

# **Oklahoma Natural Resources Conference**

**2018**

**Accepted Abstracts**

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Oklahoma Dept. of Wildlife Conservation

## Results of a 5-Year Spring-Time Roving Creel Survey on Eufaula Lake, OK

A presentation of the results of a roving springtime creel survey conducted on Eufaula Lake, Oklahoma each year from 2010-2014 beginning in March, carrying on through April and May and ending in June of each year. The lake was divided into five arms and each arm was surveyed beginning with the Gaines Creek Arm (2010), then the Deep Fork Arm (2011), the North Canadian Arm (2012), the South Canadian Arm (2013) and the Central Pool Arm (2014). Crappie were the most sought-after type of fish in the survey period, followed by catfish and then black bass. Fishing from boats was the most-preferred angling method followed by bank angling. Possible management implications of these results might include a water level management plan to improve crappie and bass reproductive and recruitment success, boating access improvements and bank fishing access improvements. Fish attractors would help improve angling success rates.

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W. Sue Fairbanks, Stephen L. Webb, Joshua A. Gaskamp, Charles Rohla,

## Wild Pig (*Sus Scrofa*) Impacts in Pecan Operations

Wild pigs (*Sus scrofa*) have expanded their range throughout the United States, causing damage to pasture land, livestock, lawns and agricultural crops. Pecans (*Carya illinoensis*) are an economically important crop that are managed and harvested where sympatric populations of wild pigs occur. Through foraging behaviors such as rooting, digging, direct consumption, an2d2 2t2r2a2m2p2l2i2n2g2,2 2w2i2l2d2 2p2i2g2s2 2m2a2y2 2r2e2d2u2c2e2 2y2e2a2r2 2t2o2 2y2e2a2r2 2y2i2e2l2d2s2.2 2O2u2r2 2s2t2u2d2y2 2i2n2v2e2s2t2i2g2a2t2e2s2 2t2h2e2 2m2o2v2e2m2e2n2t2s2 2a2n2d2 2s2e2l2e2c2t2i2o2n2 2o2f2 2p2e2c2a2n2 2o2r2c2h2a2r2d2s2 2a2n2d2 2g2r2o2v2e2s2 2b2y2 2w2i2l2d2 2p2i2g2s2,2 2p2r2e2 2a2n2d2 2p2o2s2t2-2h2a2r2v2e2s2t2,2 2a2n2d2 2q2u2a2n2t2i2f2i2e2s2 2h2a2r2v2e2s2t2 2i2n2e2f2i2c2i2e2n2c2y2 2b2e2c2a2u2s2e2 2o2f2 2w2i2l2d2 2p2i2g2 2d2a2m2a2g2e2.2 2U2s2i2n2g2 2B2o2a2r2B2u2s2t2e2r2! 2t2r2a2p2s2,2 2w2e2 2c2a2p2t2u2r2e2d2 2a2n2d2 2r2e2l2e2a2s2e2d2 21262 2a2d2u2l2t2 2s2o2w2s2 2i2n2 222021262,2 2a2n2d2 21232 2a2d2u2l2t2 2s2o2w2s2 2i2n2 222021272,2 2t2a2r2g2e2t2i2n2g2 222 2i2n2d2i2v2i2d2u2a2l2s2 2p2e2r2 2s2o2u2n2d2e2r2 2a2n2d2 2f2i2t2e2d2 2t2h2e2m2 2w2i2t2h2 2V2e2c2t2r2o2n2i2c2 2V2e2r2t2e2x2 2L2i2t2e2 2G2P2S2 2c2o2l2l2a2r2s2 2w2i2t2h2 2l2r2i2d2i2u2m2 2c2o2m2m2u2n2i2c2a2t2i2o2n2.2 2 2C2o2l2l2a2r2s2 2w2e2r2e2 2p2r2o2g2r2a2m2m2e2d2 2t2o2 2t2a2k2e2 212 2G2P2S2 2l2o2c2a2t2i2o2n2 2e2v2e2r2y2 23202 2m2i2n2 2t2o2 2m2o2n2i2t2o2r2 2w2i2l2d2 2p2i2g2 2m2o2v2e2m2e2n2t2s2 2a2n2d2 2s2e2l2e2c2t2i2o2n2 2o2f2 2p2e2c2a2n2 2g2r2o2v2e2s2 2a2n2d2 2o2r2c2h2a2r2d2s2.2 2 2C2o2l2l2a2r2s2 2w2e2r2e2 2d2e2p2l2o2y2e2d2 2f2r2o2m2 2m2i2d2-2O2c2t2o2b2e2r2 2t2h2r2o2u2g2h2 2D2e2c2e2m2b2e2r2 222021262 2i2n2 2o2u2r2 2f2i2r2s2t2 2y2e2a2r2 2a2n2d2 2S2e2p2t2e2m2b2e2r2 2t2h2r2o2u2g2h2 2D2e2c2e2m2b2e2r2 222021

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Chad King

## Monitoring Stands of Green Ash (*Fraxinus Pennsylvanica*, Marshall) At Arcadia Lake, Oklahoma County, OK

Throughout the United States, millions of ash trees have been killed by the exotic invasive, emerald ash borer (EAB) (*Agrilus planipennis*), resulting in hundreds of millions of dollars of damage. At the time of this writing, thirty-one states have confirmed EAB sightings. Our study aims to locate, measure, and monitor stands of green ash (*Fraxinus pennsylvanica*, Marshall), located in a bottomland forest adjacent to Arcadia Lake in Edmond, OK. Confirmation of EAB in Oklahoma (Delaware County) in 2016, has provided us the impetus to establish a thorough understanding of the distribution of green ash trees, and to surveil the stands for potential EAB colonization. To date, 411 green ash trees have been tagged and assigned GPS waypoints for the monitoring of individual trees. Diameter at breast height (DBH; 1.37m) has been recorded for all individuals for estimates of basal area. A subset of 42 ash trees were cored to estimate the age structure of green ash. Additionally, 100m line transects were established to better understand forest composition and tree ages adjacent to the green ash stand. Green ash trees in the study area range from 17 to 69 years old, with a median age of 24. Individual ash trees have a DBH range of 5.2 - 35.1 cm, and a median DBH of 13.5 cm. In addition to green ash, we identified 17 associate species and obtained DBH and age measurements. The age of individuals from the transects range from 16 - 80 years old, and have a median age of 29 years. To date, no EAB or evidence of EAB presence has been observed.

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Tim O'Connell

## Songbird Responses to Drought Conditions with Temporal Scale Considerations

A predicted effect of anthropogenic climate change is an increase in frequency, duration, and magnitude of weather extremes, including drought events. Drought can be assessed at multiple temporal scales, each of which relates to a different water source. For example, drought quantified at an annual scale corresponds with groundwater availability while drought quantified at a monthly scale relates to current soil moisture and surface flow. This study leverages a long-term, citizen science dataset (Breeding Bird Survey) to determine whether there are detectable songbird responses during drought conditions, and if so, at what temporal scale they occur. To account for observer bias and differing land cover at route locations, we used generalized linear mixed modeling with random effects observer identification and route location. Drought conditions were quantified using PRSIM data and a standardized precipitation evapotranspiration index. We applied AIC model ranking to determine which drought scale best explained the distribution of birds at the species level. Results show a mixed response among species with the strongest signal at an annual or near-annual scale. Some birds did not show a response to drought conditions at any scale. For species that showed a response to drought conditions, we also used dynamic occupancy modeling to determine whether drought conditions were associated with a change in local colonization or extinction rates. Some species showed a significant effect of drought on colonization and/or extinction rates, while others did not. Results indicate a complex relationship between drought conditions and songbird distribution.

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Ryan Ryswyk, Cliff Sager, Richard Snow, Daniel Shoup

### **Direct Consumptive Affects of Saugeye on White Crappie Population Growth and Size Structure**

Hybrid saugeye *Sander vitreum* x *Sander canadense* introductions have been used in numerous reservoirs in an attempt to improve stunted White Crappie *Pomoxis annularis* population size structure through increased predation and the resulting reduction in intraspecific competition. This predatory control is dependent on the saugeye population directly consuming enough crappie annually to reduce crappie population biomass at a magnitude that will significantly alter density-dependent dynamics and growth rates. However, this management strategy has only been evaluated indirectly, and no direct estimate of annual consumption of crappie by saugeye has been measured. Therefore, we estimated annual consumption of crappie in three Oklahoma reservoirs using bioenergetics modeling. We also constructed yield-per-recruit models with a density-dependent growth factor to estimate the potential change in crappie growth and size structure after including the additional mortality imposed by saugeye. Saugeye diet compositions and population dynamics (saugeye and crappie) were derived for each lake using gastric lavage samples and a subsample of otoliths, respectively. Preliminary bioenergetics models from Lake Carl Blackwell indicate saugeye consume 1,175 kg (95% CI: 895 - 1,711 kg) of crappie annually, which would cause 6.5 - 12.4% additional annual mortality to an average-size crappie population, but only 2.4 - 4.6% additional mortality to a crappie population at the 90th percentile of abundance, a theoretically high-density, stunted population. Final bioenergetics models and crappie yield-per-recruit models are ongoing, but results will be presented in this talk. The results from this study may influence saugeye regulations (liberalized length and creel limits) and advertising (sportfish vs. biological control) in an attempt to achieve the most potential from the fishery if control of over-abundant White Crappie populations is not practical.

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### **Detecting Historic Disturbance Regimes in an Oak-Hickory Forest at Hottonia Bottoms Nature Preserve**

Dendroecology uses variations in tree ring growth patterns to assess the impacts of environmental changes on tree growth, stand structure, and stand dynamics. These techniques have become vital in understanding historic disturbance regimes and forest stand dynamics. Our studies objective was to analyze historic disturbance regimes and growth release patterns in an oak-hickory forest. We collected 66 increment cores from Hottonia Bottoms Nature Preserve to analyze historic disturbance regimes and growth release patterns. Increment cores were collected from southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), and mockernut hickory (*Carya tomentosa*). Increment cores were collected along 6 belt transects throughout the study site; trees were cored every 200m along the transect. Standard dendrochronology procedures were used to prepare each sample. Ring widths were measured to the nearest 0.001mm and each series was crossdated both graphically and statistically using the program COFECHA. Percent growth change analysis was used to analyze growth release patterns of each tree ring series. Disturbance events were characterized by an abrupt growth change of greater than 100%. Preliminary results for southern red oak and post oak showed that 33% of the increment cores exhibited a growth release during the 1970s. The oldest release event occurred in 1924, while the most recent event occurred in 2001. Our preliminary results suggest canopy disturbance events occurred at Hottonia Bottoms during the 1940s and again during the mid-1970s.

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**Ciarlante, Ashley** - Ashley.N.Ciarlante-1@ou.edu  
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Rebecca Loraamm

### **Wind Energy and Wildlife Management With a Focus on Prairie Chickens**

The relationship between renewable wind energy and wildlife management will become increasingly important as the push for finding alternatives to fossil fuels continue. The demand for alternatives to fossil fuels have increase over the past couple of year and will continue to do so. However, there is a lack of research and studies of the effects these alternatives to fossil fuels might have on the environment. This paper is the compiling of literature to examine the wind energy versus wildlife management perspectives. Literature that was selected focused on wind energy compared to current fossil fuels, how to determine a site for wind turbines and regulations for wind energy, general effects of wind turbines with a focus on the effects of wind energy on prairie chickens, about prairie chickens and management of the species, and finally examining wind energy and wildlife perspectives interactions. Wildlife management of species and wind energy must work together in the future to ensure the future of wildlife species and the future of wind energy.

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Eric Duell, Cooper Sherrill, Catherine Haviland, Ryan Reuter, Laura Goodman

### **The Effect of Cattle Digestion and Rumination on Sericea Lespedeza Seed Germination**

*Sericea lespedeza* (*Lespedeza cuneata*) is a non-native legume invading rangelands in the southern Great Plains. Herbicides offer short-term control with long-term negative effects on native forbs. Increasing cattle consumption by burning and mowing has been proposed to suppress plant growth but little is known about the effect of digestion on sericea seeds. Our objective was to identify the effect of cattle digestion on sericea lespedeza seed germination. Sericea seeds were subjected to one of the following treatments: 1) passage through the complete digestive tract by feeding 500 g of seeds with 1.8 kg of dried distillers grains to 4 steers; 2) digestion in only the rumen by placing in-situ bags containing 100 g of seed in 4 cannulated steers; or 3) no digestion. At 12, 24, 36, 48, and 60 hours post feeding, fecal samples were collected from each steer and sieved for seeds. Following surface sterilization, seeds were placed on germination paper in a growth chamber with germinated seeds counted on day 3, 7, 14, and 21. Analysis of variance was used to model germination percentage as a function of exposure type and seed condition. Full digestion and rumination increased germination ( $P < 0.002$ ,  $P < 0.05$ ; respectively) by 17% and 12% over the 4% germination rate of the control seeds. The number of seeds in fecal collections declined over time ( $P < 0.01$ ) and as time in the digestive tract increased, percentage of seeds with intact endocarp was less ( $P < 0.04$ ). Hulled seeds germinated at a 15% greater rate than seeds with intact endocarps ( $P < 0.05$ ). We recommend grazing sericea-infested pastures prior to flowering and penning cattle that have been grazing sericea-infested pastures for 4 to 5 days before grazing a sericea-free pasture.

