, where the SWP and Chaparral Energy, LLC, are conducting CO2- enhanced oil recovery experiments. **Sponsor:** Department of Energy	**PI/PDs:** Peter Clark Civil & Env. Eng.: Tyler Ley Mech. & Aerospace Eng.: Jamey Jacob, Girish Chowdhary College of A&S: Jack Pashin, N. Materer
Chemical Engineering	**Multi-Scale Fouling Characterization of Fermented/Hydrolyzed Sweet Sorghum** Biofuel process streams are fouling intensive fluids that carry biological agents, dissolved solids, biomass, and other proteinaceous substances. Very little information is available about the fouling mechanisms of these fluids on either a laboratory or industrial production scale. This project will focus on the fouling characteristics of fermented sweet sorghum. The goal of the project is to develop a fundamental and applied understanding of the fouling characteristics of fermented/hydrolyzed sweet sorghum in bioethanol recovery equipment. **Sponsor:** South Central Sun Grant Program for U.S. Dept. of Transportation	**PI/PD:** Rob Whiteley

Chemistry	**A Nanostructured Energy Harvesting and Storage System for Space and Terrestrial Applications** The ultimate goal of the proposed research is the final fabrication and characterization of a nanostructured photovoltaic system connected to nanostructured batteries in order to form a novel, self-sustaining energy storage system. **Sponsor**: National Aeronautics and Space Administration	Allen Apblett, Nick Materer
Chemistry	**Hydrocarbon Fuels, Chemicals, and Intermediates from a Novel Biomass Pyrolysis Technology** Biomass fast pyrolysis holds promise for production of hydrocarbon fuels and chemicals. However, despite recent advances, converting bio-oil (product of biomass fast pyrolysis) into usable fuels and chemicals remains a major challenge. The problems with the bio-oil are due to its high oxygen content, high acidity and instability that are results of high oxygen and low hydrogen contents of its precursor biomass. As biomass and methane have complementary compositions, use of natural gas (an abundant and cheap source of methane) in limited quantity can dramatically improve selectivity and yield of hydrocarbons. The overall goal of this project is to demonstrate a novel natural Gas and Biomass to Liquids (GBTL) technology that will synergistically use biomass and methane to directly produce liquid hydrocarbons. **Sponsor**: United States Department of Agriculture	Allen Apblett, Ajay Kumar
Chemistry	**Extracting the Photonic Spectrum for the Long Range Exploration of Space: A Hybrid Photovoltaic Photon Upconversion and Biological System for Energy Production and Life Support** We are developing a novel biologically-based life support system to sustain long-range space travel. This system allows for increased biomass production using normally unused wavelengths in the solar electromagnetic spectrum by coupling photosynthesis with up and down conversion of photons. Cultures of microalgae will provide a source of oxygen and nutrients for manned space exploration, while simultaneously removing waste carbon dioxide. **Sponsor**: National Aeronautics and Space Administration	Allen Apblett
Chemistry	**Center for Interfacial Reaction Engineering** The Center for Interfacial Reaction Engineering (CIRE) was created in response to the US Department of Energy's recommendation to focus research on reducing dependence on foreign oil by promoting the use of diverse, domestic, and sustainable energy resources. CIRE is a multidisciplinary/multi-institutional effort that includes researchers from the three major Oklahoma research universities and leverages expertise in diverse areas related to catalysis, nanoscience, colloidal and interfacial science, and thermodynamics. The research is directly relevant to biomass conversion and catalytic upgrading, reactions in biphasic solvent systems containing polar and non-polar species, and subsurface conversion in oil reservoirs at the water/oil interface. **Sponsor**: Department of Energy	Jeffery L. White University of Oklahoma: Daniel Resasco
Civil and Environmental Engineering	**Development of Guidelines for High-Volume Recycled Materials for Sustainable Concrete Pavement** Incorporating a high volume of recycled materials in concrete production can reduce cost and decrease the carbon footprint without compromising performance and service life. The objective is to produce concrete for conventional pavement construction that incorporates at least 50% recycled	**PI/PD:** Julie Ann Hartell

	materials. For this project, the OSU investigator is collaborating with OU and will be conducting investigations to evaluate the durability performance of concrete mixtures designed and fabricated at OU. This entails determining the resistivity and chloride diffusivity parameters for concrete samples. Also, a series of freeze-thaw testing on concrete beam samples and salt scaling on slab samples will be conducted. **Sponsor:** University of Oklahoma for the Southern Plains Transportation Center for Oklahoma Department of Transportation	
Civil and Environmental Engineering	**Organochlorines** Organochlorine pollutants such as trichloroethene (TCE) are some of the most widely distributed toxic contaminants at Superfund sites and pose significant risk to human health. This proposal seeks to determine the feasibility and effectiveness of using naturally-occurring organochlorines as biostimulants for *in situ* remediation of these organochlorine pollutants. The central hypothesis is that organohalide respiring bacteria will be stimulated and dechlorinate TCE faster and more completely in response to natural organochlorine amendments. The rationale is that with this knowledge, chlorinated pollutants may be more thoroughly and quickly remediated, thus removing major threats to human health. **Sponsor:** National Science Foundation	**PI/PD:** Mark Krzmarzick
Civil and Environmental Engineering	**Case Study on Construction Equipment Emissions** Task 1 – Meet with ODOT and identify equipment to be reviewed for the case study. Task 2 –The identified equipment in the framework will be entered into a schedule. The framework will be used to predict emissions. Task 3 – Identified equipment will be visited weekly to collect data on daily inspection, maintenance, usage hours and climate conditions. Operator interviews will be utilized to collect data of operator understanding of their equipment and emissions associated with the equipment. Task 4 – Prepare a final report with a case study validation, incorporating traditional equipment allocation and an emission-based allocation of equipment. **Sponsor:** University of Oklahoma for the Southern Plains Transportation Center for Oklahoma Department of Transportation	**PI/PDs:** Rachel Mosier, Phil Lewis
Civil and Environmental Engineering	**Assessing the Impact of Climate on Bridge Deck Deterioration** Task 1 - The objective is to identify: 1) factors affecting bridge deck conditions, 2) existing performance models for bridge decks, and 3) Oklahoma DOT's practices in monitoring and tracking bridge deck conditions and its decision process for maintenance. Task 2 - The objective is to define climatological input variables. *Oklahoma Mesonet* will be the main source for climate data. Task 3 - The objective is to integrate climate data with the National Bridge Inventory for enhanced data analyses. Task 4 - The objective is to present research findings and promote the research to pursue additional funding from other sources. **Sponsor:** University of Oklahoma for the Southern Plains Transportation Center for Oklahoma Department of Transportation	**PI/PDs:** Yongwei Shan, Phil Lewis
Civil and Environmental Engineering	**Sustainability and Training Materials for In-Place Recycling** Studies have shown in-place recycling to be a sustainable, cost-effective procedure for rehabilitation of hot mix asphalt pavements. The intent of this project is to develop a sustainability calculator that will document the	**PI/PDs:** Phil Lewis, Stephen Cross

