

OKNRC 2019 – Abstracts of Oral Presentations

Barber, Dallas

Oklahoma's Deer Management Assistance Program

Designed for intensive management of deer herds on private lands, the DMAP program is built to give cooperators extra assistance in managing deer. Under the program, cooperators work 1-on-1 with biologists to set their own management goals ranging from producing maximum numbers to producing trophy bucks.

Brown, Kimberly

Additional authors: Robert Mollenhauer, Shannon Brewer

Effects of non-native Rainbow Trout on behavior and cover use by Smallmouth Bass

Stream-dwelling salmonids are territorial and are often stocked at relatively high densities in locations where they are not native. Depending on the stocking location, non-native salmonids may compete for limited resources with ecologically similar species. In warmwater streams of the southern United States, trout are often stocked in spring-fed streams where Smallmouth Bass *Micropterus dolomieu* are the top native predator. It is unclear what effect, if any, these stockings have on Smallmouth Bass populations. Our study objectives are to determine the density-dependent effects of Rainbow Trout *Oncorhynchus mykiss* on Smallmouth Bass behavior. We will accomplish this by assessing the frequency of intra- and inter-specific aggressions by Smallmouth Bass and the use of cover at high and low fish densities. We are simulating a series of pool-riffle complexes in the laboratory and stocking fish at four density combinations of both Smallmouth Bass and Rainbow Trout. Within each complex, only one pool contains cover in order to tease out confounding effects of pool versus cover use. We documented the frequency of aggressive behaviors over standardized periods and time intervals throughout the day. Preliminary results indicate that higher fish densities increase the frequency of aggressive interactions among Smallmouth Bass. However, fish maintained their use of cover even at relatively high fish densities of both Smallmouth Bass and Rainbow Trout. Our study is ongoing, but preliminary results suggest higher fish densities of top predators increase aggressive behavior in Smallmouth. Thus, stocking trout at high densities may negatively affect growth potential of Smallmouth Bass populations.

Buck, Joe

Additional authors: Justin Cheek, Chad B. King

A Critical Analysis of Fire in Oklahoma: Is a Universal Approach, the Right Approach?

Undisputedly, fire has played a key role in shaping and maintaining various ecoregions across the land now known as the state of Oklahoma. After nearly a century of fire suppression policy, efforts are being made to manage ecosystems by implementing prescribed fire. Commonly, land managers call for mean fire intervals (MFI) of every 1 to 3 years. Published fire history studies conducted in the state have revealed fire intervals ranging from 1.35 to 4.7 years. We present a comprehensive discussion of the state's historical fire regimes, as depicted in the literature. Additionally, we present two case studies of fire history, one, a Cross Timbers oak (*Quercus*) savanna in Lincoln County, the other, an oak-hickory (*Quercus-Carya*) forest in Choctaw County. Oak and hickory cross-sections containing fire scars were collected at the two sites and fire return intervals were analyzed. Trees from the Cross Timbers and oak-hickory sites covered similar time periods (1795 - 2017) ; (1799 - 2017), respectively) and similar mean ages (Cross Timbers=106.2 yo; Oak-hickory=106.3 yo).

Cady, Samantha

Additional authors: Craig Davis, Samuel Fuhlendorf, Laura Goodman, Dwayne Elmore, Rheinhardt Scholtz

Northern bobwhite responses to drought and woody cover in the Great Plains

Northern bobwhite (*Colinus virginianus*), an economically important Oklahoma game bird, have experienced steep population declines in recent decades. This long-term trend has largely been attributed to broad scale loss of suitable habitat throughout much of the bird's distribution. Though it is well-established that bobwhite rely on woody vegetation for thermal cover and predator avoidance, optimal thresholds of cover may support disproportionately higher occupancy probabilities for bobwhite. Our first objective was to identify these peak thresholds and to determine whether bird responses are region-specific. Additionally, it is known that

drought can negatively impact bobwhite by inhibiting reproduction and reducing survival. Drought quantified at different temporal scales captures different hydrologic attributes, which may uniquely influence food supplies and vegetation greenness/structure. Our second objective was to determine which temporal scale of drought best explains bobwhite occurrence. We used North American Breeding Bird Survey data collected over 17 years and cleaned the data to mitigate confounding effects. Statistical analyses included generalized linear mixed models coupled with information-theoretic approaches and dynamic occupancy modeling. Results indicate a strong, negative relationship between annual-scale drought and bobwhite, with a 26% decrease in bird presence for each standard deviation from normal moisture conditions. Bobwhite showed region-specific optimal woody cover thresholds when data are analyzed at a presence/absence resolution. In the Great Plains, woody encroachment and an increase in frequency and intensity of weather extremes, including drought, are two regionally important facets of global change. Therefore, expanding our understanding of the nuanced and complex relationship between bobwhite and woody cover, as well as the impact of possible stressors such as extreme weather events, will be critical for future management.