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### **Status of Aquatic Invasive Plants in Oklahoma's Lakes: Year Two of a Four Year Survey**

Partially funded with a State Wildlife Grant, I have completed two years of a four-year survey of eight aquatic invasive plants that are considered of particular interest by the Oklahoma Department of Wildlife Conservation. Surveys started in the spring of 2016 looking for Yellow Iris (*Iris pseudacorus*) at bridge crossings on the Blue River, because of the known infestation on private land NW of Connerville, OK. No irises were observed at any bridge sites. Boat ramps and docks, fishing piers, marinas, and swim beaches of public lakes are the focus of the targeted species surveys because of the likelihood of introduction at these sites. After two field seasons, I have examined over 180 public access points at 70 lakes, primarily in eastern Oklahoma. I found significant infestations of Eurasian Milfoil (*Myriophyllum spicatum*) at three lakes. I found abundant infestations of Parrotfeather (*Myriophyllum aquaticum*) at three other lakes. I found a small population of Alligator Weed (*Alternanthera philoxeroides*) at one boat dock at Pine Creek Lake. I found a single Hydrilla (*Hydrilla verticillata*) at a small southeastern lake, but an abundant infestation at Lake Murray. Lake managers and ODWC's Aquatic Nuisance Species Biologist were notified of these populations. I am currently testing eDNA techniques that may help detect invasive plants from water samples.

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### **Dispersal of Reptiles and Amphibians Among Islands of The Delta Island Complex in The Sequoyah National Wildlife Refuge, Vian, OK**

We sampled riverine ecosystems in Sequoyah National Wildlife Refuge during July, August and September 2016, and from April to September 2017. We did not sample in May 2017 due to major flooding. Three islands and two mainland site were sampled for reptiles and amphibians using Y-shaped pitfall arrays consisting of ten pitfalls connected by drift fences. Reptiles and amphibians were also surveyed using walking surveys. Walking surveys consisted of 30-minute visual searches in designated areas around the pitfall arrays. We detected 8 species of amphibians in four families on both mainland and island sites. We detected five species of lizards, six species of snakes and seven species of turtles. Amphibians were detected at all sampling sites. More species and individuals of amphibians were detected on islands than the mainland. Islands may serve as a refuge for amphibians in this riverine ecosystem. More species and individuals of turtles were detected on the islands when compared to mainland sites. Hatchling turtles were found exclusively on the islands. Islands may serve as nesting grounds and nurseries for young turtles. The role of islands as habitats likely varies between different reptile species. Field work scheduled for 2018 is expected to better highlight the varying dispersal abilities of reptiles and amphibians, as well as the ecological role that islands play in their population ecology.

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Shannon Brewer, Daniel Shoup

### **Relationships Between Hydrology and Year-Class Strength and Growth of Freshwater Drum (*Aplodinotus grunniens*) From Lotic and Lentic Ecosystems**

Environmental conditions influence fish production. Riverine fishes rely on seasonal flow fluctuations, whereas reservoir fishes are influenced by water levels that alter the type and amount of available habitat. Age and growth distributions of fishes in rivers and reservoirs are differentially affected by flows; however, predictive responses are much more difficult in highly altered ecosystem. We sampled Freshwater Drum *Aplodinotus grunniens* from rivers and reservoirs of two ecoregions in summer 2016-2017 to model the effect of inter-annual flow variation and water-level fluctuations on recruitment and growth. Ages ranged from 0 - 20 in our southeast Ouachita Mountain sites, and from 1 - 32 in our northeast Ozark Highlands sites. The top model for Freshwater Drum year-class strength in rivers included number of annual reversals and prespawn median discharge, whereas year-class strength in both reservoirs was related to annual retention time. Incremental growth of Freshwater Drum in our rivers was related to 90-day minimum flows and March median discharge, whereas minimum summer water levels and average June water levels were related to growth in reservoirs. Our study results can be used to advance environmental flow science and balance river-reservoir water needs.

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### **Announcing The Tar Creek Trustee Council - Programmatic Restoration Plan and Environmental Assessment**

The Tar Creek Trustee Council prepared a Programmatic Restoration Plan and Environmental Assessment (Programmatic RP/EA) to identify a restoration framework at the Northeast Oklahoma Mining Natural Resource Damage Assessment and Restoration Site (NOMNRDAR Site). Currently, the Trustees have recovered \$35 million for natural resource damages to restore, replace, rehabilitate, and/or acquire the equivalent of natural resources and their associated services injured.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; aka "Superfund") authorize federal and state agencies, as well as Indian tribes, to act as trustees of natural resources on behalf of the public. The natural resource trustees are the U.S. Department of the Interior, acting through the U.S. Fish and Wildlife Service and the Bureau of Indian Affairs; the State of Oklahoma, acting through the Oklahoma Secretary of the Energy and Environment, the Oklahoma Department of Wildlife Conservation, and the Oklahoma Department of Environmental Quality; the Cherokee Nation; the Eastern Shawnee Tribe of Oklahoma; the Miami Nation; the Ottawa Tribe of Oklahoma; the Peoria Tribe of Indians of Oklahoma; the Seneca-Cayuga Nation; and the Wyandotte Nation (collectively, Trustees).

The Trustees evaluated four restoration alternatives and identified Alternative 4: On- and Off-Site Restoration as preferred. In this alternative, a combination of on-site and off-site projects will be implemented to restore injured resources and services. In addition, the Programmatic RP/EA describes the criteria the Trustees will use to evaluate projects and sets out the process for the public to identify potential restoration projects, as well as how the Trustees will provide the public with notice of and opportunities to comment on specific proposed projects.

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Oklahoma Conservation Commission  
Brooks Tramell, Sarah Galloway

### **A Desktop Protocol for Identifying and Marketing Potential Wetland Restoration Opportunities**

Given that over 2/3 of the historic wetland area in Oklahoma has been lost, wetland restoration is critical for returning hydrologic, biogeochemical and biotic functions to the landscape. Identifying suitable locations for restoration, with high potential for success, can be challenging. We have developed a Geographic Information Systems (GIS) protocol to identify potential wetland restoration sites. Restoration opportunities are primarily identified based on the presence of hydric soils, topography and potential to restore hydrology. Sites are then prioritized based on their potential to restore downstream water quality based on size, watershed area and surrounding land-use. To date this protocol has been implemented in 8 watersheds, and is planned for statewide application. Field verification has validated that this approach can be useful as a restoration screening tool. Sites identified through this protocol are then listed in a statewide Wetland Registry or database of potential restoration sites. The Wetland Registry can be searched using fillable forms available at the Oklahoma Conservation Commission website ([www.occ.gov/wetlands](http://www.occ.gov/wetlands)).

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Shannon Brewer

### **Population Dynamics of Blue Suckers in the Red River, OK**

Blue Sucker (*Cyprinus elongatus*) is one of several big-river obligate species of concern native to Oklahoma. We previously documented the movement of Blue Suckers throughout the lower Red River. Data from previous efforts suggest a resident population below Denison Dam on the Red River and a migratory spawning population in the Kiamichi River below Hugo Dam. The purpose of this study was to develop an understanding of Blue Sucker population dynamics so that we may evaluate the status of the population, and determine the effect of environmental variability on the population. We captured and aged 126 Blue Suckers in the Red River, below Denison Dam and used the data to estimate mortality, recruitment variability, individual growth rates and potential fecundity. Our estimates indicate that instantaneous mortality rates for the population were low ( $z = 0.11$ ) in the Red River, and higher ( $z = 0.27$ ) in the Kiamichi River. Recruitment was highly variable in the Red River, but less variable in the Kiamichi River (recruitment coefficient of determination = 0.52 & 0.79, respectively). The mean potential fecundity of Blue Suckers was 60,000 eggs per fish (20,000 SD) with no apparent pattern between fecundity and age. The M:F ratio of the Kiamichi River population was typical of spawning catostomids (3:1); however, the M:F ratio in Red River was skewed towards females (0.27:1). These data will be used to develop a population model to examine the effects of hydrology and harvest on Blue Sucker.

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The Nature Conservancy and East Central University  
Erick Ananga

### **An Evaluation of Ecosystem Services Benefits to Cities**

This study examines why cities choose to use Ecosystem Services (ES). Literature was reviewed from 25 scientific journals and gray literature. An open-ended questionnaire was developed to find out why cities in the United States (U.S.) and some countries utilized ES. The literature review showcased how financial resources played an integral role in deciding to use ES. Also, local government along with support from state government can play a role in implementing ES projects. Leadership was also key in whether ES was implemented. ES was an important factor when deciding whether to invest lots of money in projects versus letting nature do what it does naturally. When scientists could relate ES to stakeholders and decision makers, ES projects started to be recognized as an important way of conducting business.

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Department of Natural Resource Ecology and Management  
Bradley Cosentino, Stephen Hager, Scott Loss

### **Influence of Avian Life History Strategies on Building Collision Risk: Lessons for Oklahoma From a Continental Study**

Bird collisions with building windows kill up to 1 billion birds annually in the U.S. and therefore pose a substantial concern for conserving migratory bird populations both in Oklahoma and across North America. Recent research has greatly increased understanding of factors influencing avian vulnerability to bird-window collisions (BWCs), but the role of different avian life history strategies in influencing BWC risk has yet to be rigorously evaluated. We used a standardized BWC monitoring protocol at 40 universities across North America, including Oklahoma State University, to: (1) examine variation in collision vulnerability among birds with different life history strategies (e.g., foraging and migratory strategies), and (2) assess building-, vegetation-, and landscape-related characteristics influencing mortality for different life history strategy groups. Collision vulnerability estimates for each bird species accounted for sampling biases associated with overall population abundance and degree of range overlap with sampling sites. Pairwise comparisons were used to compare vulnerability among life history strategies, and multivariate analyses were used to assess relationships between predictor variables and collision mortality for select life history strategies and species. Across sites, 275 birds of 70 species were found as BWC victims and used in analyses. We expect to find certain life history strategies (e.g., insectivory and long-distance migration) to be associated with elevated BWC risk and that different variables will predict mortality for different life history strategies. Our study linking life history strategies to BWC risk increases mechanistic understanding of collisions and will therefore help more effectively mitigate BWC impacts in Oklahoma and beyond.

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Lusha Tronstad, Michael Dillon

### **The Potential Effects of Wind Energy Development on Terrestrial Invertebrates**

Wind farms may strongly affect terrestrial invertebrates which are often the dominant consumers and pollinators of plants, are a major food resource for birds, bats, mammals, reptiles, and other invertebrates, and are critical soil engineers and detritivores. There has been little work on potential effects of wind farms on terrestrial invertebrates. Many insects are killed by collisions with turbines and vehicles on wind farm access roads, but the magnitudes of these losses and their impacts on local communities have not been measured. Although these collisions may be more apparent, other aspects of wind farm development may have more pronounced effects on invertebrate communities. Construction and operation of wind farms can lead to habitat loss and fragmentation, chemical pollution and dust, noise pollution, the introduction of invasive species along access roads, and changes in climate. We largely lack data on how these changes may affect terrestrial invertebrates in the context of wind farms; however, a large body of literature suggests that these byproducts of wind farm development will, individually and in concert, have strong impacts on terrestrial invertebrates. Further, because terrestrial invertebrates play critical and diverse roles at intermediate trophic levels, effects of wind farms on this group will likely cascade through the ecosystem.

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University of Science and Arts of Oklahoma  
Rachel A. Jones

### **Mycological Survey of Boehler Seeps, OK**

A survey of the mycological species of The Nature Conservancy's Boehler Seeps Preserve was conducted from Summer 2016-2017. The goal of the project was to provide a baseline of what species were present at the newly acquired property, as well as correlate abiotic factors to fungal species to determine the factors tied to location of several more common species. Surveying was based on the Intuitive-Controlled method discussed by Norman and Huff, based around water sources. Abiotic factors were measured using the Xplorer GLX. Two sites were surveyed, a Northern and Southern site. The Northern site contains Hasell Lake and is approximately 87 acres. The Southern site contains Boehler Lake and is approximately 500 acres. Approximately 20 species have been identified at this time. Data analysis is in the process.

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Henry Adams

### **The Role of Stand Density in Tree Mortality of Quercus Associated With Water Stress and Biscogniauxia atropunctata**

Incidence of Quercus decline have been driven by complicated interactions among factors such as temperature, drought, pathogenic fungi, and tree density, which operate at multiple time scales. In particular, past occurrences of elevated tree mortality in response to drought in the highlands of Oklahoma were associated with biotic factors; specifically, Biscogniauxia atropunctata infection of Quercus species. Many studies have suggested the association between water stress and Biscogniauxia atropunctata, however, little is known about the interactions between stand density, water stress and infection. We investigated the effects of stand density on Biscogniauxia atropunctata prevalence at two different sites in Oklahoma - Pushmataha Wildlife Management Area (PWMA) and Okmulgee Game Management Area (OGMA) - experiencing varying degrees of forest densification. Stands at PWMA were thinned to 9 m<sup>2</sup>/ha and were subjected to 0-, 4-, 3-, 2-, and 1-year fire return intervals, while OMGA stands received no initial thinning and 0-, 2.5-, and 4.3-year fire return intervals. Following a field survey, we utilized a generalized linear model and found that incidence of Biscogniauxia atropunctata were highest among treatments with a fire return interval greater than 4 years ( $p < 0.002$ ) and canopy health was highest among treatments with a fire return interval of 4 years and less ( $p < 0.005$ ). These results suggest interactions between reduced basal area and fire return intervals influence tree mortality and health, demonstrating the importance of reducing stand density to amplify resilience and resistance in forest ecosystems.