	sustainability benefits of in-place recycling compared to traditional maintenance and rehabilitation techniques and to develop interactive training materials that will serve as a Basic Recycling Primer for in-place recycling. The sustainability calculator will be made available for local agencies and the training materials developed will be provided to the Transportation Curriculum Coordination Council, which will develop an interactive web based training course. **Sponsor:** University of Oklahoma for the Southern Plains Transportation Center for US Department of Transportation, Asphalt Recycling & Reclaiming Association	
Civil and Environmental Engineering	**Monitoring Extreme Loading and Climate Impact on Infrastructure** To address climate impact and traffic overload on concrete infrastructure, evaluation and monitoring guidelines will be developed using sensing technologies such as acoustic emission monitoring capable of qualifying and quantifying material damage and locating zones in distress. Climatological profiles will be created for critical infrastructure regions of Oklahoma using climatological data from *Oklahoma Mesonet*. The effects of exposure combinations on concrete properties will be continuously monitored and analyzed using AE and ultrasonic techniques. Signature wave parameters that may be characteristic of temperature change, moisture change or microstructural changes will be determined and implemented towards the creation of new monitoring guidelines. **Sponsor:** University of Oklahoma for the Southern Plains Transportation Center for Oklahoma Department of Transportation	**PI/PDs:** Julie Hartell, Phil Lewis, Tyler Ley, Yongwei Shan
Civil and Environmental Engineering	**SusChEM: Collaborative Research: A Multi-Scale Environmental and Kinetics Study on the Pyrolysis of Sustainable Biomass Feedstock** This collaborative study between Tennessee Technological University and OSU looks at the kinetics and socio-economic broader impacts of biomass pyrolysis. The investigators will introduce a Multiple Variable Control Volume Reactor to independently control the particle-related and homogenous-related transport phenomena and associated reactions, making it possible to independently observe the two processes. In a serious of experiments, model compounds and whole biomass will be studied in an effort to understand the extent to which pyrolysis occurs within condensed phase intermediates and the homogeneous gas phase. The PIs will also introduce a new multi-scale modeling platform based on kinetic cellular automaton. **Sponsor:** National Science Foundation	**PI/PD:** Tyler Ley
Civil and Environmental Engineering	**Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO2-Enhanced Oil Recovery Pilot, Anadarko Basin, Texas** OSU, with the cooperation of the Southwest Regional Carbon Sequestration Partnership (SWP), will develop and implement new near-surface and airborne monitoring technologies. The research will focus on the design and deployment of a dense grid of shallow subsurface and surface sensors in combination with low-altitude airborne detection of CO2 and CH4. These technologies will be deployed in the Farnsworth Oil Unit in the Anadarko Basin of the northeastern Texas panhandle, where the SWP and Chaparral Energy, LLC, are conducting CO2- enhanced oil recovery experiments. **Sponsor:** Department of Energy	**PI/PDs:** Tyler Ley Chemical Eng.: Peter Clark MAE: Jamey Jacob, Girish Chowdhary College of A & S: Jack Pashin, Nicholas Materer
Entomology and Plant Pathology	**Pest Management in Winter Wheat and Canola in the Central and Southern Plains**	**PI/PD:** Kristopher Giles

	The effects of natural enemies on pests of wheat and canola have not been fully incorporated into IPM programs in the Southern Plains. Project members continue to monitor the distribution and abundance of insect pests of wheat and Canola, refine and validate insect pest sampling plans in wheat and canola, examine dynamic interactions among insect pests, narrow spectrum insecticides, and natural enemies, describe the relationship between bird-cherry oat aphid infestations on wheat, and describe the ecology of aphidophagous natural enemies in simple and diverse wheat/canola agroecosystems. Results will be used to optimize pest management approaches. (2935) **Sponsors:** Oklahoma Agricultural Experiment Station, USDA	
Forensic Science	**Detection of Environmental Clandestine Laboratory Residues: Implications for Health** Clandestine laboratories (clan labs) are hidden laboratories that engage in the synthesis of illicit materials, such as controlled substances and explosives, and they are commonly encountered throughout the world. Currently, the FTTL is using common clan lab production techniques and determining trace residues and indicators that are left behind following the cooks. The National Institute of Justice recently awarded Savannah River National Laboratory (SRNL) and Oklahoma State University funds to examine the impact of methamphetamine clan labs on waste water infrastructure and also investigate signature chemicals for clan lab detection.	**PI/PD:** Matthew Green, Austin Csieleski, Jarrad Wagner
Geography	**An Analysis of Innovation and Performance in US Biofuel Firms: Implications for the Biofuel Technological Innovation System** The project focuses on an analysis of the evolution of the biofuel technological innovation system within the United States, with emphasis on both first- and second-generation biofuels. The investigators will analyze firm performance and the role of the producer within the U.S. biomass-based biofuel technological innovation system. They will focus on analysis of answers to two specific sets of questions: (1) What internal and external factors determine innovation and business performance in biofuel firms, and to what extent do biofuel firms depend on local policy and partners to improve performance? (2) How do adjustments in firm-level processes affect system-wide functions, and how do firms shape and reshape the overall environment of biofuel innovation and production? **Sponsor:** National Science Foundation - Geography and Spatial Sciences (GSS)	Sharmistha Bagchi-Sen (PI), Peter Kedron (Co-PI)
Geography	**EPSCoR RII (OIA-1301789): Adapting Socio-Ecological Systems to Increased Climate Variability (FY 2013-2019)** This multi-disciplinary program supports research and the creation of a multi-university research team to advance our understanding of how socio-ecological systems adapt sustainably to changing environmental conditions. The program has establish a first-of-its-kind, statewide, socio-ecological observatory network designed to provide a systems-level understanding of coupled human and natural system under a variable climate. A key goal is the improvement of research infrastructure, transforming Oklahoma's capability to be nationally competitive in the arena of coupled human-natural systems and other programs in NSF's crosscutting Science, Engineering, and Education for sustainability portfolio. Partners include Oklahoma State University, the Univ. of Oklahoma, The University of Tulsa, Langston University, The Samuel Roberts Noble Foundation, and the Donald W. Reynolds Foundation among many others.	Raymond Huhnke (PI), Alicia Knoedler (Co-PI)

	Sponsor: National Science Foundation, Oklahoma NSF EPSCoR	
Geography	**Dean's Incentive Grant: Hyperspectral Vegetation Monitoring of Second-Generation Biofuel Crops (FY 2015-2016)** As oil prices continue to rise and energy security becomes paramount, there is a pressing global need to develop reliable sources of alternative renewable energy. Considerable efforts are currently being directed toward research and development of second-generation biofuels, which can be manufactured from various types of plants, such as switchgrass (Panicum virgatum L.), but far less is known about the biophysical and biochemical composition of these sources than their first-generation predecessors (e.g., corn and soybeans).This research develops a new hyperspectral index to indicate the chlorophyll content in two second generation bioenergy crops: switchgrass (*Panicum virgatum* L.) and sorghum (*Sorghum bicolor*) using imaging spectroscopy techniques. **Sponsor**: Oklahoma State University College of Arts and Sciences	Amy Frazier
Geography	**Land System Vulnerability and Resilience to Drought: A Multi-Scalar, Comparative Analysis of Public and Private Lands in the American West** Oklahoma's Cimarron County and New Mexico's Union County are important cattle producers. Yet, threats from drought, changing cattle market conditions, invasive species that compete with natural grasses, and governmental policies, which alter agro-business through public land leases and environmental regulations, make land users vulnerable to environmental change. The region is in the midst of extreme drought. Land managers must make decisions based on complex economic and policy influences albeit based, in part, on past experiences (e.g. 1930's Dust Bowl). This human-environment study explores land use in terms of land users' vulnerability and resiliency in the region through a mixed-methods approach. **Sponsor:** NSF/IMEE	Jacqueline Vadjunec (PI) University of Oklahoma: Todd Fagin University of Ohio-Chillicothe, Brenda Phillips
Geology	**Southeastern Offshore Storage Resource Assessment** Ensuring safe and economically viable CO2-enhanced oil recovery programs is imperative for the commercial and environmental success of carbon capture and storage programs. This research project focuses on assessment of the CO2 storage capacity and operational potential of the eastern Gulf of Mexico (offshore of Mississippi, Alabama, and Florida). Potential exists in a large portfolio of Mesozoic and Cenozoic sandstone and carbonate formations. Regionally extensive sealing strata have been identified that help ensure safe storage of injected CO2. **Sponsor:** U.S. Department of Energy through Southern States Energy Board	**PI/PD:** Jack Pashin
Geology	**Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO2- Enhanced Oil Recovery Pilot, Anadarko Basin, Texas.** Ensuring safe and economically viable CO2-enhanced oil recovery programs is imperative for the commercial and environmental success of carbon capture and storage programs. This research project is deploying advanced geological characterization and monitoring techniques that are designed to ensure safe and permanent geological storage of CO2 while substantially reducing the costs of near-surface and airborne monitoring programs. This project features the deployment of miniaturized CO2 and CH4 sensors in surface monitoring arrays as well as unmanned aerial vehicles. **Sponsor:** U.S. Department of Energy	**PI/PD**: Jack Pashin
Geology	**Basin, Alabama, USA**	**PI/PD**: Tracy M. Quan