Cheadle, Cheryl

Forward March - A New Commitment to Protecting the Earth: Volunteers Needed

The Oklahoma Conservation Commission's Blue Thumb Water Quality Education Program is now in its 25th year. Blue Thumb is a premier organization with a known track record of training and maintaining volunteers who consistently submit data on wade-able streams throughout the state. The data generated is used by the Commission and even other agencies in making decisions to protect waterbodies. These volunteers have frequently been active as educators as well, and it has come to the attention of Blue Thumb staff members that there are people who care about the environment, and they want to be proactive, but they do not want to be water quality monitoring volunteers. With this in mind, Blue Thumb is making an effort to strengthen its corps of volunteers who are willing to be involved in education.

Blue Thumb staff members and Conservation Commission administrators agreed that the program was in need of a position with the primary goal of managing volunteers with an emphasis on making use of volunteers with an interest in educating others. A staff position for this role was filled in late summer 2018. This person is leading the charge to: 1) recruit volunteers for ALL Blue Thumb duties; 2) inventory volunteer interest and help volunteers find their place within Blue Thumb; 3) coordinate the tools needed for volunteers to be effective educators; 4) serve as a mentor to volunteers and be a liaison between volunteers, conservation districts, and other Blue Thumb staff members so that volunteers make a smooth transition as they move into educator roles; and 5) motivate volunteers to put their best foot forward for the cause of protecting the environment.

This presentation will cover:

Blue Thumb's changing role as environmental issues gain urgency
Current trends in Oklahomans placing a value on protecting natural resources
Effective education and/or experiences that create an ecologically literate population and
How to come aboard and start making a difference.

Cleary, Madeleine

Additional authors: Omkar Joshi, W. Sue Fairbanks

Human dimensions of black bear (*Ursus americanus*) management in eastern Oklahoma: an assessment of human values, attitudes, behaviors and population tolerances

After a successful reintroduction in the 1960s, black bears have recolonized the Ouachita and Ozark mountains of Oklahoma. Since recolonization, anthropogenic habitat alteration has increased, creating overlap between black bears and humans in the rural and suburban parts of their range. As both human and black bear populations change in eastern Oklahoma, the frequency of human-black bear interaction is expected to increase. A higher frequency of human-black bear conflict can cause human attitudes towards black bears to shift which can complicate management if misunderstandings between wildlife managers and the public are not resolved. Eastern Oklahoma offers a unique opportunity for research on human-black bear interactions because it contains a gradient of black presence and hunting conditions. To understand how residents view black bears across this

gradient, we administered a mail survey to collect information on elements of the “value-attitude-behavior” cognitive hierarchy, and human acceptance of black bears (measured as social carrying capacity). Preliminary results suggest that respondents are willing to accept a level of human-black bear interaction that is consistent with the amount of black bears in the Oklahoma Ozark black bear population (approximately 100 bears). Our study will provide management and outreach recommendations that will enable effective black bear management in eastern Oklahoma.

Crawford, Priscilla

Additional authors: Jessa Watters

Testing the effectiveness of sampling environmental DNA to detect the presence of aquatic invasive plants.

Sampling aquatic habitats for DNA that has been shed into the environment (environmental DNA or eDNA) has the potential for detecting species not easily observed in the habitat. Visual searches for aquatic invasive species can be time consuming and habitat can be difficult to access. We believe it could improve survey efficiency if we could take a sample in a water body and be able to determine if an invasive species is present somewhere within that water. Therefore, we tested the ability to detect aquatic invasive plant DNA in water samples taken in lakes of a known infestation. *Myriophyllum aquaticum*, parrot feather watermilfoil, a popular aquatic garden plant native to the Amazon River, was our target species. *M. aquaticum* forms monocultures in freshwater systems throughout the southern U.S. and is considered invasive. We collected 500mL water samples in three Oklahoma lakes with *M. aquaticum* infestations. Samples were taken at four locations in each lake to determine if eDNA could be detected at a distance from the plant: adjacent to plants, 1m, 5m, and 10m away. Water samples were filtered to concentrate DNA, then eDNA was extracted from the filters. The extract was screened for the target species using a species-specific primer-probe with quantitative, real-time PCR (qPCR). Additionally, native *Myriophyllum* species were used to assist in primer-probe development as a related, but non-target species.

Duck, Jeremy

Evaluating the effectiveness of a statewide trophy length limit (762 mm) for Blue Catfish (*Ictalurus furcatus*) in Oklahoma

Growing interest in trophy Blue Catfish, *Ictalurus furcatus*, angling over the past 20 years has resulted in implementation of trophy regulations to manage this species by some natural resource agencies. On January 1, 2010, the Oklahoma Department of Wildlife Conservation adopted a 762 mm (30 inches) length regulation for Blue Catfish in response to research that suggested growth overfishing was occurring for most Blue Catfish populations in Oklahoma. The goal of the regulation was to redirect angler harvest towards smaller fish (<762 mm), control harvest of large fish (>762 mm), and improve the overall size structure (growth rates) of these populations. . The impetus for this study is to evaluate whether the 762 mm length regulation has resulted in improved size structure of Blue Catfish in Oklahoma reservoirs. This was done by comparing pre- and post-regulation population parameters (age, condition, growth, mortality, size structure, and relative abundance) from eight Oklahoma reservoirs (Ellsworth, Eufaula, Grand, Kaw, Keystone, Oologah, Texoma, Waurika) to determine the effectiveness of the trophy regulation. Results are ongoing. Pre- and post- regulation data will be presented.