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Jeff. R. Walters, Rodney E. Will, Scott R. Loss

### **Red-Cockaded Woodpecker Habitat Selection in the Ouachita Mountains of Oklahoma and Arkansas**

The red-cockaded woodpecker (*Picoides borealis*) is an endangered species native to pine savannahs and woodlands of the southeastern U.S. Due to increased understanding of the species' life history and habitat needs, collaborative efforts among state and federal agencies have allowed the species to slowly recover over the last three decades. At the northwest edge of its range, the red-cockaded woodpecker occurs in two populations on state and federal lands in the Ouachita Mountains of Oklahoma and Arkansas. Despite extensive monitoring and habitat restoration by the Oklahoma Department of Wildlife Conservation and U.S. Forest Service, the population in this region, especially in Oklahoma, has been slow to recover. Red-cockaded woodpeckers exclusively inhabit shortleaf pine (*Pinus echinata*) in the Ouachita Mountains, and inhabited forests are more mature than in other areas of the species range. Few studies have examined factors influencing habitat selection in this region and in old growth forests in general. We are conducting a multi-scale assessment of red-cockaded woodpecker habitat selection in Oklahoma and Arkansas. At the tree level, we are comparing attributes of selected cavity trees with random unused trees in the same habitat patch (or "cluster"). At the cluster scale, we are comparing characteristics of clusters with random unused areas, and at a landscape scale we are assessing characteristics of the landscapes surrounding used and unused clusters. We will present preliminary results of the tree-level habitat selection analysis and highlight our future research directions. This study will further our understanding of the attributes red-cockaded woodpeckers are selecting when determining suitability of trees for cavity excavation. This information will ultimately help develop more effective management approaches for increasing Red-cockaded Woodpecker populations in Oklahoma and throughout the Ouachita Mountains.

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Jason Schooley

## **Taking the Guesswork Out of Paddlefish Restoration Stocking: Methods For Analyzing and Predicting Restoration Stocking Success**

Paddlefish historically occurred in the Arkansas and Red River drainages in Oklahoma. The creation of reservoirs in these systems, which disrupted natural flow regimes, had varying effects on paddlefish stocks. While increases in lentic habitat resulted in increased stock size in some waters, stocks were extirpated from other waters such as the upper Verdigris River and upper Illinois River. Restoration stocking was recently attempted in four reservoir/river systems where extirpation had occurred. One of the restorations succeeded in establishing a recruiting stock while the remaining three did not. A thorough analysis of each of the four systems where restoration was attempted may elucidate which factors contributed to restoration success. We suggest methods for analyzing the systems, including a novel approach to measuring spawning habitat, and propose Tenkiller Lake as a candidate to test the likelihood of future restoration success.

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## **The Impact of Traditional Management Techniques on a Dominant Native Wetland Plant**

*Carex hyalinolepis* (shoreline sedge) is a dominant graminoid that forms dense monotypic stands in nutrient rich wetlands. It has become invasive on restored riverine floodplain wetlands along the Deep Fork River in Lincoln County, Oklahoma. As wetlands are particularly sensitive ecosystems, the use of herbicides to facilitate the removal of invasive species is not ideal. Traditional management methods such as burning, flooding, and grazing are beneficial historical ecological processes that have the potential to help reduce the negative impacts of dominant species such as the decrease in overall biodiversity. Our objectives were to assess the effects of fire on wetland plant communities and species richness and to determine if varying intensities of historical disturbance mechanisms inhibit the growth pattern of *Carex hyalinolepis* using a field study and two greenhouse studies. The field study utilized a nested plot design that examined pre and post fire plant community changes for both summer and winter burns. The greenhouse studies examined the effects of burning, flooding, the combination of burning and flooding, and simulated grazing on the aboveground biomass and growth rate of *C. hyalinolepis*. Results indicate that winter burns increase overall coverage of *C. hyalinolepis*, but also resulted in increased bare ground present and decreased litter levels. Species richness was not affected by either summer or winter burns. The outcome of the greenhouse studies suggest that the combination of treatments is more effective at reducing both the growth rate and overall biomass of *C. hyalinolepis*. The use of fire and flooding produced the only significant result that effectively decreased the aboveground biomass of *C. hyalinolepis* plants. Conclusions from this study will be informative in guiding management objectives and future research on the use of traditional management practices for controlling dominant species in wetland ecosystems.

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James M. Long

## **Longitudinal Trends in Prey Use and Condition of Age-0 Shovelnose Sturgeon in an Altered River System**

Like most of the large rivers in the United States, the river systems shovelnose sturgeon (*Scaphirhynchus platyrhynchus*) inhabit have been altered for navigational purposes or have impoundments. Currently, shovelnose sturgeon is a species of concern and require long distances of riverine habitat to successfully reproduce. Working with specimens collected by the US Army Corps of Engineers and Nebraska Game and Parks Commission, we examined how feeding by age-0 (<120 mm) sturgeon was influenced by longitudinal distance from an upstream dam that controls flow for barge navigation in the lower Missouri River. In general, we observed higher catch rates of age-0 sturgeon at reaches furthest downstream from the dam, but prey use and body condition showed the opposite trend. Ephemeroptera was more represented at sites closest to the dam, whereas diptera larvae was the dominant prey item in stomach contents from sturgeon collected furthest from the dam. Body condition, as measured by total lipid content, was positively related to fish length and fish mass, but the strength of those relationships was also related to distance downstream. Sturgeon captured closer to the dam contained more lipids per unit of fish length and fish mass than sturgeon captured further from the dam. The types of prey being used, and the lipid storage they are conferring to age-0 sturgeon could be a surrogate for habitat as it has been affected by hydrologic alterations from the dam.

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## **Dispersal of Small Mammals Among Islands of The Delta Island Complex in the Sequoyah National Wildlife Refuge, Vian, OK**

We sampled small mammals on island and mainland sites of riverine ecosystems in Sequoyah National Wildlife Refuge. We have conducted two sampling periods in 2016 and 2017. Three islands and two mainland sites were sampled using Y-shaped pitfall arrays consisting of 10 pitfalls connected by drift fences. Fifty-two individuals representing two orders were captured. Rodents and shrews were detected at all sites. After adjusting for catch effort, our analysis showed that there was no significant difference in small mammal detections on the islands versus the mainlands. However, rodents were detected most often at mainland sites while shrews were detected most often at island sites. The traditional view of islands as sink areas for wildlife populations may not be true for shrews. Islands may be performing as sink areas for rodents in riverine ecosystems, but they may be preferred habitats for shrews. Additional field work scheduled for 2018 is expected to better highlight the varying dispersal abilities of small mammals to riverine islands as well as to clarify their functional role for different vertebrate groups in their surrounding ecosystems.

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Oaks and Prairies Joint Venture

Helen Davis, Jim Giocomo, Ken Gee, Steve Riley, Tim O'Connell

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### **Monitoring Grassland Bird Decline For Strategic Conservation: The Oaks and Prairies Joint Venture**

The Oaks and Prairies Joint Venture (OPJV) is a public-private partnership of agencies and organizations working together to enhance habitat conditions for priority bird populations, and encompasses approximately 60 million acres of habitat within Oklahoma and Texas. Included in this area are the Edwards Plateau (BCR 20) in central TX and the Oaks and Prairies (BCR 21) ecoregion in OK and TX. Since 2013, the OPJV partners in cooperation with Oklahoma State University and Texas State University have monitored grassland bird populations within 10 focal counties in Oklahoma and 20 focal counties in Texas. Surveys follow the Breeding Bird Survey protocol and are conducted on 3-5 routes per focal county with 30 points per route. From 2013-2017, a total of 16,805 points have been surveyed in TX and OK. We are using the results of our monitoring efforts to examine species-habitat relationships for selected priority species such as, Northern Bobwhite, Eastern Meadowlark, Scissor-tailed Flycatcher, Lark Sparrow, Dickcissel, Yellow-billed Cuckoo, and Painted Bunting to better focus conservation efforts through the OPJV's Grassland Conservation Incentive Program, or GRIP, and other conservation incentive programs like the US Department of Agriculture Farm Bill programs. In addition, this monitoring effort represents the first five years of a ten-year monitoring program to examine the effectiveness of enhanced partner conservation efforts within the OPJV focal counties under an adaptive management framework.

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Kailiang Yu, Luke Wilson, Rodney Will, William Anderegg, Henry Adams

### **Point of No Return: Experimental Determination of the Lethal Hydraulic Threshold During Drought For Loblolly Pine**

The strength of the terrestrial carbon sink - dominated by forests - remains one of the greatest uncertainties in climate change modelling. How forests will respond to increased variability in temperature and precipitation is poorly understood, and experimental study to better inform global vegetation models in this area is needed. Necessary for achieving this goal is an understanding of how increased temperatures and drought will affect landscape level distributions of plant species. Quantifying physiological thresholds representing a point of no return from drought stress, including thresholds in hydraulic function, is critical to this end. Recent theoretical, observational, and modelling research has converged upon a threshold of 60 percent loss of hydraulic conductivity at mortality (PLClethal). However, direct experimental determination of lethal points in conductivity and cavitation during drought is lacking. We quantified thresholds in hydraulic function in Loblolly pine, *Pinus taeda*, a commercially important timber species. In a greenhouse experiment, we exposed saplings (n = 96) to drought and rewatered treatment groups at variable levels of increasing water stress determined by pre-selected targets in pre-dawn water potential. We measured physiological responses to water stress, including hydraulic conductivity, native PLC, water potential, foliar color, canopy die-back, and dark-adapted chlorophyll fluorescence. Following the rewatering treatment, we observed saplings for at least two months to determine which survived and which died. Using these data we calculated lethal physiological thresholds in water potential, directly measured PLC, and PLC inferred from water potential using a hydraulic vulnerability curve. We found that PLClethal inferred from water potential agreed with the 60% threshold suggested by previous research. However, directly measured PLC supported a higher threshold.

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### **Evaluation of the Feasibility, Sustainability, Usage, Angler Opinion, and Alternative Options of the Winter Trout Fishery at Lake Carl Etling, Black Mesa State Park**

The Oklahoma Department of Wildlife manages a winter time trout fishery at Lake Carl Etling located in Black Mesa State Park, Cimarron County. Limited information is known on angler pressure, demographics, attitudes and harvest. The objective was to evaluate angler harvest rate, angler pressure, angler satisfaction, feasibility and opinion on the introduction of Tiger Muskies (*Esox masquinongy* x *Lucius* or *Esox Lucius* x *masquinongy*) to the fishery. A creel survey was conducted during the winter of 2014/2015 with randomly selected days and times. Approximately 16,000 trout were stocked during the survey period. The survey resulted in a total of 61 fisherman interviews with seven individuals identifying as being interviewed previously. The remote location of the Carl Etling trout fishery likely resulted in low angler pressure. Anglers surveyed reported a total of 82 trout were caught with 14 of those being released. The fish per angler ratio is high, and contributed to a high 4.5 out of 5 angler satisfaction rating. Spring electrofishing observations indicated a high number of trout harvested during the designated trout season. Survey and sampling results have shown a need to alter stocking rates in order to manage current trout/angler ratio to a more acceptable rate. The majority of anglers targeted only trout, with a few acknowledging to fishing for both trout and channel catfish. The majority of anglers surveyed expressed "no opinion" towards the introduction of tiger muskies on other species, while only a few expressed "concern."

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Paige M. Schmidt, William P. Johnson

### **Snowy Plover Abundance and Spatial Survey Methods on Salt Flats of Salt Plains NWR**

Thomas et al. (2012) published a range wide population estimate for snowy plovers (*Charadrius nivosus*). They found approximately 42% of the breeding population nested at Great Salt Lake, Utah and Salt Plains National Wildlife Refuge (NWR), Oklahoma. The population estimate for Salt Plains NWR was slightly below Great Salt Lake. However, only 2% of available suitable habitat was at Salt Plains NWR compared to Great Salt Lake, possibly making Salt Plains one of the most densely populated breeding areas for snowy plovers. Since this study was published, Salt Plains NWR has conducted an annual survey of the salt flats following spatial survey techniques used by Thomas et al. (2012). Objectives of annual surveys were to a.) compare annual population estimates to rangewide estimates and b.) describe spatial use of salt flats within a dense population. Population estimates have been 5078±637 (95% CI: 3830, 6326) in 2013, 3086±367 (95% CI: 2365, 3807) in 2014, 4896±577 (95% CI: 3766, 6027) in 2015, 5112±571 (95% CI: 3992, 6231) in 2016, and 4581±574 (95% CI: 3455, 5706) in 2017. Moving forward, annual survey grid cell densities will be used to stratify habitat across the salt flats. This should improve population estimates and guide habitat management efforts.

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## **A Multi-Scale Evaluation of Darter Community Habitat Associations to Aid Conservation of Species of Conservation Concern**

Understanding the species-environment relationships for a larger species assemblage may help elucidate factors associated with species of conservation concern that are rarely encountered. With minimal encounters, environmental variables are difficult to associate with rare species, limiting understanding of ecology and ability to manage. For example, as many as twelve darter species historically occurred in Lee Creek, several of which are designated as species of greatest conservation need in Oklahoma; elucidating habitat associations of co-occurring darter species could further management for these rare species. Lee Creek is one of the few streams in Oklahoma where the Sunburst Darter (*Etheostoma mihileze*) can be found and is believed to host the last known Oklahoma populations of the state-endangered Longnose Darter (*Percina nasuta*). However, a population of Longnose Darters might persist in Blackfork creek from 1991-92 translocation efforts. Our objectives were to examine differences in habitat associations of the darter communities between systems and to sample these two systems to thought to contain Longnose Darters to evaluate the success of past translocation efforts. Between the two systems, a total of 31 stream reaches were sampled via backpack electrofishing in the summer of 2017. Nine darter species were detected during sampling, two of which were only found in Lee Creek: Longnose Darter and Sunburst Darter. We used a canonical correlation analysis (CCA) to evaluate habitat associations of the darter communities at both the stream reach and 20-m scales. Among co-occurring darter species, Longnose Darter and Sunburst Darter were both associated with lower water velocities and pool habitats but were found in distinctly different substrate size categories. Results from this study will be used to further manage for these species of conservation concern.