	The funding from this project was used to obtain produced water samples from the Black Warrior Basin. The biogeochemical processes that shaped the produced water composition and methane production in this basin are unconstrained, and analysis of the chemical composition of the produced waters using a wide range of methods can provide critical information about the formation and degradation processes of hydrocarbons in this system. **Sponsors:** College of Arts and Sciences	
Geology	**REU Site: Evaluating the Effectiveness of Stream Restoration Projects Based on Natural Channel Design Concepts Using Process-Based Investigations** This Research Experience for Undergraduates (REU) project integrates Hydrologic, geosciences, and biological research at the Cow Creek Stream Rehabilitation Site located on the OSU campus and includes other stream restoration sites in Oklahoma, to evaluate natural channel design approaches through process-based scientific investigations with the goal of developing the science for a new stream restoration paradigm. Oklahoma is distinct in that it is highly rural with a large percentage of Native Americans and first generation college students. The proposed REU program has unique opportunities to recruit from these populations in combination with national recruitment. **Sponsor:** U.S. National Science Foundation	**PI/PDs:** Andrew Dzialowski, Mark Fishbein, Todd Halihan College of Agriculture: Garey Fox, Shannon Brewer, Jason Vogel, and Chris Zou
Horticulture and Landscape Architecture	**Improved Vegetable Crop Development Through Sustainable Cultural Practices** The research will develop sustainable cultural systems for Oklahoma vegetable crops. Specifically, strategies will be identified to effectively manage pest populations in urban vegetable gardens with minimal insecticide use by encouraging natural enemies, and to enhance pollination services by increasing pollinator diversity and abundance. The research also will determine continuous production periods that could meet market demand for selected Oklahoma vegetable crops, including sweet corn and eggplant. (2026) **Sponsors**: Oklahoma Agricultural Experiment Station, Oklahoma Department of Agriculture, Food & Forestry, Southern Sustainable Agriculture Research & Education Program	**PI/PD**: Brian Kahn
Horticulture and Landscape Architecture	**Investigations of Turfgrass Drought Resistance** Turfgrasses and other landscape plants serve an important role in society, yet improvements could be made to develop drought resistant turfgrass varieties and increase turf grass water use efficiency in Oklahoma. The goal of this project is to promote urban environmental sustainability and efficient use of water through the development, commercialization, marketing, and use of drought resistant bermudagrass varieties for Oklahoma and the U.S. transition zone and to increase knowledge pertaining to bermudagrass drought resistance. The objectives of this project are to: 1.) Test and select several experimental bermudagrass genotypes for improved drought resistance; and 2.) Further the understanding of bermudagrass abiotic stress tolerance or resistance through transcriptomics. (2923) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Justin Moss
Human Sciences	**Animal Production Systems: Synthesis of Methods to Determine Sustainability** Food demand, specifically the demand for animal protein is expected to increase. However, the quantity and quality of available land, fresh water, and energy resources are declining. More and more consumers increasingly want	**PI/PDs**: Paulette Hebert, Mihyun Kang

	to know how their food is produced. Consumer preferences create demand for different production practices with respect to food safety, nutrition, animal welfare, environmental protection and retail practices. The goals of this project are to engage collaborators from a broad range of disciplines, including facility management and design; facilitate organization, synthesis, and integration of systems research; and interpret the impacts to animal-production systems. (2900) **Sponsor:** Oklahoma Agricultural Experiment Station	
Industrial Engineering and Management	**Designing Databases for a Hazardous Material Movement Model in Oklahoma (Phase 1)** The objective of this effort is to develop a database containing information regarding the amount of HazMat transported in the state of Oklahoma. The project will provide a database structure which may be utilized in subsequent phases (phases conducted after Oct 2016) to identify the HazMat distribution and movement via major highways and Metropolitan Statistical Areas (MSAs) in Oklahoma. **Sponsor:** Oklahoma Emergency Management for the USDOT-Pipeline and Hazardous Materials and Safety Administration	**PI/PDs:** Arash Pourhabib, Manjunath Kamath, Chaoyue Zhao DASNR: R. Scott Frazier
Integrative Biology	**Implications of grassland management practices for monarch butterfly conservation in the southern Great Plains.** The monarch butterfly decline has been attributed to several factors, including habitat fragmentation, loss, and degradation (including milkweed loss), overutilization, and disease/predation, as well as climate change, weather extremes, invasive species, and pesticides. The Oklahoma-Texas region has been identified as critical for conservation efforts in the southern Great Plains, with an emphasis on milkweed and nectar resource availability. This project evaluates the availability of resources in the southern Great Plains to support the migration and reproduction of monarchs during the spring and fall, as well as monarch use of these resources. **Sponsor:** ABSTC-NTO	**PI/PD:** Kristen Baum
Integrative Biology	**Assessment of grassland habitat quality and management practices for pollinators in the southern Great Plains.** Pollinators play an important role in grasslands, as well as most managed and natural ecosystems. Concerns over pollinator declines have increased in recent years, especially with the identification of colony collapse disorder in managed honey bee colonies, and documented declines in native bee communities, as well as the decline in the monarch butterfly population. Pollinator declines have been attributed to several factors, including habitat fragmentation and loss, invasive species, and pesticides. This project evaluates the status of native bee communities and monarch butterflies on National Park Service lands, including an assessment of resource availability in the context of management practices. **Sponsor:** National Park Service	**PI/PD:** Kristen Baum
Integrative Biology	**1st Generation Biofuel Crop.** This project evaluates the effect of winter canola (*Brassica napus*) pest management strategies on bee communities and canola productivity in Oklahoma, where winter canola is grown as a rotational crop with winter wheat. Specifically, we are evaluating the effect of two new narrowspectrum insecticides, flonicamid and sulfoxaflor, on the abundance and species richness of native bees, winter canola seed set, and field-level production. Results are being compared with fields treated with broad-spectrum	**PI/PDs:** Kristen Baum College of Agricultural Sciences and Natural Resources: Kristopher Giles

	insecticides (synthetic pyrethroids), as well as fields with and without managed honey bee colonies. **Sponsor:** Oklahoma Center for the Advancement of Science	
Integrative Biology	**Terrestrial Connectivity across the South Central United States: Implications for the Sustainability of Wildlife Populations and Communities.** Connectivity is an important component of the landscape for sustaining wildlife populations and communities, especially given that habitat fragmentation, modification, and loss have been implicated in the decline of almost all threatened and endangered species. We are using graph theory to predict patterns of terrestrial connectivity for species in the South Central United States. We also are evaluating the implications of predicted land use change across the study area. **Sponsor:** DOI USGS South Central Climate Science Center	**PI/PDs:** Kristen Baum, Mona Papeş CASNR: S. Fuhlendorf, K. Giles, US Forest Service: D. Saenz USDA, Ag Research Service: N. Elliott
Integrative Biology	**Development of landscape GIS models for the prediction of wetland condition in Oklahoma** An important goal of wetland managers is to determine how anthropogenic alterations of the landscape affect wetland condition. One approach to determining the relationships between landscape and condition is to sample a large number of wetlands that have been exposed to varying levels of disturbances. However, field-based monitoring and assessment programs can be expensive and laborious so that only a proportion of the total sites can be assessed at one time. At broad scales, predictive tools may allow for the estimation of wetland condition in the absence of field-based sampling events. The goal of the proposed research is to develop a series of models that use landscape-level parameters to predict the condition of Oklahoma wetlands. **Sponsor:** United States Environmental Protection Agency	**PI/PDs:** Andrew Dzialowski, Mona Papeş College of Agriculture: Craig Davis
Integrative Biology	**Assessment of created shallow water habitats in the lower Missouri River** The Missouri River has experienced significant alterations over the past 100 years. Of particular concern has been the loss of shallow water habitat (SWH), which is defined by the U.S. Fish and Wildlife Service as having depths less than 1.5 m and velocities less than 0.61 m/sec. In response, the U.S. Army Corps of Engineers created roughly 1393 ha of SWH on the lower Missouri River (from Sioux City, Iowa downstream to the confluence with the Mississippi River) over the past 15 years. An important goal of these efforts is to determine if the created habitat is providing habitat to native fishes. In this project, I am working with the USACE to assess this important habitat by looking at potential fish prey items including zooplankton and macroinvertebrates. **Sponsor:** United States Army Corps of Engineers	**PI/PD:** Andrew Dzialowski
Integrative Biology	**Remote sensing of water quality and harmful algae in Oklahoma's lakes** Harmful algal blooms (HABs) negatively impact water quality, lake aesthetics, and human health. Therefore, lake managers need tools that allow them to monitor and manage HABs. The purpose of this one-year project is to provide a proof-of-concept demonstration of the use of satellite-based imagery to quantify water quality and HAB abundances across space (horizontal variation) and time (annual and seasonal variation) in two of Oklahoma's most important lakes, Lake Texoma and Grand Lake. This project will provide the foundation for the development of a state-of-the-art remote sensing-based tool for providing efficient, near-real time, low-cost remote monitoring	**PI/PDs:** University of Oklahoma: David Hambright, Xia Xiangming Integrative Biology: Andrew Dzialowski

	for targeting limited resources for *in-situ* monitoring while allowing greater coverage of lakes for public health protection in Oklahoma. **Sponsor:** Oklahoma Water Resources Research Institute	
Integrative Biology	**Probabilistic monitoring of select Oklahoma reservoirs** Zooplankton and phytoplankton have the potential to serve as ecological indicators of lake and reservoir health. In this project we are identifying plankton from Oklahoma reservoirs that are collected as part of the Oklahoma Water Resources Board's (OWRB) routine Beneficial Use Monitoring Program (BUMP). We are assessing relationships between plankton and associated water quality data in order to develop tools that can be used to better manage and study Oklahoma reservoirs. Specifically, we are looking for plankton taxa that are associated with different water quality conditions (e.g. harmful algal blooms, high levels of turbidity). Combined, the results from this study should allow us to better manage, understand, and monitor reservoirs throughout the state. **Sponsor:** Oklahoma Water Resources Board	**PI/PD:** Andrew Dzialowski
Integrative Biology	**Long-term changes in zebra mussel veligers in Kansas reservoirs** While invasive zebra mussels have been well studied in natural lakes, much less is known about their population dynamics and ecological impacts in turbid, eutrophic reservoirs that are characteristic of the south central United States. We have been studying the dynamics of zebra mussel veliger populations in a series of Kansas reservoirs since 2004. This long-term data set should provide managers with important information that can be used to monitor and manage zebra mussel infestations. **Sponsor:** Kansas Department of Wildlife, Parks & Tourism	**PI/PD:** Andrew Dzialowski
Integrative Biology	***Liolaemus* Lizard Species as Storytellers on the Effects of Climate Change in Temperate South America.** Because of global warming, many plants and animals around the world have moved upwards in mountainous areas in an attempt to find the same cooler habitat in which they previously lived. This can, in turn, invoke changes to their ecology that sometimes affect them negatively. Such an upward shift in elevational range has never been studied in lizards of the southern temperate zone. We are looking for such a phenomenon in the lizard fauna of the Andes in central Chile, comparing sites we studied 30 years ago plus natural history museum records, and additionally evaluating possible negative conservation effects. **Sponsors:** National Geographic Society**,** Phoenix Zoo, Explorers Club	**PI/PDs:** Stanley Fox, Enrique Santoyo-Brito Chilean National Museum of Natural History: Herman Núñez University of Lincoln, England: Daniel Pincheira-Donoso
Integrative Biology	**Greenhouse gas fluxes in playa wetlands**: **Restoration potential to mitigate climate change.** Land use change has impacted services provided by playas in the High Plains, U.S. and likely affected their role in climate change forcing from greenhouse gas emissions. As a leading contributor to atmospheric greenhouse gases, the U.S. is taking steps to reduce emissions. This project was designed to examine seasonal greenhouse gas fluxes from playas embedded in dominant land use types in the western High Plains and Rainwater Basin region of Nebraska with the goal of evaluating the potential for U.S. conservation programs to reduce emissions from playas. This is a three year project scheduled for completion in October, 2014. **Sponsor:** United States Environmental Protection Agency	**PI/PDs:** Loren M. Smith, Scott T. McMurry

Integrative Biology	**Ecosystem Services Provided by Playa Wetlands Relative to USDA Programs** Ecosystem services are the values that society receives from the natural environment. As part of a national assessment, an OSU team is evaluating the services provided by playa wetlands in the High Plains and how those services are influenced by USDA conservation programs and practices. Some of the services provided by playas include biodiversity provisioning, pollinator capacity, groundwater recharge, floodwater storage, contaminant filtration, and recreation. Practices are being evaluated in Texas, New Mexico, Oklahoma, Kansas, Colorado, and Nebraska in over 300 playas. Some USDA programs (NRCS and FSA) enhance certain services as well as hamper others. **Sponsor:** United States Department of Agriculture	**PI/PDs:** Loren M. Smith, Scott T. McMurry
Integrative Biology	**Influence of land use and the Conservation Reserve Program on native invertebrate pollinator communities in Southern High Plains** Numerous studies have documented that invertebrate pollinator services are critical to the world economy. Our objective was to determine how the predominant land uses in the Southern High Plains of Texas (native grassland, Conservation Reserve Program, and agricultural) affect invertebrate pollinator diversity and more specifically, if CRP land hosts a diverse pollinator population given it consists primarily of non-native upland grasses. We are also examining how wetlands contribute to pollinator diets. Playa wetlands are the keystone ecosystem in the Southern High Plains, and although only 3% of the land base, they are a refuge of relative floral diversity in an otherwise intensively cultivated landscape. Initial results indicate that land use has a profound influence on composition and diversity of SHP pollinators. The floral diversity wetlands provide is important to pollinators in this landscape and is highly influenced by hydroperiod. **Sponsor:** USDA-FSA	**PI/PDs:** Loren M. Smith, Scott T. McMurry
Integrative Biology	**Genomic analysis of the golden eagle.** Our knowledge of the biology of the golden eagle is so deficient that it is difficult to develop proper management plans for this ecologically and culturally important species. Moreover, this species is currently experiencing negative population pressures due to lead poisoning and wind farms. The initial objective of this project is to completely sequence and annotate the genome of the golden eagle can compare this annotated genome to the sequenced and annotated genomes of other raptors. The ultimate goal would be to develop a long-term, non-invasive genetic monitoring program for golden eagle and the development of a national database of genotypes based on Single Nucleotide Polymorphisms (SNPs; single base substitutions or deletions within a sequence occurring with a population frequency greater than 1%). **Sponsor:** The Iowa Tribe of Oklahoma	**PI/PDs:** Ronald Van Den Bussche, Meredith Hamilton
Integrative Biology	**Genomic Resources for the conservation and management of bald and golden eagles**. The first step in any conservation or management program should be the delineation of biologically relevant boundaries across the species range. This step is critical as it informs the wildlife managers, biologists, and policy makers of the boundaries they are attempting to conserve or manage and sets the biological foundation for future decisions. Unfortunately, the existence of discrete genetic boundaries, if they exist, have not been evaluated for either bald or golden eagle. This project continues the previous work in my laboratory on bald and golden eagles by developing standardized	**PI/PDs:** Ronald Van Den Bussche, Meredith Hamilton