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## **Evaluation of the Usage, Feasibility, Sustainability, and Angler Opinion of a Seasonal Winter Trout Fishery in Southeast Oklahoma at Robbers Cave State Park**

A popular winter time trout fishery is managed by the Oklahoma Department of Wildlife Conservation at Robbers Cave State Park. Despite it being a popular destination among trout anglers, there was limited information available regarding angler demographics, attitudes, motivations, and harvest. Our objective was to evaluate angler pressure, harvest rate, preferences and motivations and view of current trout fishing regulations to inform future management decisions. A creel survey was conducted during the winter of 2016/2017 (November 6, 2016 - March 27, 2017), with randomly selected days and start times. The survey resulted in 185 interviews encompassing 366 individuals. In spite of the creel survey being biased towards weekends, half of anglers fished during the week and harvested disproportionately more trout. Of those surveyed 82 % were targeting trout, with the majority keeping fish and using artificial bait. The survey estimated 85% of Rainbow Trout (*Oncorhynchus mykiss*) stocked were harvested during the designated trout season. Leading motivations for trout anglers were "to catch fish to eat" and "unique fishing opportunity." 79.5% of anglers supported the trout daily limit of 6 as "just right."

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## **Post-Fledging Movements of Bald Eagle From Nests in Oklahoma**

Dispersal behavior has a strong influence on connectivity of populations and is often highly relevant to species-specific conservation management plans. Within Oklahoma, bald eagle populations are expanding and, as a consequence of natural processes and recovery efforts, there are now > 50 eagle nests in the state. To understand the movements of these birds and their connectivity to other populations in central North America, we telemetered 7 nestling bald eagles in 2016 and an additional 4 in 2017. Post-fledging eagles employed generally one of two movement strategies. Three of the 2016 nestlings and 3 of the 2017 nestlings were long-distance dispersers, moving up to 1388 km north through Kansas and Nebraska and sometimes even into Minnesota. When dispersing long distances, eagles moved 166 km/day, generally over a 17-day period. Such long distance movements are risky and all of the 2016 birds died during or after dispersal (by mid-September or so). Non-dispersing eagles (4 in 2016, 1 in 2017) made exploratory movements to neighboring states but generally returned to Oklahoma within after a few weeks. Daily distance travelled of these birds was 82 km/day over a 7-day period. In other populations where large numbers of nestlings have been tracked (the upper Midwest and the Chesapeake Bay), eagles exhibit these same two movement strategies, although generally a smaller proportion of nestlings make long distance movements. This suggests that the decision to make long-distance movements may be a function of the quality of the habitat and its ability to support young, often inexperienced, eagles.

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## **The State of the Sportsman: Status and Trends of Oklahoma's Hunters, Anglers, and Wildlife-Viewers**

The Oklahoma Department of Wildlife Conservation, like most state fish and wildlife agencies, is primarily funded by hunters and anglers through the purchase of licenses and sporting equipment. Long-term national trends reveal declines in both hunting and fishing participation, and subsequently the available funding for wildlife conservation. Many state fish and wildlife agencies have restructured their funding and management strategies in response to these declines. Meanwhile, Oklahoma has remained relatively resilient to these participation and funding declines. This presentation will combine research from national and statewide surveys to describe the current status and trends of hunting, fishing and wildlife-associated recreation in Oklahoma, and draw comparisons to regional and national trends. Additional discussion will cover the factors that drive changes in participation, as well as implications for state wildlife management and conservation.

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### **An In-Depth Look at Crappie Population Dynamics in an Aging Ozark Reservoir**

Spavinaw Lake is a 1,549 acre reservoir in the Ozark Plateau region of northeastern Oklahoma. The reservoir was impounded in 1924 as a water supply source for the City of Tulsa. According to the last angler creel performed on the reservoir in 2009; the main target species are Largemouth Bass, Crappie, and sunfish. Crappie anglers have voiced concern regarding the current size limit (none) and number of quality fish. The most recent crappie age data from the reservoir (2014) showed a lack of older fish (> Age-3), as well as lower growth rates than the reservoir just upstream (Eucha Lake). During the fall of 2017, The Oklahoma Department of Wildlife (ODWC) began an in-depth study of the crappie population on Spavinaw Lake. The sampling followed the ODWC Standardized Sampling Protocol (SSP) for random fyke netting, as well as non-randomly targeting crappie with fyke net sets for age and growth analysis. In addition to the sampling of crappie, an angler creel survey was performed from September 2017 thru February 2018. The creel survey consisted of 40 randomly selected active creel days (4 consecutive hours each day), and pamphlets located at boat ramps and access points for anglers to keep track of lengths of harvested/released crappie. By obtaining sampling data and creel data during the same time frame, angler caught crappie and sampled crappie can be compared. This provides the ODWC valuable information on the creditability of current fyke netting protocol versus what anglers are actually catching. Data gathered from both the creel survey and fyke net sampling will help to guide future crappie management decisions on Spavinaw Lake, and possibly across the northeast region of Oklahoma.

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### **Habitat Use and Movements of Shovelnose Sturgeon in the Arkansas River, OK**

Shovelnose Sturgeon, a migratory species, and a species of special concern to Oklahoma, is native to the Arkansas, Little, and Red rivers and major tributaries in Oklahoma. Habitat fragmentation has limited the distribution and overall success of this species in Oklahoma. Drought conditions and additional dam proposals have highlighted the necessity of increasing our understanding of Oklahoma's Shovelnose Sturgeon populations. We implanted 25 Shovelnose Sturgeon with ultrasonic transmitters in October 2014. Implanted sturgeon were passively and manually tracked from October 2014 through September 2015, although unprecedented flooding limited both forms of tracking during late spring and summer 2015. Submersible ultrasonic receivers (SURs) were strategically placed throughout the study reach for passive tracking, and manual tracking employed the use of both directional and towable hydrophones. Most individuals were quite sedentary during the study, traveling < 25 rkm from their original capture location. The greatest distance traveled was 97 rkm. Fifty-two percent of Shovelnose Sturgeon locations were in sand substrate, followed by 31% in a mixture of sand and cobble, and the remainder in cobble or a mixture of sand and bedrock. The mean velocity at Shovelnose Sturgeon locations was 0.14 m/s; however, velocities at locations ranged 0.01-0.26 m/s. Mean depth at Shovelnose Sturgeon locations was 1.18 m, and depths ranged 0.4-2.5 m. These results will be used to initiate management efforts for Shovelnose Sturgeon populations in Oklahoma, as well as to inform decisions and guide mitigation efforts for future projects that may further fragment riverine habitat throughout the state.

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Kristen Baum

### **Lespedeza cuneata Versus Native Legumes: Implications For Ecosystem Services**

Invasive plants modify native ecosystems by altering disturbance regimes, ecosystem services, biodiversity, and productivity. Studies suggest soil and litter invertebrates can modify the outcome of competitive interactions between invasive and native plant species, while plants may modify the composition of the soil invertebrate community. Comparing soil invertebrate community structure and decomposition rates between invasive and native plant species can provide important insight into the mechanisms that allow for invasion, and the outcome of interactions between soil invertebrates and plants. We compared litter decomposition among areas with low ( $\leq 5\%$ ) and high ( $\geq 25\%$ ) densities of *Lespedeza cuneata*, an invasive legume, and a common density of a native legume, *Baptisia bracteata*, as well as two time periods since fire [year of burn (0YB) and 2 years post-burn (2YB)]. Decomposition rates were compared between plant species, density and time since burn using 3 litter size classes. Trends suggest plant material decomposes faster in both densities of *L. cuneata* and in both times since fire when compared to *B. bracteata*. When assessing decomposition and time since fire, litter size classes show 0YB plots tend to have larger amounts of silt and duff composition at the intermediate litter size class whereas 2YB tend to have large amounts

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### **Mapping Annual Riparian Water Use Based on the Single-Satellite-Scene Approach**

The accurate estimation of water use by groundwater-dependent riparian vegetation is of great importance to sustainable water resource management in arid/semi-arid regions. Remote sensing methods can be effective in this regard, as they capture the inherent spatial variability in riparian ecosystems. The single-satellite-scene (SSS) method uses a derivation of the Normalized Difference Vegetation Index (NDVI) from a single space-borne image during the peak growing season and minimal ground-based meteorological data to estimate the annual riparian water use on a distributed basis. This method was applied to a riparian ecosystem dominated by tamarisk along a section of the lower Colorado River in southern California. The results were compared against the estimates of a previously validated remotely sensed energy balance model for the year 2008 at two different spatial scales. A pixel-wide comparison showed good correlation ( $R^2 = 0.86$ ), with a mean residual error of less than 104 mm/year (18%). This error reduced to less than 95 mm/year (15%) when larger areas were used in comparisons. In addition, the accuracy improved significantly when areas with no and low vegetation cover were excluded from the analysis. The SSS method was then applied to estimate the riparian water use for a 23-year period (1988-2010). The average annual water use over this period was 748 mm/year for the entire study area, with large spatial variability depending on vegetation density. Comparisons with two independent water use estimates showed significant differences. The MODIS evapotranspiration product (MOD16) was 82% smaller, and the crop-coefficient approach employed by the US Bureau of Reclamation was 96% larger, than that from the SSS method on average.

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### **The Center For Wildlife Forensic Science and Conservation Studies at the University of Central Oklahoma: An Interdisciplinary Approach to Collaborations in Natural Resource Research and Practice**

There is a rapidly evolving need for collaborative, interdisciplinary approaches to addressing complex issues of natural resource conservation, wildlife protection, and wildlife management. A new collaborative Center for Wildlife Forensic Science and Conservation Studies (C-FACS) at the University of Central Oklahoma (UCO) has brought together an interdisciplinary group of 18 faculty from the W. Roger Webb Forensic Science Institute (FSI) and the College of Math and Science (CMS) at UCO. These faculty demonstrate a wide array of expertise in disciplines ranging from wildlife biology, ecology, genetics, forensic science, criminal justice, and others. One of the primary goals of C-FACS is the development of collaborations with local, state, and national natural resource professionals to assist in addressing questions related to natural resource management and conservation. This presentation will introduce the audience to the framework of C-FACS, the professional expertise and interests, goals, and future directions of the Center.

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### **Comparing The Effects of Broad-Spectrum and Narrow-Spectrum Insecticides on Bees in Winter Canola Fields**

Animal pollinators, particularly bees, contribute substantially to the world's biodiversity and human food production. Studies have found that animal pollinators are necessary for 78-94% of plant species. Furthermore, 33% of human food production is attributed to pollinators. However, pollinator populations are decreasing globally. Within the contiguous United States, bee populations have been reduced by 23%. The reasons for pollinator decline include: climate change, invasive species, disease, habitat loss, and pesticides. Pesticide use is frequently touted as one of the largest contributors to pollinator decline. Developing and evaluating new insecticides that are effective against agricultural pests, but are safe for beneficial insects such as bees, is essential to preserving biodiversity and improving crop yields. Recently, a new insecticide, flonicamid, was approved for market that is supposed to target sap-sucking insects but not be harmful to bees. I compared the effects of this new insecticide to traditionally used broad-spectrum insecticides on bee communities and subsequent pollination services in Oklahoma winter canola fields. I compared bee species richness and abundance in canola fields with different insecticide treatments. I collected canola plants to evaluate pollination services (i.e. average seed count and seed weight). No significant results were found between treatments. However, weather conditions that altered insecticide application times and high numbers of predatory insects may have reduced the necessity for insecticide application over the duration of the study. An integrated approach should be used to inform management decisions that support pollinators and maintain crop yields. Additional research is needed to assess the implications of insecticide applications in crop fields on pollination services in the surrounding landscape.

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### **Grassland Birds Exhibit Variable Responses to Energy Development in a Grassland Managed for Heterogeneity**

Grasslands are inherently dynamic systems having evolved with frequent disturbance from fire and grazing. Today, many management practices emphasize the even utilization of grasslands by grazers, resulting in grasslands that lack the natural variability to support the entire suite of grassland birds. Previous research has suggested that the reintroduction of variable disturbance patterns may be among the best conservation strategies for grassland birds, as these practices promote diversity and abundance of many species through the creation of a mosaic of patches differing in vegetation structure. However, the introduction of these management methods is taking place in the context of the continued development of grasslands for energy production, and utility of heterogeneity based management practices may decline in fragmented landscapes. We investigated how fragmentation from oil and gas may constrain management efforts to promote heterogeneity by evaluating changes in bird abundance with distance from roads and conventional oil wells across a gradient of times since fire. Time since fire was the primary driver of grassland bird distribution, with dickcissels, eastern meadowlark and grasshopper sparrows occurring in all patches, while Henslow's sparrows only occurred in unburned patches and upland sandpipers were primarily detected in recent burns. Henslow's sparrows avoided oil wells for considerable distances, while eastern meadowlarks abundance increased in areas close to wells in patches that were one year post fire. Grasshopper sparrows avoided roads in recent burns and dickcissels and eastern meadowlarks were attracted to roads in patches that were recently burned and one year post fire respectively. The restoration of heterogeneous fire regimes will benefit bird communities by creating variable vegetation structure that can support the all grassland bird species, however energy development has the potential to fragment grasslands.

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### **Resource Selection & Home Range Analysis of the American Black Bear in the Ozark Mtns of East-Central OK**

Recolonizing black bears (*Ursus americanus*) in the Oklahoma Ozark Mountains region are expanding into anthropogenically-fragmented territory. This population may have potential to fill a sustainable niche, if management and conservation practices align. After trapping and collaring black bears in the Oklahoma Ozark region, we will study home range size and resource selection in ArcGIS 10.2, R, and Geospatial Modeling Environment to further assess the status of the population. From the estimated black bear population of 77 - 82 (Lyda, et al., 2016), a total of 23 individuals collared between 2011 and 2016 collected sufficient data to be analyzed (10M:13F). Individuals included in the study had an average of  $1015 \pm 868.4$  (SD) recorded locations. Home ranges in the fragmented region of the study area are expected to be larger than home ranges found in continuous habitat in other similar study areas. Female home ranges ( $75.4 \text{ km}^2 \pm 53.7$ ) were found to be significantly smaller than male home ranges ( $176.5 \pm 129.6 \text{ km}^2$ ,  $p = 0.002$ ). Land cover use for some individuals may favor human development more than other studies due to the availability of high quality anthropogenic food sources such as corn feeders. Resource selection functions will be run to determine land cover type preference. Applicable findings will inform future management policies in the Oklahoma Ozark region.