	suites of genetic markers (single nucleotide polymorphism, SNPs) on species-specific SNP Chips. **Sponsor:** The Iowa Tribe of Oklahoma and the Shakopee Mdewakanton Sioux of Minnesota	
Integrative Biology	**Using environmental DNA (eDNA) to assess the presence of cave-fish and crayfish population in caves of the Ozark Highlands**. The goal of the project is to use eDNA to verify the presence of cave organisms while developing the foundation for monitoring methods that may be used in the future to document abundance. The proposed project will support recovery and monitoring efforts of the Fish and Wildlife Service and various conservation partners and help inform conservation decisions. The objectives of the project are to (1) develop species-specific DNA mini-barcodes makers for cavefish and several crayfish species and (2) perform eDNA surveillance of caves using these established markers. **Sponsor:** U.S. Fish and Wildlife Service	**PI/PDs:** Shannon Brewer, Ronald Van Den Bussche
Mathematics	**Adapting Socio-ecological Systems to Increased Climate Variability** In this five-year project, Oklahoma Experimental Program to Stimulate Competitive Research (EPSCoR) seeks to advance understanding of how socio-ecological systems can adapt sustainably to increased climate variability caused by a changing climate. This knowledge will be used to empower managers to effectively adapt socio-ecological systems to climate variability and educate Oklahomans about the expected consequences of regional environmental change. Three interlinked research focus areas are proposed to examine complex human, climate, and natural resource systems. These are: a socio-ecological observatory network; a socio-ecological forecasting system, and a decision support system. Each of the three components is linked with feedback loops, providing integration among the constituent parts. The major participants in this proposal are: Oklahoma State University (OSU), the University of Oklahoma (OU), the Samuel Roberts Noble Foundation (SRNF), and the University of Tulsa (TU). OSU and OU are the state's public Ph.D. granting institutions serving 23,500 and 22,600 students respectively , TU is a Ph.D. granting private institution serving approximately 4,000 students and SRNF is an independent non-profit institute that moves science and innovation from the laboratory to agricultural producers. The project also involves additional collaborations with Langston University (LU), a historically black university that serves 3,000 students, four tribal colleges, state and federal agencies/laboratories, and K-12 schools. **Sponsor: National Science Foundation**	PI/PDs: Dana Brunson (Senior Personnel) Ray Huhnke
Mechanical and Aerospace Engineering	**Geothermal Vision Study** A DOE Geothermal Technologies Office vision study taskforce focuses on thermal applications of low temperature geothermal energy, particularly, geothermal heat pump (GHP) and direct use. This project will review and evaluate the current status of GHP applications in the U.S., including the installed base and geographical distribution, barriers preventing wider market penetration, cost and performance of the state-of-the art technologies, and technologies under development that target the barriers. This project will also investigate the maximum technical potential of thermal applications in the U.S. based on robust data, modeling, and analysis of available geothermal resources and potential demands for thermal applications. **Sponsor**: UT-Battelle, LLC for Oak Ridge National Laboratory	**PI/PD:** J.D. Spitler

Mechanical and Aerospace Engineering	**Viscous Heating Demonstration for Helminth Deactivation** Fecal sludge contamination with helminthes causes many health issues in poor countries that lack sophisticated waste treatment facilities. The most problematic is contamination of soil when solid human waste is scattered on the topsoil where residents may become (re)infected with helminthes through ingestion of contaminated food or through direct contact by open wounds in the skin. Our technology is designed to heat a fecal sludge stream by pumping it through an intense shear zone reactor where viscous (friction) heating is used to uniformly heat the feedstock above a threshold temperature to kill the helminth eggs. **Sponsor**: Curators of the University of Missouri at Kansas City for Bill & Melinda Gates Foundation	**PI/PD:** Jim Smay
Mechanical and Aerospace Engineering	**EnergyPlus Whole-Building Modeling and Simulation Software Development** EnergyPlus is a key part of DOE's building energy-efficiency strategy. In its ongoing program implementation and technical management efforts, the National Renewable Energy Laboratory (NREL) requires the assistance of OSU to provide technical support for new features development and for software defects resolutions. **Sponsor:** Alliance for Sustainable Energy, LLC for National Renewable Energy Laboratory	**PI/PD:** Dan Fisher
Mechanical and Aerospace Engineering	**Comparison of the Energy Performance and Capacity of an Air Conditioning System that Uses Low GWP Refrigerants** The overall scope of this research is to study the energy efficiency and cooling performance of an air conditioning (AC) system that uses new low GWP refrigerants manufactured by DuPont. OSU will conduct the performance tests in its large scale climate control chamber and will experimentally measure the energetic coefficient of performance (COP), cooling capacity, evaporator and condensers heat transfer capacity, and the refrigerant thermodynamic state points for the vapor compression cycle. A commercially available air-source AC system will be used in these experiments. **Sponsor:** E.I. du Pont de Nemours and Company	**PI/PD:** Lorenzo Cremaschi
Microbiology and Molecular Genetics	**Structure, Function, and Regulation of the NDH-1 Complexes in Cyanobacteria** Photosynthetic organisms have specialized mechanisms to extract CO2 from the atmosphere and concentrate it in the cellular environment of the major carbon fixing enzyme, which has a notoriously poor affinity for CO2. Understanding these mechanisms is critical for optimizing bioenergy and agricultural production and will be important for the design of biomimetic devices capable of performing artificial photosynthesis and for the development of the next generation CO2 scrubbing materials. The natural mechanism thus provides a basic scientific template for the development of engineered devices addressing critical national energy goals. **Sponsor: US Department of Energy, Basic Energy Sciences**	PI/PD: Robert Burnap
Microbiology and Molecular Genetics	**Assembly and Function of the Photosystem II Complex** Photosystem II is the key enzyme of photosynthesis, natural solar energy production, and needs to be understood for food production and for carbon neutral production of energy and chemical feedstocks. Molecular genetic, biophysical, and bioinformatic techniques are being used to understand the catalytic properties of this crucial enzyme. The aim is to understand basic redox enzymology and provide insight for the production of biomimetic devices for future solar energy applications.	PI/PDs: Robert Burnap, Steven Holland

	Sponsor: National Science Foundation, Molecular and Cellular Biochemistry	
Microbiology and Molecular Genetics	**Isolation and Characterization of Novel Lignin-Degrading Bacteria for Enhanced Saccharification and Biofuel production from Plant Biomass** This is a NSF funded REU program. Undergraduate students are recruited from diverse populations and given the opportunity to participate in STEM research carried out by various researchers at OSU. The primary goal of this subproject is to isolate novel bacteria that have high potential to be useful in the bioconversion of plant biomass to biofuel. We utilize genomic and proteomic approaches to identify novel lignin-degrading genes in isolated strains. In my lab, students learn how to cultivate microorganisms, determine lignin content, and perform lignin peroxidase and phenol oxidase assays. In addition, students learn basic molecular techniques such as isolation of DNA, PCR amplification, gel electrophoresis, DNA sequencing and database searches for lignocelluloses degrading genes. The outcomes of our project include a better understanding of the role of bacteria in lignin degradation and also exposing students to various research tools **Sponsor: NSF-REU**	PI/PDs: Babu Fathepure (Co-PI) College of Agricultural Sciences and Natural Resources, Gopal Kakani (PI)
Natural Resources Ecology and Management	**Coordination and Report of Research Efforts Related to Fisheries, Rangeland, and Wildlife Resources in Natural Resource Ecology and Management** This project will coordinate the conduct and reporting of grants awarded to Natural Resource Ecology and Management investigators that are supported by OAES for the purpose of exploring novel approaches to current issues related to natural resources, ecology, and conservation issues. It is intended that the results of these grants will lead to more extensive research in areas that require preliminary data to stimulate creative approaches to address the sustainable management and conservation of fisheries, forestry, rangeland, and wildlife resources. (2610) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** R. James Ansley
Natural Resources Ecology and Management	**Understanding Plant-soil Microbial Processes to Enhance Soil Carbon Sequestration in Bioenergy Feedstock Production** The Energy Independence and Security Act of 2007 mandates increased reliance on biofuels to reduce our dependency on foreign oil. It has been suggested that prairie grasses can provide a sustainable, low-input biofuel feedstock, while at the same time sequestering large amounts of soil carbon (C). We have studied the importance of mycorrhizas to prairie ecosystems, as well as their contribution to belowground C storage for over 25 years. We wish to apply this ecological knowledge towards the development of sustainable practices for biofuel feedstock production. (2808) **Sponsors:** USDA AFRI, Oklahoma Agricultural Experiment Station	**PI/PDs:** Gail W.T. Wilson Plant & Soil Sciences: Yanqi Wu Argonne National Lab.: R. Michael Miller No. Arizona Univ.: Nancy C. Johnson
Natural Resources Ecology and Management	**Impacts of Landscape Heterogeneity and Fragmentation on Grassland Birds** Historically, Great Plains grasslands were shaped by fire and grazing interactions, which created a heterogeneous habitat for grassland birds. Fire suppression in Oklahoma has played a role in the loss and degradation of habitat. Additional fragmentations in habitat are being caused by increases in human structures on the landscape. Little information exists on how these fragmentations directly impact grassland birds. Our objectives are to evaluate how fragmentation in the forms of fire suppression, woody plant encroachment, and human structures are related to survival, movement, and reproduction of select grassland birds. (2838)	**PI/PDs:** R. Dwayne Elmore, Samuel D. Fuhlendorf, Craig A. Davis, Mark Gregory

	Sponsors: Oklahoma Agricultural Experiment Station, Oklahoma Cooperative Fish and Wildlife Research Unit, Kansas Department of Wildlife, Parks, and Tourism, Oklahoma Department of Wildlife Conservation, Kansas Cooperative Fish and Wildlife Research Unit, Sutton Avian Research Center, University of Oklahoma, donations from private individuals, NGOs, and industry through the OSU Foundation	
Natural Resources Ecology and Management	**Carbon Sequestration in Oklahoma Forests & Probable Response to Climate Change** A significant amount of atmospheric carbon has been stored in forests in the US, much of which would have otherwise been released to the atmosphere with potentially deleterious effects with regard to global warming. Carbon storage is not necessarily incompatible with production of forest products since the end use of timber affects carbon storage. Management of southern forests in general and Oklahoma forests in particular is significant for economies and for the potential for climate change. Climate change may affect many aspects of forest growth and hence forest management. This project will collect data which will provide a more complete picture of carbon storage for certain Oklahoma forest types & analyze potential responses to future climate change. (2843) **Sponsors:** Oklahoma Agricultural Experiment Station, USDA Forest Service, Southern Research Station	**PI/PD:** Thomas B. Lynch
Natural Resources Ecology and Management	**Nano-based Wood Plastic Composites Manufactured from Eastern Red Cedar** The eastern red cedar population in Oklahoma is growing. Eastern red cedar adversely affects grassland productivity, water resources, and wildlife habitat. This research proposes to develop wood plastic composite technology that would impact Oklahoma's economy by exploiting the largely underutilized eastern red cedar. (2862) **Sponsor:** Oklahoma Agricultural Experiment Station, OSU Food and Agricultural Products Research and Technology Center, Oklahoma Redcedar Association	**PI/PD:** Salim Hiziroglu
Natural Resources Ecology and Management	**Impacts of Regional Bioenergy Systems on Water Availability and Quality** An opportunity exists in the Great Plains to supply feedstock for a vibrant cellulosic biofuel industry while also enhancing ecosystems services, in particular, water supply. This research will determine the impact of harvesting eastern red cedar on water yield at the watershed scale, as compared to recovering and intact native grasslands. It will also determine how planting switchgrass after eastern red cedar harvest affects water quantity and quality and compare to recovering and intact native grasslands. (2892) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA AFRI	**PI/PD:** Rodney E. Will, Jr.
Natural Resources Ecology and Management	**Ecologically-based Invasive Plant Management of Forages in Oklahoma** Biological invasion by non-native plants is a major cause of native ecosystem loss. This research will focus on further assessment of basic ecological characteristics invasive plant species exhibit. This knowledge will be applied to the development of appropriate management practices for controlling invasive plants. (2893) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA AFRI, Oklahoma Cooperative Fish and Wildlife Research Unit	**PI/PD:** Karen R. Hickman
Natural Resources	**Combining Field Studies & Quantitative Reviews of Existing Data to Improve Understanding of Direct Human-caused Wildlife Mortality**	**PI/PD:** Scott R. Loss

Ecology and Management	This research seeks to: 1) estimate abundance, density, and the factors influencing density, of populations of free-ranging domestic cats, 2) identify correlates of mortality rates for bird building collisions and for bird and bat collisions with wind turbines and estimate the amount of total mortality, along with taxonomic patterns of vulnerability, caused by bat collisions with wind turbines at national, regional, and state (including Oklahoma) scales, and 3) assess how biases inherent in conducting dead bird and bat surveys and applying statistical estimators to fatality counts influence estimates of local mortality rates, mortality rate correlates, and regional and national mortality. (2915) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA NIFA, Oklahoma Cooperative Fish and Wildlife Research Unit	
Natural Resources Ecology and Management	**Restoration and Maintenance of Forest Health of South Central United States Bottomland Hardwoods** This research will determine the original composition and structure of bottomland hardwood forests in south-central North American, the changes in land use that lead to their current condition and the cultural treatments to restore the integrity and health of floodplain ecosystems. The expected benefit of the proposed research is new knowledge and management tools for restoration and maintenance of bottomland hardwood forests. (2928) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA NIFA	**PI/PD:** Stephen Hallgren
Natural Resources Ecology and Management	**Silviculture of Forest and Woodland Communities in Oklahoma in Relation to Productivity and Water Use** Loblolly pine is the most important commercial tree species in the United States and the world. While extensive pine plantation research has focused on maximizing productivity through the addition of nutrients and control of competing vegetation, less is known regarding the potential impact of changes in climate on southern pine productivity and how reduced precipitation may interact with nutrient availability. To address this issue, we will determine the effects of reduced water availability and increased nutrient availability on loblolly pine plantation growth, carbon sequestration, water use and physiology by measuring plantation response to a 30% decrease in throughfall and fertilization. (2929) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA NIFA	**PI/PD:** Rodney E. Will, Jr.
Natural Resources Ecology and Management	**Improving Oklahoma Rangelands through Understanding Above- and Below-ground Linkages** The research project will examine above and below ground linkages of rangeland ecosystems with a goal of improving rangeland quality throughout Oklahoma, the central U.S., and worldwide. Specifically, this project includes 3 major objectives to further assess: 1) ecosystem level implications of woody plant encroachment, 2) sustainable management for biofuel production, and 3) successful restoration following invasion by non-native grasses. (2930) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA NIFA	**PI/PD:** Gail Wilson
Natural Resources Ecology and Management	**Vegetation and Land Use Impact on Vadose Soil Moisture Dynamics and Groundwater Recharge in Oklahoma** Rapid change in land cover in the southern Great Plains has revitalized interest in managing land cover for water supply. The goal of this project is to assess the effects of vegetation types on soil moisture dynamic and groundwater recharge potential in upland ecosystems. Specific objectives include: 1) quantify soil moisture for the rooting zone under three contrasting vegetation types - grassland, post oak dominated deciduous forest and	**PI/PD:** Chris Zou