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Craig Zimmermann

### **Spatial Evaluation of Activity Patterns Along the Grand Lake Shoreline By Gray Bats (*Myotis grisescens*) and Northern Long-Eared Bats (*Myotis septentrionalis*)**

Hindering our understanding of bat ecology is the recent emergence of continental threats to bat populations that underscores the importance for population monitoring efforts. The volant nature of bats during their nightly and seasonal migratory movements, allows them access to multiple habitats, and in some cases multiple landscapes, decreasing their dependence on any single habitat. This study combined the use of stationary and mobile boat acoustic routes to assess aspects of aquatic foraging ecology of the endangered gray bat and threatened northern long-eared bat along the shoreline of Grand Lake in northeastern Oklahoma. We assessed bat activity in summer 2015 and 2016 using acoustic detection units. There were 34,593 identifiable echolocation calls recorded for 9 species of bats during the shoreline surveys: 274 identifiable echolocation calls were recorded using mobile surveys and 34,319 identifiable echolocation calls were recorded at stationary survey locations. Echolocation calls for the tri-colored bat and gray bat were the most frequently recorded, comprising 92% of the total number of the identifiable calls. Stationary surveys identified a greater species richness compared to mobile surveys. Mobile shoreline routes recorded 2.4 gray bats per hour of effort compared to 0.7 gray bats detected per hour of recording effort at stationary transect points. Using GPS data and corresponding recorded echolocation calls, 48 specific locations along the Grand Lake shoreline were identified as supporting foraging activity of federally imperiled species of bats (28 gray bat; 20 northern long-eared bat). On a broader scale, 293 specific locations have been identified that support bat activity across 9 different species. These GPS referenced calls can be used to potentially define spatial habitat variations that are preferred or avoided by different species of bats in general, and federally imperiled species specifically.

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### **Examination of Carcass Preferences by the Endangered American Burying Beetle**

The American burying beetle (*Nicrophorus americanus*) is an endangered species which buries the carcasses of small animals to nourish their larvae. If the beetles have a preferred carcass type for burial then conservation practices could be employed to increase that species and subsequently increase *N. americanus* numbers. Carcass preference was evaluated by providing breeding pairs of *N. americanus* with the choice of three carcass types (rat, rabbit, and quail). This was repeated for each of the 28 breeding pairs available. Burials were observed and recorded. Carcasses were buried 60.7% of the time. Each type of carcass was buried at least three cases. Rats were buried most frequently (10 burials) although they were not the largest carcass available. This suggests that *N. americanus* prefers to bury rats over rabbits and quail. Conservation efforts to increase the rat population in this area may result in more beetle progeny.

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### **Effects of Throughfall Reduction and Fertilization on the Growth of Mid Rotation Loblolly Pine Stands in Southeastern Oklahoma**

Loblolly Pine (*Pinus taeda* L.) is financially and ecologically important in the southeastern US. Management of loblolly pine will likely be more challenging as climate variability increases. Understanding interaction of fertilizer and soil water availability can improve management for growth in response to climate change. As part of the USDA-NIFA funded PINEMAP (Pine- Integrated Network: Education, Mitigation, and Adaptation Project), the Oklahoma Tier III study was installed in 2012 (fifth growing season) in a loblolly pine stand near Broken Bow, OK. Treatments receiving fertilizer were treated with 224 kg ha<sup>-1</sup> N, 28 kg ha<sup>-1</sup> P, 56 kg ha<sup>-1</sup> K plus micronutrients in early spring 2012 and throughfall excluders for treatments receiving throughfall reduction (30% reduction) were complete in mid summer 2012. The average precipitation at the site is 1253 mm y<sup>-1</sup>. Precipitation was 1026, 1190, 1046, and 2117 mm in 2012-2015 respectively. Trees in the control treatment increased from 2.9 to 7.8 m tall and 3.6 to 14.3 cm dbh during the 2012-2015 growing seasons. Throughfall reduction significantly reduced both dbh and height growth while fertilization significantly increased dbh growth. Annual volume growth was significantly reduced by throughfall reduction by 20% in 2013 and 9% in 2014. Fertilization significantly increased volume growth by 11% in 2013 and 20% in 2014. No significant effects were measured in either 2012 or 2015. No significant interactions between throughfall reduction and fertilization occurred. Results indicate that fertilization can compensate for negative effects of throughfall reduction and that effects of throughfall reduction depend on annual precipitation.

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### **Multi-Scale Influences of Habitat on Age-0 Smallmouth Bass Abundance in the Ozark Highlands**

Understanding the habitat characteristics that influence the survival of age-0 Smallmouth Bass (*Micropterus dolomieu*) is important for effectively managing populations. One impediment in understanding juvenile survival is our general lack of understanding the landscape controlling factors. Thus, our research aimed to determine the role of both local abiotic and coarse-scale watershed features on the abundance of age-0 Smallmouth Bass in Ozark Highland streams. We surveyed 116 stream reaches near the end of the first growing season in 2015-2017. We surveyed age-0 Smallmouth Bass by snorkeling and conducted double-pass surveys at a subset of sites (n=83) to model detection variability and adjust counts from single-pass surveys. We collected habitat variables at the reach and watershed scales using field surveys and GIS. Detection varied between passes and among sites and was related to differences in habitat conditions and fish densities. Although we were able to detect individuals at low densities (i.e., n < 5), detection was higher at sites with greater abundances, and counts were overestimated at sites with extremely high densities. Abundance of age-0 Smallmouth Bass varied with stream size, with greater abundances often found in larger streams. Although in relatively lower abundances, individuals were regularly found in small streams (≤ 3rd order). Understanding influences on age-0 individuals across spatial scales will help determine appropriate management actions for maintaining Smallmouth Bass populations. Spatial context-dependence of habitat effects may further explain differences in population-level responses to broad-scale environmental conditions.

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National Wild Turkey Federation

James Giocomo, Kenneth Gee, Meta Griffin, Helen Davis, Steven Riley

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## **Habitat Restoration Synergy: Oaks and Prairies Joint Venture Efforts Aided by USDA Regional Conservation Partnership Program in Oklahoma and Texas**

National Wild Turkey Federation, on behalf of the Oaks and Prairies Joint Venture partners, and the USDA Natural Resources Conservation Service are working together to provide grassland conservation resources through the Regional Conservation Partnership Program (RCPP), created under the 2014 Farm Act. This RCPP will combine partner investments totaling \$6.3 million to address significant declines in grassland wildlife populations and the loss of natural water-cycle conditions through the improvement and restoration of native grassland habitats on working lands in the Southern Great Plains of Oklahoma and Texas. Benefits will accrue to declining grassland bird species like northern bobwhite, and will also benefit wild turkey, white-tailed deer, and monarch butterfly populations, especially in oak savannah woodland portions of the region. Private landowner contributions added will bring total projected expenditures to on this effort to well over the \$6.4 million partner organization investment to benefit at least 60,000 acres of grasslands in the OPJV region over the next four years. OPJV will administer the grant in concert with their Grassland Restoration Incentive Program, or GRIP, which helps landowners pay for grassland restoration work, including range planting, prescribed burning, prescribed grazing, and invasive plant control. In its first three years, the GRIP program paid out more than \$1.1 million and help incentivize grassland habitat restoration on over 65,000 acres. Monetary support for GRIP has been provided by many diverse sources including Texas Parks and Wildlife Department's Upland Gamebird Stamp Fund, local Quail Coalition Chapters, a Monarch Conservation Grant, and a ConocoPhillips SPIRIT of Conservation Award, along with in-kind support from cooperating agencies and non-governmental partners. This partnership brings together many diverse parties to address the larger issue of declining grassland habitat and wildlife populations.

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Shannon Brewer

## **Seining Detection Probability of Small-Bodied Fishes in Great Plains Sand-Bed Rivers**

Species detection error (i.e., imperfect and variable detection probability) is an essential consideration for accurately mapping distributions and interpreting habitat associations. Sand-bed streams of the Great Plains represent a unique challenge to address stream-fish detection error due to highly variable instream environments and limited gear choice. We quantified seining detection probability for small-bodied fishes across a range of sampling conditions in Oklahoma sand-bed rivers. Detection probability varied in relation to multiple physicochemical variables. We observed a quadratic relationship between water depth and seining detection probability, where the exact nature of the relationship was species specific and dependent on water clarity (i.e., an interaction). Similarly, the direction of the relationship between water clarity and detection probability was species specific and dependent on levels of water depth. The relationship between water temperature and detection probability was also species dependent, where both the magnitude and direction of the relationship varied among stream fishes. We also show how ignoring detection error confounded an underlying relationship between stream-fish occurrence and water depth. Despite the complexity associated with detection probability, our results supported that confidently differentiating between a true and false species absence can be accomplished with a reasonable amount of sampling effort (4-5 spatially-replicated seine hauls) under average sampling conditions. However, detection probability was extremely low for the federally-threatened Arkansas River Shiner *Notropis girardi*. Even under ideal sampling conditions, >10 seine hauls per 200 m stream reach may be required to assess Arkansas River occurrence. We demonstrate the inferential issues associated with ignoring stream-fish detection error; however, incorporating methods to address the challenge into sampling protocols is both practical and flexible.

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## **Effect of Growing Season Burns on Forage Quality of Browse Plants: a Case Study**

Prescribed burning is a popular land management tool used in the southern Great Plains that is typically used during the dormant season. Growing season burns are growing in popularity, but the impact of fire on the forage quality of browse species is important to understand so land managers can better manage their resources for wildlife and livestock. Five browse species were sampled in the growing season of 2017 before and after a July burn and compared to an adjacent site that was not burned. The five browse species sampled were Chickasaw plum (*Prunus angustifolia*), smooth sumac (*Rhus glabra*), poison ivy (*Toxicodendron radicans*), roughleaf dogwood (*Cornus drummondii*) and greenbrier (*Smilax bona-nox*). It appears that growing season burns do not impact TDN or ADF. However, all species except for roughleaf dogwood showed an increase in crude protein following the burn compared to the control. The burn effect on crude protein lasted for two months for greenbrier and smooth sumac. There was only a one month effect of fire on crude protein for Chickasaw plum and poison ivy. These results indicate a need to frequently burn areas of native vegetation throughout the year to provide a high plane of nutrition at all times.

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Dan Shoup

## **The Effects of Turbidity on Habitat Use by Bluegill Under the Threat of Predation by Largemouth Bass**

Current literature indicates bluegill sacrifice optimal feeding behavior for refuge in dense vegetation while under the threat of predation, resulting in reduced growth rates. The majority of these studies were performed in clear water, which is uncommon in the field, especially with ever increasing anthropogenic disturbances. We investigated the effects of turbidity on habitat use by bluegill under the threat of predation by largemouth bass. Trials were conducted in 6.5-ft diameter tanks with artificial vegetation on one side and open water on the other. Bluegill and bass were given 18 hours to interact at one of five turbidity levels (0, 5, 10, 30, or 50 NTU), after which a divider was dropped, allowing us to quantify the number of fish on the vegetated and open-water sides of the tank. At all turbidity levels above 0 NTU, significantly fewer bluegill were found on the vegetated side of the tank. Therefore, vegetation manipulation and establishment efforts designed to increase recruitment and provide fishing opportunities may be less useful in turbid systems, given bluegill may not use vegetation as a refuge as often at higher turbidities.

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### **A New Technique For Determining Crayfish Population Demographics**

Aging organisms is one of the most important methods in fisheries science because it provides crucial information about growth, recruitment, and mortality. Aging fish and mussels relies on calcified structures that relate directly to age, whereas for crustaceans indirect techniques are typically used. Indirect techniques are only useful for the populations and time being studied and do not provide an exact age for the individual, which impedes conservation and management decisions for crustaceans. This is especially alarming for crayfish, which are some of the most important and threatened species within stream ecosystems. Recent work has shown that the gastric mill within the stomach of crustaceans may be useful for aging. Therefore, our objective was to determine if crayfish could be aged using the gastric mill. We collected 100 ringed crayfish *Faxonius neglectus* from streams in the Ozark Highlands ecoregion. Gastric mills were extracted from crayfish and each ossicle was separated, cleaned, sectioned, and mounted on a microscope slide. Each crayfish was aged independently by three different readers, using a combination of the ossicles. If different ages were obtained for a crayfish we assigned it the median age estimate. All three ossicles show growth bands, but the mesocardiatic and zygocardiatic ossicles had superior readability. Crayfish age estimates ranged from 0 to 11 years. Our age estimates generally match length-frequency histograms until about year five. Length-frequency histograms are not accurate past year four, so it is likely that ringed crayfish can live to be much older than five years as generally accepted. Future work will focus on validating that bands correspond to one year of growth, environmental effects on band deposition, and if daily bands are deposited in age-0 crayfish.

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### **Using Soil Temperature to Predict Water Temperature**

Methodologies to predict current on site water temperatures would assist fisheries professionals. Current Mesonet data is available at 119 locations throughout Oklahoma. Strong correlations between soil temperatures 10cm below the sod and current water temperatures occurred at several study lakes during 2016-17. The Mesonet collects real time data on a multitude of parameters. This data is available at some locations dating back as early as 1994. The utility of historical data may allow researchers and managers to explain data variance. One example of the scale of this difference is soil temperatures at Canton Reservoir from 2012 and 2013. During the month of March, the brood stock collection peak, soil temperature differences on the same calendar day, March 1st, were 55°F and 34°F respectively. A daily difference of 21°F was observed with a mean weekly difference for the first week of March of 9°F. During 2017 Sardis Reservoir had a linear average temperature 7°F higher than Ft Supply. Using soil temperature to water temperature relationships, managers may be able to determine lake progression differences between lakes. Mesonet data could assist in promoting the sport of fishing during peak angling seasons, improve the efficiency of filling/fertilizing hatchery ponds, promote successful brood stock collection, aid in understanding of historical data, and effectively plan future sampling efforts.