	juniper woodland with the same precipitation input, 2) monitor the level of water table and evaluate interflow under different vegetation types and their seasonal variations, and 3) assess long-term water efflux out of the rooting zone using chloride mass balance - proximity for recharge potential. (2931) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA NIFA	
Natural Resources Ecology and Management	**Conservation of Rangelands and Wildlife on a Changing Landscape** If native rangelands are to fully meet the expectations of society, it will require fundamental and substantial change in the principles of the discipline of rangeland management, and ultimately to its application at the landscape level. Objectives have been developed that will evaluate the relative importance of several of the principles over the next several years. Specific objectives include: 1) evaluate the response of economically and ecologically important wildlife populations to heterogeneous landscapes as influenced by agricultural management, fire, energy development and global change, and 2) evaluate vegetation responses as fuel for fires, forage for livestock and habitat for important wildlife populations to agricultural management, fire, energy development and global change. (2954) **Sponsor:** Oklahoma Agricultural Experiment Station, USDA NIFA	**PI/PD:** Samuel Fuhlendorf
Natural Resources Ecology and Management	**Assessments of Landscape Function for Native Oklahoma Birds** The overriding objective of this project is to provide information that can be used by stakeholders to assess the ability of landscapes to support select native bird species. In some applications, the focus will be on specific species of conservation priority, for others the information will be folded into a broader community analysis to model overall ecosystem integrity for entire landscapes and ecoregions. (3007) **Sponsor:** Oklahoma Agricultural Experiment Station, Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma Department of Wildlife Conservation, OSU Department of Integrative Biology, Oaks and Prairies Joint Venture	**PI/PD:** Timothy J. O'Connell
Natural Resources Ecology and Management	**Conservation of Wildlife in Fire-dependent Rangelands** The general objective of this project is to examine the response of wildlife populations, predominantly avian species, to landscape changes at multiple spatial and temporal scales in shrub-dominated rangelands in western Oklahoma. Specifically, this project will be focused on examining the impact of both long-term and short-term land-use changes at multiple scales to guide conservation strategies for imperiled species such as northern bobwhite and lesser prairie chickens, as well as other wildlife. (3008) **Sponsor:** Oklahoma Agricultural Experiment Station, Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma Department of Wildlife Conservation, USDA Natural Resource Conservation Service	**PI/PD:** Craig A. Davis
Natural Resources Ecology and Management	**Status, Distribution, and Ecology of Black Bears in Eastern Oklahoma** The overall objective of this research is to provide information on the recently re-established black bear populations in Oklahoma that will provide a scientific basis for their management and contribute to a broader understanding of the ecological and anthropogenic effects on black bear populations. (3009) **Sponsor:** Oklahoma Agricultural Experiment Station, Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma Department of Wildlife Conservation, USDA Forest Service, Ouachita National Forest, Tulsa Zoo	**PI/PD:** W. Sue Fairbanks
Plant and Soil Science	**Land Application and Beneficial Re-use of Industrial and Agricultural by-products**	**PI/PD:** Chad Penn

	Since October of 2014, a P removal structure that was previously constructed has continued to be monitored. This structure was built on a poultry farm in Eastern OK, and has removed around 60% of the dissolved P that has entered into it. Multiple efforts are being made throughout the U.S. and this has resulted in collaborations in OH, IN, VT, WV, PA, NY, WI, and MD. We have developed the first version of the design software for the P removal structures, known as PhROG: Phosphorus Removal Online Guidance. Oklahoma State University has licensed this software to the Maryland Department of Agriculture for construction of 30 structures, and is currently licensing a company in Ohio. The software and tutorials can found at www.phrog.okstate.edu. This also led to many presentations and popular press articles. (2658) **Sponsor:** Oklahoma Agricultural Experiment Station	
Plant and Soil Science	**Assessment of the Carbon Sequestration Potential of Common Agricultural Systems on Benchmark Soils across the Southern Region Climate Gradient** This project will generate essential, scientifically based field data to support accurate projections of and provide guidance for soil C sequestration potentials across the climate gradient of the southern US. Collected data and findings will be made available via the internet and accessible through the group's website, which will facilitate dissemination of information generated. The group project stimulates common understanding, shared research, and provides an educational platform among southern US academic institutions and government partners. Data collected, between 2009-2012 from an on-farm soil carbon sequestration assessment, was compiled and utilized by the Oklahoma carbon program to validate carbon sequestration estimates for no-till. Furthermore, data collected between 2011-2013 to evaluate the stability of carbon analysis as a function of sample collection technique was used to develop a sampling protocol for the Oklahoma carbon program. This data has been presented at regional meetings to provide data for the far western portion of the southern region and is currently being developed into manuscripts. (2815) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PDs:** Jason Warren, Tyson Ochsner
Plant and Soil Science	**Managing Plant Microbe Interactions in Soil to Promote Sustainable Agriculture** Near the root surface termed the rhizosphere is one of the most microbially active regions on earth. Billions of bacteria from tens of thousands of species inhabit the rhizosphere. These are fed by plant produced photosynthetic carbon to support or detract from plant biomass accumulation. These organisms are essential for protecting plants from disease, extracting nutrients from soil substrates, and producing plant growth promoting compounds. Potential pathogens also inhabit the rhizosphere causing disease in susceptible varieties. Here we develop the experimental, statistical and bioinformatics procedures to identify the organisms that support and detract from plant productivity. Using next generation sequencing of rhizobacterial DNA, a refined experimental wheat growth design, a novel and powerful nonparametric statistical approach, we have been successful in distinguishing positive vs negative organisms from the tens of thousands microbes (*Applied and Environmental Microbiology 78: 4434- 4446*). We have identified quantitative criteria to judge the productivity of the microbial system under a given soil system. We are currently developing approaches to enhance soil-plant productivity through application of specific microbial inoculums and	**PI/PD:** Michael Anderson, Hailin Zhang Statistics: Joshua Habiger