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### **Demographic Trends of a Reestablished American Black Bear (*Ursus americanus*) Population Under Harvest Pressures in Southeastern Oklahoma**

Animal reintroductions can be a critical tool for wildlife managers to restore species to their historical range and understand demographic trends of a recolonizing population. Since their extirpation from Oklahoma in the early 1900s, and subsequent reintroduction in the 1950s in Arkansas, black bears have successfully recolonized portions of eastern Oklahoma. After preliminary demographic studies, the Oklahoma Department of Wildlife Conservation opened a hunting season in 2009 in four southeastern counties. To examine the effects of hunting pressures on the population and how their continued expansion throughout the region has progressed, a reassessment of demographics was implemented in 2014 (Pfander 2016). From May to August 2014-2017, snares were placed along established trap lines in all four counties with an open season on black bears. Over a period of 4,169 trap nights, we handled 181 individuals (96M and 85F) a total of 312 times. Information from these efforts will be used to estimate survival rates of individuals, population growth and abundance. A subset of captured females were fitted with GPS satellite collars that are used to locate their winter hibernacula and obtain counts of cub production. We will use these data to make management recommendations to the ODWC in an effort to maintain a long-term, sustainable black bear hunting season in this region.

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### **Seasonal Variations in Site Occupancy and Detectability of Mesocarnivores, Estimated Using Systematically Baited Camera Traps in South-Central Oklahoma**

Mesocarnivores have important ecological roles as the main predators of food webs, and significantly contribute to the sustentation of lower trophic levels. Various anthropogenic effects impact the viability of mesocarnivore populations; therefore, conservation is essential to maintain ecosystem integrity. Our study was conducted at Oka' Yahli Preserve (OYNP), located in southcentral Oklahoma. The primary goal of this project was to expand the current body of knowledge about mesocarnivore ecology in southcentral Oklahoma, specifically in OYNP. Camera traps were used to trap mesocarnivores in the preserve over winter 2016 and summer 2017. Six remotely-triggered infra-red cameras were deployed for 4 weeks. After 4 weeks, cameras were moved to different, random locations. Half of the cameras were systematically baited by using canned mackerel. Using the photos obtained from the camera traps, species richness, detection frequencies, detectability, and occupancy estimates were determined. Mesocarnivore species identified from both seasons are coyote (*Canis latrans*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), opossum (*Didelphis virginiana*), and striped skunks (*Mephitis mephitis*). Highest naïve occupancy estimates are coyotes. Proportion of site occupied and detection probability were higher for all species during winter than in summer (single specie occupancy modelling). Overall detection probability was higher with baited camera traps for raccoon, opossum, and skunk during winter (single specie occupancy modelling,  $p=0.34, 0.29, 0.07$  respectively). Baiting has no overall effect for the probability of detection for all species in summer. A possible reason would be the abundance of food resources are higher during summer than winter; therefore, there is less attraction for the baits around camera sites in summer. The data gathered from this research will be useful in conservation, management, and habitat restoration of mesocarnivores in OYNP.

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## **Mapping Annual Forest Cover in Sub-Humid and Semi-Arid Regions Through Analysis of Landsat and PALSAR Imagery**

Accurately mapping the spatial distribution of forests in sub-humid to semi-arid regions over time is important for forest management but a challenging task. Relatively large uncertainties still exist in the spatial distribution of forests and forest changes in the sub-humid and semi-arid regions. Numerous publications have used either optical or synthetic aperture radar (SAR) remote sensing imagery, but the resultant forest cover maps often have large errors. In this study, we propose a pixel- and rule-based algorithm to identify and map annual forests from 2007 to 2010 in Oklahoma, USA, a transitional region with various climates and landscapes, using the integration of the L-band Advanced Land Observation Satellite (ALOS) PALSAR Fine Beam Dual Polarization (FBD) mosaic dataset and Landsat images. The overall accuracy and Kappa coefficient of the PALSAR/Landsat forest map were about 88.2% and 0.75 in 2010, with the user and producer accuracy about 93.4% and 75.7%, based on the 3270 random ground plots collected in 2012 and 2013. Compared with the forest products from Japan Aerospace Exploration Agency (JAXA), National Land Cover Database (NLCD), Oklahoma Ecological Systems Map (OKESM) and Oklahoma Forest Resource Assessment (OKFRA), the PALSAR/Landsat forest map showed great improvement. The area of the PALSAR/Landsat forest was about 40,149 km<sup>2</sup> in 2010, which was close to the area from OKFRA (40,468 km<sup>2</sup>), but much larger than those from JAXA (32,403 km<sup>2</sup>) and NLCD (37,628 km<sup>2</sup>). We analyzed annual forest cover dynamics, and the results show extensive forest cover loss (2761 km<sup>2</sup>, 6.9% of the total forest area in 2010) and gain (3630 km<sup>2</sup>, 9.0%) in southeast and central Oklahoma, and the total area of forests increased by 684 km<sup>2</sup> from 2007 to 2010.

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## **Effects of Management and Human Activity on Space Use and Movement of Wild Turkey**

Management practices and landscape impacts of energy development can cause changes in animal behavior, distribution, and space use. Understanding how anthropogenic structures and disturbance affects wildlife is pertinent to management. Although disturbance has been recognized as an important factor affecting wild turkey populations, little research has been conducted to quantify the effects of energy development (oil and gas) and management practices (prescribed fire) on wild turkey space use and movement. Effects of energy development may include the direct loss of habitat by the instillation of well pads (and removal of roost trees) and indirect loss of habitat due to changes in space use because of sound or vehicle traffic. To better understand how of Rio Grande Wild Turkeys (*Meleagris gallopavo intermedia*; hereafter turkey) respond to management practices and energy development, we placed backpack-style GPS transmitters on 30 female turkeys and deployed 15 traffic counters throughout Packsaddle Wildlife Management Area in western Oklahoma. Each of the transmitters recorded 7 daytime locations (every 2 hours from 0800-2000) and one nighttime location (0200) daily. These GPS locations along with a spatial map of the study area were used to create home ranges and selection functions to determine if turkey locations are related to distance to oil and gas wells, distance to roads, and level of vehicle traffic. In addition, we mapped and combined prescribed fire into three time since fire categories (<1 year, 1-2 years, >2 years) to determine if turkey locations are related to time since fire.

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Mia Revels

## **Northern Saw-whet Owl (*Aegolius acadicus*) Fall Migratory Movements in Oklahoma**

The Northern Saw-whet Owl (*Aegolius acadicus*) has a very limited history in Oklahoma. They were considered a rare fall visitor with fewer than 10 confirmed state records prior to our study in 2016. These records range from Cimarron to Tulsa Counties and as far south as Oklahoma County. The BNA Northern Saw-whet Owl range map shows that their nonbreeding range goes as far south as central Texas, but they are very scarce past central Kansas. However, efforts to find them in south central United States have been minimal. New banding stations in Arkansas and Missouri have shown that saw-whets may move farther south during their nonbreeding season than previously thought. In fall 2016, we opened Oklahoma's first Northern Saw-whet Owl banding station to document saw-whet movements. This banding station is located in Cherokee County, Oklahoma about 70 miles west of the Arkansas banding station. On November 4th we captured and banded our first Northern Saw-whet Owl. The season resulted in 18 saw-whet captures with two individuals being previously banded. Capture dates ranged from November 4th to November 20th. These results indicate that the Northern Saw-whet Owl may be more common in Oklahoma during the fall than originally thought. The previously banded birds from our Oklahoma station combined with the Arkansas and Missouri stations show that there may be a migratory route from the western Great lakes to the Ozarks. Current banding efforts (fall 2017) are examining how topographic exposure effects capture rates with an emphasis on wind speeds and sky illumination.

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## **Drought and Gender Vulnerability in Cimarron County, OK**

Farmers and ranchers use different strategies to cope with climate extremes. In some instances, producers might seek assistance in the form of disaster relief funds and conservation subsidies. However, case studies on gendered agricultural relations in China, India, Mexico, and other developing countries have demonstrated female farmers and ranchers often lack equal access to information, state funds, resources, and agricultural technology. This makes women particularly vulnerable to climate variability and change. The purpose of this paper is to conduct a gender-based analysis of farm subsidies, disaster payouts and conservation subsidies in Cimarron County, OK USA from 1990 to the present. Beginning in 2000, Cimarron County, Oklahoma suffered from extreme drought conditions, the severest of which were worse than the notorious 'Dust Bowl' of the 'Dirty Thirties.' We use USDA Agricultural Census and Environmental Working Group subsidy data to analyze gender-based access to subsidies and payouts in Cimarron County before, during, and after the most recent prolonged drought. The overall goal of this research is to determine whether female producers are more, less, or equally vulnerable to extreme drought conditions as their male counterparts and to provide recommendations to ensure gender equity in disaster assistance in the face of climate variability and change.

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## **Seasonal and Longitudinal Variability of Benthic Macroinvertebrates in a Southeastern Oklahoma Cold Water Tailrace**

Existing literature emphasizes the significance of examining spatial and temporally variability of macroinvertebrates in aquatic systems, but little is known about the variability of macroinvertebrate communities inhabiting cold tailwaters. The release of hypolimnetic water from reservoirs alters downstream water quality, especially water temperatures, which can cause a disruption of the natural stream community. Therefore, we examined the benthic macroinvertebrate community of the Lower Mountain Fork river, a coldwater tailrace of Broken Bow reservoir, to investigate spatial and temporal changes in the taxonomic and quantitative composition of macroinvertebrate assemblages. We collected macroinvertebrates from riffles, at 14 sites originating below the spillway dam and extending downstream 19 km. We conducted sampling monthly, from May 2016 through July 2017 and determined longitudinal changes and assessed temporal variability seasonally (i.e., summer, fall, winter, and spring). We collected over 70 taxa (primarily genera) from the study sites, which were mostly comprised of Trichoptera, Diptera, and Isopoda. Distinct longitudinal patterns were evident, which likely affect the ecology of the system.

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## **Wildlife in Urban Areas: Nocturnal Lights Affect Bird-Window Collisions**

The expansion of urban areas is bringing more wildlife into conflict with human activity and human-altered landscapes. Anthropogenic collisions, or collisions with human structures and vehicles, are increasingly recognized as a major source of mortality for wildlife, especially for volant animals like bats and birds. Many songbird species migrate primarily at night, and they evolved this behavior when artificial light sources were non-existent. The artificial lighting that accompanies urbanization alters behaviors and flights paths of nocturnally migrating birds. Nighttime lighting can attract and confuse birds, which increases their risk of colliding with buildings. Particularly intense lighting can lead to circling flights, which may exhaust and ground birds, elevating their subsequent risk of daytime collisions. We hypothesized that nocturnal light intensity is positively correlated with bird-building collision mortality rate. We surveyed for carcasses of window-killed birds at 15 buildings in Stillwater, Oklahoma from Apr 2015 to May 2017. We used a spectrometer with a cosine receptor to record light intensity (Watts/M<sup>2</sup>) from 350-700 (the range of wavelengths visible to birds) within and near collision survey areas when high-intensity lights at the Oklahoma State University football stadium were on and off. We used GIS to interpolate maps of light intensity and compared those to collision hot spot maps. Although there was a positive correlation between light intensity and collision rates, the brightest locations did not always have the most collisions. While artificial lighting at night contributes to collision risk for nocturnally migrating birds, there are many other important factors that also influence collisions. To help reduce collision risk, we recommend that urban areas in Oklahoma and beyond, including relatively small urban areas like Stillwater, adopt "lights out" programs similar to those already in place in downtown areas of many major U.S. cities.

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## **Status of Lotic Fish Communities in Two Drainages With an Emphasis on SGCN Sport Fish, and Invasive Species**

The Oklahoma Department of Wildlife Conservation Stream Program began long-term lotic fish community monitoring in 2016. Drainages will be sampled statewide on a rotational basis and objectives include: updating current fish species distribution records, monitoring trends in those distributions over time, and analyzing changes between historical stream fish community data and contemporary data. Special emphasis is placed on monitoring state listed species, Oklahoma Species of Greatest Conservation Need (SGCN), sport fish, and invasive species. Stream fish surveys are conducted within an occupancy modeling framework that estimates species-specific probability of occurrence while accounting for imperfect detection by utilizing three replicate surveys at each site. Abiotic covariates, on multiple spatial scales, are used to elucidate observed species distribution patterns. Fish surveys were conducted at 48 sites on 17 streams in the upper Red River drainage (upstream of Lake Texoma west to the Texas border) in the summer of 2016. In 2017, 58 sites on 28 streams were surveyed in the Arkansas River drainage (from the Kansas border in north central Oklahoma downstream to the McClellan-Kerr Arkansas River navigation channel near Muskogee). Data was collected on 53 species representing 13 families and 63 species representing 12 families in the upper Red River and Arkansas River drainages, respectively. Of the cumulative species sampled, seven are listed as SGCN, nine are sport fish of recreational value, and three are invasive species. On-going analyses will inform management, research, and conservation of species of concern, identify stream sport fishing opportunities, monitor changes in stream fish communities, and track the potential spread of invasive species.