	substrates in a long term study. We will use plant productivity, our quantitative criteria referred to above and an analysis of the overall microbial community structure to gauge our progress. We have initiated projects to examine the changes in productivity associated microbial communities in response to organic nitrogen fertilization and biochar in comparison to the more typical inorganic nitrogen fertilization practices. The work will pave the way for a better understanding of the long term contribution of the microbial community to plant productivity and in the development of tools and technology for characterizing and improving plant productivity and agricultural sustainability. (2874) **Sponsor:** Oklahoma Agricultural Experiment Station	
Plant and Soil Science	**Soil Health in Soil Conservation Management Systems** Much of Oklahoma's soil resources are degraded due to a century of tillage and the resulting loss of topsoil. With this loss of topsoil; soil organic matter and nutrients have been lost as well as the healthy biological and physical characteristics of the native soil system. This project is aimed at identifying production systems that provide economically viable alternatives to conventional production that result in improved soil health through utilization of no-till management and improvements in crop diversity. This effort will focus but not be limited to the extensive integrated crop/livestock production complex currently dominated by dual purpose wheat grazed by cattle. This project will utilize long-term no-till rotations currently in place to assess soil health. It will use newly established research plots to evaluate crop/livestock production systems that promote diversity and crop health while providing economically viable alternatives to the monoculture/conventional wheat based system. This project will improve the diversity of cropping systems in the region, thereby making them more resilient to drought and economic volatility while improving soil health. (2938) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PDs:** Jason Warren, Hailin Zhang, Brian Arnall
Plant and Soil Science	**Effect of Management Practices on Soil Microbial Community and Enzyme Activity in Relation to Ecosystem Health and Function** Soil microflora and enzyme activities play crucial roles in maintaining sustainable agricultural production and soil health. Research progress is hindered by the lack of effective detection methods, and limited understanding of the complex soil systems and the vastly unknown microbes that reside within. We have made progress in standardizing methods in soil enzyme detection for valid data comparison and meaningful interpretation. Through evaluation of over 130,000 bacterial gene sequences originated from soils under various land uses and management practices, we demonstrated the importance and potential in sustaining agricultural production through preserving activities of the soil microbial community. (2953) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PDs:** Shiping Deng Natural Resources and Ecology Management: Sam Fuhlendorf Horticulture and Landscape Architecture: Jeff Anderson
Plant and Soil Science	**Developing and Improving Bioenergy Crop Models** Bioenergy crops will be grown in both traditional and non-traditional areas and require intensive experimental studies to evaluate production potential, environmental, and economic consequences. Crop models can reduce the costs involved in conducting field experiments by identifying key treatments and by extrapolating results to other regions and environmental conditions. Morphological and physiological, growth, and yield traits measured for bioenergy species (switchgrass, sorghum, energy beets) will be used to develop algorithms and modules to develop and improved bioenergy crop	**PI/PD:** Gopal Kakani

	models. Experiments are being conducted in growth chamber, green house, and field facilities to derive the data sets needed for developing and improving models. Algorithm development and model validation is ongoing as part of this program. Undergraduate students are being trained in bioenergy research through an NSF funded Research Experience for undergraduates' project. Current collaborations with national and international organizations are being strengthened to improve the profile of bioenergy crops in Oklahoma. An Agricultural Model Intercomparison and Improvement Project (AGMIP) - Bioenergy Crops team has been initiated to address the issues associated bioenergy crop model development by collaborating with researchers in US and around the world. Several in-state and multi-state teams are being developed to address regional feedstock production issues through Competitive Grants and Industry collaboration. (2969) **Sponsor:** Oklahoma Agricultural Experiment Station	
Plant and Soil Science	**Pasture, Turfgrass and Biofuel Grass Breeding and Genetics Research** Grasses used in pasture, range, and turf plantings are economically, environmentally, and societally important. The main objective of this project is to develop new grass cultivars bred for improvements in yield, quality, adaptation, and other selected performance traits. Cultivars will be bred for pasture, turf, and bioenergy feedstock uses. This will involve collecting, evaluating, and enhancing germplasm of selected grass species, elucidating reproductive behavior, genetic variation, and breeding improvement potential in selected grass species, as well as development and testing of new plant breeding models that incorporate molecular techniques. Development and use of DNA molecular markers, encompassing simple sequence repeat (SSRs) and amplified fragment length polymorphism (AFLP) in bermudagrass and switchgrass is one of the currently focused research investigations. The developed DNA markers will be used in molecular analysis of important traits and construction of genetic maps for the selected important species. A new bermudagrass cultivar for forage and pasture use, 'Goodwell' bermudagrass was released by Oklahoma Agricultural Experiment Station in March, 2007. A new switchgrass cultivar 'Cimarron' (SL 93 2001-1) was released by the OAES for biofuel feedstock and forage production in February, 2008. Two new turf bermudagrass clonal selections had outstanding performance in multiple locations of the National Turfgrass Evaluation Program Bermudagrass Test. The two turf bermudagrass clones, OKC 1119 and OKC 1134 were released by the Oklahoma Agricultural Experiment Station in July 2010. OKC 1119 is officially named Latitude 36 while OKC 1134 has a name of NorthBridge. The two new turf cultivars have been licensed for commercial production since 2011. As of writing the report, there are 36 sod producers who have obtained licenses to produce sod for the two turf bermudagrasses in the US. (2972) **Sponsors:** Oklahoma Agricultural Experiment Station, U.S. Golf Association, USDA, Oklahoma Turf Research Foundation, Oklahoma Bioenergy Center, and Sun Grant Initiative	**PI/PD:** Yanqi Wu
Plant and Soil Science	**Soil, Water, and Environmental Physics across Scales** This was a productive year for the project. Objective 2 of this multi-state project is to develop and evaluate new instruments and analytical methods to connect our understanding of mass and energy transport in the vadose zone at different scales and environmental transformations. To accomplish that objective, we evaluated a method for estimating drainage rates from the root zone using long-term in situ soil moisture data, and we evaluated the	**PI/PD:** Tyson Ochsner

	relationship between those drainage estimates and long-term groundwater recharge rates. We prepared a manuscript describing the results of this research and the manuscript is currently in review at Vadose Zone Journal. Key outcomes of this project were advances in scientific knowledge on estimating drainage rates from the root zone using long-term in situ soil moisture data. This new knowledge was generated by the project team and shared with audiences of researchers and stakeholders at state and national conferences. (2973) **Sponsor:** Oklahoma Agricultural Experiment Station	
Plant Biology, Ecology and Evolution	**Feasibility testing of a passive solar and geothermal water circulation and temperature control system for outdoor algae cultures** This project will test whether: 1) passive solar convection can be used to circulate water through shallow raceways (for outdoor algae cultures) during sunny days, and 2) temperature regulation is possible using underground heat exchange with the return water stream. These two aspects are potentially independent – one could be used without the other, but the intent is to couple them. If successful, this system could circulate and temperature regulate outdoor algae cultures using only zero-cost energy and no water input for these aspects of cultivation. **Sponsor:** National Energy Solutions Institute – Smart Energy Source (NESI-SES)	**PI/PD:** William Henley
Robert m. Kerr food and agricultural products research and technology Center	**Advanced Processing Techniques for Biobased Product Development** Biomass can be thermally converted to bio-oil, combustible gases and bio-char by pyrolysis in the absence of oxygen. The objective of this research project is to optimize a microwave assisted pyrolysis (MAP) process that will produce bio-oil from algal biomass. The direct conversion of the electromagnetic energy into heat at the molecular level makes microwave an efficient technology for biomass pyrolysis. Biomass from Oklahoma native algae strains grown on waste water is used as feedstock for MAP. The target bio-oil can be refined into fuels with energy content and functional properties similar to petroleum based fuels or converted other bio-products. Adaptation of the pyrolysis oil as feedstock for bio-product manufacturing will not require substantial changes to the existing fuel production, use and distribution infrastructure. (2894) **Sponsor:** Oklahoma Agricultural Experiment Station	**PI/PD:** Nurhan Turgut Dunford
Sociology	**Adapting Socio-ecological Systems to Increased Climate Variability** Representing more than a dozen academic disciplines and four institutions across Oklahoma, the Climate Variability Team studies how humans and the environment interact and how those relationships adapt to changes in climate. The research advances understanding of socioecological systems and how to enhance resilience and sustainability. **Sponsor**: National Science Foundation EPSCoR	**PI/PDs**: Duane A. Gill, Beth Caniglia