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## **Local- and Landscape-Scale Factors Influencing Tick Populations and the Role of Birds in Carrying Ticks Across an Urbanization Gradient in Oklahoma City**

Tick abundance and tick-borne disease prevalence have increased in many urban areas in the United States. Tick-borne diseases have a strong link to urban natural resource management because ticks respond to habitat characteristics in parks and greenspaces, and feed on urban wildlife that complete disease transmission cycles. Despite growing importance to public health and land management, little is known about tick and tick-borne pathogen ecology in urban areas. This study will identify local and landscape-scale factors that influence the abundance of ticks and prevalence of tick-borne pathogens across an urbanization gradient. The study will also assess the role of resident bird species as carriers of ticks in urban areas. Sixteen parks and greenspaces that capture a gradient of urbanization intensity across Oklahoma City were selected for tick and bird sampling. Both CO<sub>2</sub> traps and flagging were used to collect ticks from May to August and mist-nets were used to capture and check birds for ticks from June to August. Preliminary results indicate there is a risk of encountering ticks across the entire urbanization gradient, from parks in the outlying exurban areas to parks in the heavily urbanized urban core. Intensity of urbanization (measured as the amount of undeveloped land surrounding parks) influenced abundance of ticks sampled both from the vegetation and from birds. Continued research will further assess tick abundance and tick-borne pathogen prevalence in relation to local-scale factors (e.g., ground cover, deer abundance, temperature, and humidity) and landscape-scale factors (e.g., human population density). The multi-scale information gathered will allow natural resource managers to strategically plan and manage for habitat within parks and greenspaces that balances provision of habitat for birds and other wildlife, while minimizing tick-borne disease transmission risk to humans.

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Garrett Johnson

### **Accuracy and Precision of Horizontally-Oriented Hydroacoustics When Estimating Abundance of Gizzard Shad**

Abundance and size-structure data for Gizzard Shad are important for managing piscivore populations that forage on them. Horizontally-oriented hydroacoustic sampling has potential to provide more accurate and precise estimates of Gizzard Shad populations than traditional sampling approaches, but this has not been directly tested. We created known densities of Gizzard Shad in a 15-m long x 15-m wide x 4.5-m deep net pen (6-mm square mesh) and imaged them at night with a Simrad® EK60 120 kHz echosounder (7° split-beam transducer moved at 0.1m/s along the edge of the net pen). Measured Gizzard Shad abundance was significantly correlated with known density in the pen. Coefficient of Variation of Gizzard Shad abundance was 15%, indicating better precision than other methods for sampling Gizzard Shad (i.e., electrofishing or gill nets). A laboratory experiment was also conducted to develop Gizzard Shad-specific horizontal target strength equations; one equation described target strengths from randomly-oriented fish and a second equation explicitly incorporated fish orientation. These equations were developed using euthanized Gizzard Shad (60 - 321 mm, TL) that were individually tethered with monofilament fishing line within a 5.5-m diameter tank and imaged with the above echosounder. Data were collected at 4 Hz for > 1 min at each 5° orientation from 0° (i.e., facing left) to 180° (facing right). The target strength equation that assumes random fish orientation explained 87% of the variation in measured target strengths. The equation using orientation and fish TL explained a significantly greater amount of variation in target strength than the base model that only consider TL. These new equations could increase precision of Gizzard Shad population estimates from horizontally-oriented hydroacoustics, especially when fish are not randomly oriented.

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**Shoup, Daniel** - daniel.shoup@okstate.edu  
Oklahoma State University  
Dray Carl, Ryan Ryswyk, Cliff Sager, Richard Snow

### **Integrating Results From a BACI Analysis and Multi-Lake Diet Study to Evaluate the Utility of Stunted Crappie Control by Introduced Saugeye**

Over-populated crappie *Pomoxis* spp. populations with poor size structure are a common management concern. To combat this, hybrid saugeye (*Sander vitreum* x *Sander canadense*) introductions have been used in numerous systems in attempt to reduce population biomass and thus, moderate intraspecific competition. Case studies from Thunderbird Reservoir, OK and Richmond Lake, SD suggest increased crappie growth and size structure after saugeye introductions. However, the lack of control lakes in these studies as well as known influences of crappie population dynamics (hydrology, environmental factors, etc.) justifies a reevaluation of this management strategy. We compared White Crappie size structure and condition before and after saugeye introductions in six Oklahoma reservoirs with paired controls (12 total lakes) in a BACI experimental design. Though White Crappie size structure (PSD, PSD-P) increased significantly following saugeye introductions, parallel responses between impact and control lakes were observed, indicating crappie size structure increased independent of saugeye introductions. A diet study was also conducted at five Oklahoma lakes to determine the potential of saugeye to control crappie via predation. 1,859 saugeye were sampled for diet analysis, yielding 990 total diets. Diet compositions varied among lakes, seasons, and predator sizes; and we are currently running analyses for specific descriptive statistics. We conclude that White Crappie population dynamics were more influenced by coarse-scale environmental variables than saugeye stocking, although diet analysis revealed some lakes may have more potential than others for a predatory control. Lastly, our study highlights the importance of including spatial controls to make sound management conclusions.

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**Smith, Sierra** - sierrasmith@ou.edu  
University of Oklahoma, Sam Noble Museum of Natural History  
Jessa L. Watters, Cameron D. Siler

### **Assessment of Seasonal Variation in Amphibian Infectious Diseases in Central Oklahoma**

There are numerous factors contributing to the decline of amphibian populations all over the world; however, one of the most pressing of these causes is infectious disease. Two pathogens, *Batrachochytrium dendrobatidis* (chytrid) and Ranavirus, are linked with declines and extinctions of amphibian populations. Despite the current research on these diseases, few studies have investigated seasonal patterns in the infection levels among amphibian populations. The results of experimental studies on amphibians in captivity indicated that both pathogens may have an optimum temperature for host infection. However, more temporal studies are needed to assess wild amphibian populations before we might better understand how infection rates and intensity vary with host species across seasons. Funded by an Oklahoma City Zoo Conservation Action Now grant, the Herpetology Department at the Sam Noble Museum sampled four sites in Central Oklahoma repeatedly, from Spring to Fall of 2015, to assess whether seasonal patterns might exist in amphibian disease prevalence. For chytrid screening, we collected skin swabs from wild amphibians, and for Ranavirus screening we collected tissue samples, with or without euthanization, from the host organism. After extracting DNA from both swab and tissue samples, we used quantitative PCR (qPCR) techniques to screen for the presence of the two infectious diseases. We present our findings on seasonal patterns of infection rates and disease load across sites in central Oklahoma, in the context of local weather patterns. This project has helped broaden our understanding of these two pathogens in the state, and will contribute to regional conservation efforts for Oklahoma's native amphibian species.

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**Starks, Trevor** - trevor.starks@odwc.ok.gov  
Oklahoma Dept. of Wildlife Conservation  
Anthony Rodger, Donnie King, Matthew Skoog

### **Assessing Temporal Shifts in Lotic Fish Community Structure in the Upper Red River Basin, OK**

A long-term fish community monitoring program was established by the Oklahoma Department of Wildlife Conservation Streams Program in 2016. One of the primary goals of this program is to evaluate contemporary fish species distributions in Oklahoma and draw inferences regarding changes in those distributions over time. In 2016, fish community surveys took place from late June to early August at a total of 48 sites within the upper Red River basin. Compared to the most comprehensive historical sampling effort within the basin, contemporary surveys detected an additional eight species while three species historically present were not detected in 2016. Generalized linear model results indicated significant differences in community structure between historical and contemporary surveys. Post-hoc Sum-of-Likelihood analyses revealed differences in community structure were largely driven by increases in generalist fish species (e.g. Green Sunfish and Common Carp) and decreases in small-bodied specialist cyprinids (e.g. Chub Shiner). Although changes in species occurrences may be partially driven by differences in sampling methodology and effort, community shifts across multiple stream reaches likely reveal real trends.

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**Starr, Morgan** - morgan.starr@okstate.edu  
Oklahoma State University  
Omkar Joshi

## **What Do Stakeholders Think About Better Management of Cross-Timbers?**

The Cross-timbers region of the United States, which is comprised of a mixture of oak forest, savannah, and prairie- stretches from southern Kansas through central Oklahoma and into Texas. The region is threatened by both natural and anthropogenic factors including climate variability, invasive species, changes to historic disturbance regimes, and urbanization. Active management practices such as: prescribed fire, timber thinning, and fuels reduction are largely absent in the Cross-timbers. Review of existing literature suggests that while research has been conducted to understand what can be done to restore Cross-timbers ecosystems, little has been done to understand what the stewards of Cross-timbers woodlands and prairies - the private landowners - think about the usefulness and challenges of utilizing active land management practices. In addition, opinions of additional stakeholders (research scientists, government agency professionals, extension agents, consulting foresters, etc.), which are equally important for the sustainability of active land management practices, are not well documented. Therefore, we adopted the strengths, weaknesses, opportunities, and threats (SWOT)-Analytic Network Process (ANP) approach to gain insight on these issues in the Cross-timbers ecoregion. The initial results suggest that presence of healthy and resilient forests and the opportunities associated with increased revenue could be the motivating forces in implementing active Cross-timbers management. On the other hand, the financial burden of managing and the possibility of uncontrolled fire were recognized as the major obstacles in these efforts. Tailoring appropriate outreach programs can help traditional and non-traditional stakeholders in identifying innovative management solutions in the Cross-timbers.

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**Swedberg, Dusty** - dusty.swedberg@okstate.edu  
Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma State University  
Robert Mollenhauer, Shannon Brewer

## **Patterns of Least Darter Detection Across the Stream Landscape**

Variation in detection confounds underlying ecological relationships. The issues associated with detection can be exacerbated for rare species with limited distributions (i.e., missing important ecological relationships). Our study objective was to estimate detection probability for Least Darter *Etheostoma microperca*, across the stream landscape. Least Darter is a species of greatest conservation need in Oklahoma and a species with isolated southern populations located in the Ozark Highlands and Arbuckle Mountain ecoregions. We used data from locations with repeat surveys to relate variation in detection to a series of available instream and geospatial covariates. The estimated detection probabilities will be used in future species distribution models to determine ecological factors driving occupancy. Applying variation in detection to distribution mapping can be used to increase the usefulness of models to conservation strategies.

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**Taylor, Andrew** - andrew.t.taylor@okstate.edu  
Oklahoma State University  
James M. Long, Michael R. Schwemm, Shannon K. Brewer

## **A Genetic Status Assessment of The Neosho Smallmouth Bass: Hybridization, Diversity, and Population Structure**

The Neosho Smallmouth Bass (*Micropterus dolomieu velox*) is endemic to drainages of the Arkansas River in the Ozark Highlands and Boston Mountain ecoregions. Despite several studies documenting the morphological and genetic distinctiveness of this subspecies, the genetic integrity of these native Smallmouth Bass (SMB) populations has not been assessed, including the potential effects of non-native SMB stocking and possible population structuring among drainages within the basin. We used seven polymorphic microsatellite markers and several analytical approaches to quantify hybridization, genetic diversity, and population structure of Neosho SMB. Introgressive hybridization was most prevalent in the Illinois River, wherein non-native alleles increased with proximity to Lake Tenkiller, a downstream impoundment that was stocked in the early 1990s with non-native Tennessee lake-strain SMB. Genetic diversity measures for pure Neosho SMB were generally higher in larger rivers and lower in smaller, isolated streams. The uppermost level of population structure of pure Neosho SMB contained three distinct clusters, which accounted for approximately 7% of hierarchical genetic variation within our dataset. Secondary structure existed within all three clusters, but structuring at this level was relatively weak and accounted for an additional 2% of genetic variation. The remaining majority of hierarchical genetic variation (91%) was accounted for within sampling localities (i.e., the individual level). The spatial distribution of hybridization, genetic diversity, and population structure uncovered in this study can help delineate genetic management units that promote conservation of native diversity.

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**Thomas, Keith** - keith.thomas@odwc.ok.gov  
Oklahoma Dept. of Wildlife Conservation

## **Angler Participation and Opinions at Two "Close To Home" Fishing Program Sites in the Oklahoma City Metropolis: a Review of Creel Survey and Trail Camera Data**

Oklahoma's "Close To Home" fishing program is in its 18th year. There are 14 municipalities statewide who have signed on as cooperators assisting the Oklahoma Department of Wildlife Conservation. Program goals include; safe, enjoyable, relaxing, neighborhood fishing opportunities. Two of the communities, Oklahoma City and Norman, were chosen to evaluate proposed changes as far as species stocked and regulations. 429 anglers were asked pertinent questions as far as catch, harvest, zip code, and preference attitude on regulation change proposals. In addition, a digital trail camera (Reconyx HC550) was placed at each site to capture pressure counts from May through August 2017. Pressure counts revealed 1,233 anglers spent over 1,345 hours fishing at both sites. Over 80% of the participants were in favor reducing the daily fish limits in order to better manage the fisheries.

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**Tibbits, Jeff** - jeff.tibbits@odwc.ok.gov  
Oklahoma Dept. of Wildlife Conservation  
Kasie Joyner, Haley Lockard

### **Increasing Recreational Access: the Oklahoma Land Access Program**

In recent years, declining trends in sportsman participation and available access has led to an increase in efforts to improve public access. One such program, The Voluntary Public Access - Habitat Improvement Program (VPA-HIP), is a competitive grants program administered by the NRCS that assists state and tribal governments with creating, sustaining, and expanding public recreational access programs. The Oklahoma Department of Wildlife Conservation is used the received VPA-HIP grant of \$2.26 million to create the Oklahoma Land Access Program (OLAP) which opened on September 1, 2017. The OLAP provides financial incentives to enrolled landowners who allow public access for hunting, fishing, stream access, and wildlife viewing. The purpose of this presentation is to inform natural resource professionals about the first year in review, collaboration with Quail Forever for habitat incentives, and the future of the program.

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**Tuck, Jayme** - tuckjm@student.swosu.edu  
Southwestern Oklahoma State University  
Lisa Castle

### **Invasive Species as Gateway Ecology: a Personal Case Study**

Invasive Species can be a great tool for connecting students to applied ecology. The species are easy to find and observe and present economic problems that force students to think in interdisciplinary ways about the environment. Here I present my personal history with invasive species, from undergraduate research project on giant reed (*Arundo donax*) in Oklahoma, to crew leader for high school student with the Student Conservation Association in New York City. I mention what has intrigued (and bored) me and the younger students I have worked with, and how invasive species can be used as a gateway to other applied ecology projects, both in and out of the school setting.

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**Watters, Jessa** - jwatters@ou.edu  
Sam Noble Museum, University of Oklahoma  
Cameron Siler

### **Results of a Statewide Assessment of Amphibian Infectious Disease on Oklahoma Public Lands**

Amphibian populations are declining all over the world due to a number of factors, including infectious diseases. The fungus *Batrachochytrium dendrobatidis* (Bd or chytrid) and a viral pathogen Ranavirus (RV), have been linked directly to North American amphibian mortality events. Despite documentation of chytrid and Ranavirus throughout the United States, little is known about their presence or infection levels in Oklahoma. Supported by the Oklahoma Department of Wildlife Conservation (ODWC), the Herpetology Department at the Sam Noble Museum has just completed an intensive three-year infectious disease monitoring program to sample 23 counties in Oklahoma. Sampling focused on Wildlife Management Areas and other public lands in each focal county. Chytrid was screened via skin swabs from live animals and Ranavirus was screened through tissue samples, both collected with or without euthanization of the host animal. Following DNA extraction from the swab/tissue samples, pathogen presence is screened and infection load is estimated using quantitative PCR (qPCR) techniques. As a standard of validity during the qPCR process, samples are tested in triplicate, with both positive and negative controls. We present the results of our statewide surveys for both pathogens, including discussion of dual infection prevalence, from three different regions in Oklahoma: southeast, northeast, and west. The observed high levels of disease prevalence are concerning as the sampling regions overlap with the distributions of most of Oklahoma's amphibian species of greatest conservation concern. The findings of this research program have the potential to provide guidance in assessing the state's current, long-term management and conservation plans for its native amphibian species.

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**Will, Rodney** - rodney.will@okstate.edu  
Oklahoma State University  
Dan Hoff, Chris Zou, Nathan Lillie

### **Dynamics of *Juniperus virginiana* Encroachment in The Cross Timbers Forest of North-Central Oklahoma**

Fire exclusion is altering composition and structure of the Cross Timbers forests of Oklahoma. To assess the current forest condition, we measured 130 plots in north-central Oklahoma. We encountered 33 species in the tree (407 trees ha<sup>-1</sup> and 19.0 m<sup>2</sup> ha<sup>-1</sup> basal area) and shrub layers. *Quercus stellata* (171 trees ha<sup>-1</sup> and 8.21 m<sup>2</sup> ha<sup>-1</sup>) dominated the tree layer, but exhibited lower abundance in the sapling and seedling layers. *Quercus marilandica* was present in small quantities (16 trees ha<sup>-1</sup> and 0.66 m<sup>2</sup> ha<sup>-1</sup> of basal area) despite its reputation as a historically an abundant tree. *Juniperus virginiana* was encroaching into the forest matrix (57 trees ha<sup>-1</sup> and 1.31 m<sup>2</sup> ha<sup>-1</sup> basal area), while fire-intolerant species including *Ulmus americana*, *Carya texana*, and *Celtis* spp. were most abundant in the understory. Increment cores collected from mature trees indicated that *Quercus* recruitment has declined since the 1950s while recruitment of *J. virginiana* and other fire-intolerant species has been increasing. The fire-intolerant, more mesic species, exhibited significantly higher basal growth rates than *Quercus* species and *J. virginiana*. The densification of the Cross Timbers by fire-intolerant species and *J. virginiana* will have significant effects on future fire regimes and restoration options.

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**Wilson, Luci** - lucir@okstate.edu  
Oklahoma State University  
Gail Wilson, Karen Hickman

### **Reductions in Soil Organic Carbon and Microbial Biomass by Non-Native Invasive Grass, *Bothriochloa bladhii*, May Inhibit Restoration Success**

Grasslands cover 35% of earth's land surface, provide many essential ecosystem services, and play an important role in driving global biogeochemical cycles. One of the greatest current threats to these ecosystems is invasion by non-native species. While underlying biological mechanisms facilitating non-native species invasion are still unknown, there is growing recognition that alterations in belowground processes may play fundamental roles in the success of invasive species. The objectives of our study were to assess above- and belowground consequences of invasion into native tallgrass prairie by a non-native warm-season grass, *Bothriochloa bladhii*. We established four replicate 0.25 m plots in invaded and adjacent non-invaded (native) sites at Konza Prairie Biological Station, Manhattan, KS. In each replicate plot, above- and belowground biomass and plant species composition were assessed. Soil biotic parameters included abundance of inter-radical arbuscular mycorrhizal [AM] fungi (hyphae in soil), and intra-radical AM fungi (hyphae in roots). Soil abiotic parameters included plant-available N and P, soil organic carbon and aggregate distribution. Plant species richness was reduced from 12-14 species/m<sup>2</sup> in native areas, to 1 species (*B. bladhii*)/m<sup>2</sup> in plots invaded by the non-native grass. While aboveground biomass production of the non-native grass was greater than native species, allocation to root biomass was significantly less, compared to native plant species. Invasion by the non-native grass reduced soil organic carbon, as well as total soil microbial biomass, likely driven by reductions in AM fungal allocations. These soil alterations following invasion by *B. bladhii* invasion likely reduce ecosystem functioning and inhibit successful restoration.

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**Wilson, Luke** - luke.a.wilson@okstate.edu  
Oklahoma State University  
William Hammond, Kailiang Yu, Rodney Will, William Anderegg, Henry Adams

### **Point of No Return: Non-Structural Carbohydrates at the Lethal Hydraulic Threshold of Loblolly Pine**

Identifying the environmental conditions under which trees will persist or die is necessary to reduce uncertainty regarding success of managed forests and terrestrial carbon cycling under a changing climate. We experimentally determined a water stress threshold related to mortality for loblolly pine (*Pinus taeda*) saplings, re-watering along a water stress gradient ranging from mild to lethal. We measured plant physiological traits including water potential, percent loss of conductivity, photosynthetic capacity of photosystem II (fv/fm fluorometry) and collected tissue to measure the concentration of non-structural carbohydrates (NSC). NSC analysis was used to determine soluble sugars and starch content at time of re-watering in foliage and twigs near the hydraulic threshold related to mortality. Preliminary NSC analysis suggests mobilization of starch to soluble sugars at all levels of water stress indicating that stored carbohydrates under drought are mobilized. Our experiment is one of the first times that measurements of NSCs have been assessed in trees that were re-watered at different levels of water stress in conjunction with known fates of life or death. This information can be used by forest managers to understand the impact of water-stress on forest health and identify the conditions under which forests may become a carbon source rather than sink. Additional study is needed to determine the role of NSC in trees during extreme water stress in additional tissues and the implications on life or death of a tree and the resulting forest.

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**Wolf, Skylar** - skylar.wolf@okstate.edu  
Oklahoma State University  
Evan Tanner, Robert Mollenhauer, Sam Fuhlendorf, Shannon Brewer,

### **Determining the Temperature Selection Patterns of Native Stream Fishes in an Ozark Stream**

Temperature influences the success and survival of stream fishes at multiple spatial and temporal scales. In the Ozark Highlands ecoregion, streams are heavily influenced by karst topography and associated subsurface flow, creating local and seasonally-dependent patches of cool and warm thermal refugia. Competition over such refugia may affect the overall survival and recruitment of important sport fishes or species of conservation concern, particularly during vulnerable life stages (e.g., juvenile). We sought to determine how thermal patches are selected both seasonally and during ontogeny. We deployed a fiber optic distributed temperature sensing system (FO-DTS) to map the thermal patchiness of a pool-run complex in Spavinaw Creek, Oklahoma. Once deployed, we snorkeled the pool-run complex twice daily over four days, and marked patches occupied by fishes of interest including Smallmouth Bass (*Micropterus dolomieu*), Creek Chub (*Semotilus atromaculatus*), Redspot Chub (*Nocomis asper*), Redhorse (*Moxostoma* spp), and Northern Hog Sucker (*Hypentelium nigricans*). We spatially referenced each occupied location to the FO-DTS, providing a snapshot of both used and available temperatures in respect to each individual. Additionally, we measured other physical habitat attributes at each marked location, allowing for comparison of thermal and physical habitat-selection patterns. We show that multiple native species segregate habitat based on a variety of features including thermal resources. Sampling will continue across multiple seasons, allowing for the identification of critical periods where thermal habitat selection is most prominent. These data will identify fishes that are most sensitive to loss of particular thermal conditions, and identify time periods when species most rely on these refugia.

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# Late Presentation Submissions

## Jeff Boxrucker

Reservoir Fisheries Habitat Partnership

### **Reservoir Fisheries Habitat Restoration is too Big a Job for Any one Agency to Tackle: Partnering and the Friends of Reservoirs Role in its Promotion**

The task of restoring habitat in the nation's reservoirs is a multijurisdictional challenge and cost prohibitive for a federal and/or state agency to accomplish without partnering with other public and private organizations or individuals. The Reservoir Fisheries Habitat Partnership (RFHP) recognizes that reservoir fisheries habitat impairments are often extensions of poor land-use practices in the respective watersheds. RFHP works to bring agencies and local organizations and individuals together to address habitat impairments at the local scale. RFHP and the Friends of Reservoirs Foundation have a membership and grant program that encourages local groups to work with state fisheries biologists to ensure that projects enhance fisheries management plans. RFHP has conducted a habitat impairment assessment of reservoirs nationwide to help prioritize activities. Funded projects have focused on native vegetation restoration, structure addition and shoreline stabilization. Future projects look to partner with organizations to address watershed impairments to improve water quality and habitat in downstream impoundments.

## Branham, KaLynn D.

Department of Natural Resource Ecology and Management, Oklahoma State University  
W. Sue Fairbanks, Victoria Jackson, Sophia Alvarez-Briglie

### **Establishing a Reliable Population Survey for Bobcats in the State of Oklahoma**

**Objectives:** The Oklahoma State University student chapter of The Wildlife Society, the University of Central Oklahoma student chapter of The Wildlife Society, and the Oklahoma Department of Wildlife Conservation teamed up to conduct a pilot study on the effectiveness of hair snares to detect bobcat (*Lynx rufus*) presence for occupancy modeling. Data previously used to monitor trends in Oklahoma's bobcat population was highly dependent on fur prices. We are working on an occupancy study that will provide information on distribution trends of bobcats in different parts of the state, while taking into account differences in detectability. Because the bobcat is a major furbearer species in Oklahoma, the information resulting over time will be useful for managing the species.

**Methods:** In November on 2016, we invited experienced trappers to visit our student chapter of The Wildlife Society to train students in setting cubbies designed to collect hair from bobcats. Students and other interested volunteers constructed and set out the cubbies in December/January when students went home for winter break, allowing widespread coverage of the state. Each cubby had 4 .30 caliber gun brushes to collect hair samples. During the spring semester, students performed microscopic identification of hairs extracted from the cubbies. In this study, fifteen counties were sampled.

**Results:** At this point, 84 gun bore brushes have been examined. 52% of those brushes contained 1-141 hairs. Work on identification of hairs is ongoing. Results of hair identification will be presented in the poster, and that, based on successes from the first season, we will expand the area covered in winter 2017-18.

## Hill, Jahna

City of Tahlequah Stormwater Manager

### **Stormwater Managers Protect Oklahoma's Natural Resources**

Tributaries to scenic rivers require extra protection through intensive biological, chemical, and physical monitoring efforts. Monitoring of biological indicators of water quality; such as, aquatic species, animals, plants, and their habitats, ensures that these natural resources are protected. Stormwater runoff is a major contributor to pollution; the runoff carries sediment, chemicals, bacteria, oil, and toxins that harm aquatic life and impair water. Stormwater Managers are tasked with protecting water quality through federal, state, and local regulations, as well as permitting. In Tahlequah, Oklahoma, runoff from city surfaces is regulated within the Municipal Separate Storm Sewer System (MS4) and is not treated before it is discharged into the Illinois River. Tahlequah Creek is a tributary to the Scenic Illinois River and requires monitoring of bacteria, fish and macroinvertebrate populations, and various water quality parameters. The City of Tahlequah Stormwater Program, Oklahoma Conservation Commission's Blue Thumb program, and a local watershed group collaborate to protect the local waterbody. Management of natural resources through stormwater efforts strives to improve water quality and aquatic life and the overall environmental health of these natural resources.

## Lewis, Brian

City of Tulsa  
Jacob Hagen

### **Urban Watershed Characterization**

The City of Tulsa Stormwater Quality Program operates under a Municipal Separate Storm Sewer System (MS4) Permit. This permit is to ensure that the rain water collected within the City of Tulsa will not damage the natural resources of the Arkansas and Verdigris River systems in which it discharges. While compliance and enforcement of construction and industry is a major component of this permit, a monitoring aspect of the permit is too. The City of Tulsa Stormwater Quality group uses biological indicators to assess and monitor stormwater discharge from the City limits. Fish collections, macroinvertebrate collections, and of course analytical collections are performed in 30 streams across the City. Combined with physical habitat assessments, this information makes up is called our Watershed Characterization Program. This is a demonstration of a large municipality paying attention to natural resources to get a better understanding of how we impact them and how we can improve. While this program has its trials and tribulations, it demonstrates a more thorough way to assess Stormwater Quality.

## VanLoo, Scott

City of Tulsa

### **Low Impact Development – Incorporating Green Infrastructure**

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The City of Tulsa Stormwater Quality Program operates under a Municipal Separate Storm Sewer System (MS4) Permit. This permit is to ensure that the rain water collected within the City of Tulsa will not damage the natural resources of the Arkansas and Verdigris River systems in which it discharges. A major step in eliminating polluted runoff is to reduce the runoff itself. Low Impact Development is the reduction of stormwater runoff by minimizing impervious surfaces or promoting recapture. Incorporating green infrastructure like rain gardens or bio swales help to eliminate pollutants that could damage our natural resources. It could be as simple as disconnecting rain gutter downspouts or as complex as a large rain garden or a green roof.

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