Dudek, Jeff

Additional authors: Henry Adams

A burning question: How much drought causes eastern redcedar to become more easily combustible?

Woody encroachment of *Juniperus virginiana*, eastern redcedar, due to fire suppression, is one of the greatest contributors to the degradation of North American grasslands. Mature trees are unlikely to burn during wet periods. However, during extended dry periods when live fuel moisture (LFM) approaches 60% they become more easily ignited and combustible. Currently, the amount of drought that is necessary to cause reductions in LFM is unknown. To identify factors that contribute to wildfire risk we examined correlations between LFM in *J. virginiana* and leaf water potential and soil moisture. We used a dual greenhouse/field approach to link field conditions with changes in LFM and water potential.

In the greenhouse, we watered eastern redcedar saplings of the ‘Canaertii’ cultivar to field capacity at the start of the experiment. We ceased watering on all redcedar saplings except for the randomly chosen controls. All saplings were measured twice a week for water potential and LFM. Simultaneously, all pots were measured gravimetrically for soil moisture. The field study was designed to relate greenhouse results to realistic field conditions. We chose 3 sites in Oklahoma with different levels of annual precipitation: Woodward (dry), Stillwater (middle), and Cookson (wet), which were co-located with OK Mesonet stations. We measured LFM, water potential, and soil moisture in the field through a range of seasonal variation in climate.

In both the field and greenhouse experiments, we observed non-linear relationships between LFM and water potential, and soil moisture and water potential, but not between soil moisture and LFM. The greenhouse experiment showed that LFM drops below the important 60% threshold at a lower water potential than we observed in the field. Future work will use locally excavated trees to address species variation concerns. Overall, our results demonstrate that drought conditions in Oklahoma frequently cause elevated wildfire risk in eastern redcedar.

Dunn, Suzanne

Oklahoma Response and Management Team: J&M Response Success Story

The Oklahoma Kill Response Management Team (OKRMT) is an inter-agency and inter-governmental task force, whose mission is to facilitate communication and collaboration between government entities regarding fish kills in Oklahoma, and to provide a framework for coordinated, consistent, and effective fish kill response. The OKRMT was put to the test, July 2018, when J&M Farms, a mushroom plant near Miami, OK, released “Compost Tea” into a tributary to Tar Creek. The release was high in ammonia and compounds that remove oxygen from the water that killed thousands of fish.

The response to the release and fish kill included numerous members of OKRMT including, Oklahoma Department of Agriculture Food and Forestry (ODAFF), Grand River Dam Authority (GRDA), Oklahoma Department of Wildlife Conservation, Oklahoma Department of Environmental Quality, U.S Fish and Wildlife Service, Peoria Tribe of Indians of Oklahoma, and the Ottawa Tribe of Oklahoma. The agencies and Tribes coordinated efforts to reduce redundancy, maximize collection of information, and share critical information. Due to the pre-planning OKRMT conducted in years prior to this release, the agencies and Tribes were in a position to reduce additional impacts and collect timely information.

Dvoretz, Daniel

Oklahoma's Wetland Program Plan: A Collaborative Approach to Wetland Management

In 1990, the Oklahoma Conservation Commission (OCC) was appointed the lead agency in wetland planning and strategy development by the Oklahoma Legislature. However, in Oklahoma, numerous government agencies, tribes, universities and non-governmental organizations have authority and interest in the management of wetlands. As such the management strategy for wetlands is developed through consensus building among technical experts, and is later reviewed by a broader array of participants including private sector stakeholders. The Oklahoma Wetland Technical Workgroup (OWTWG) convened a series of meetings in 2012-13 to create a Wetland Program Plan (WPP) to guide the management priorities for wetlands through 2018. According to U.S. Environmental Protection Agency (USEPA) guidelines, the WPP set forth achievable actions and activities in four core areas (1. Monitoring and Assessment, 2. Voluntary Restoration, 3. Regulation and 4. Water Quality Standards). As the timeframe for the current WPP concludes, we review how well the Wetlands Program achieved the established goals, and use this as an opportunity to establish management priorities for the next 5 years. OCC will convene the OWTWG in 2019, and is soliciting input from our technical partners, who wish to be engaged in the creation of the next WPP.

Elmore, Jared

Additional authors: Matthew Fullerton, Dillon Fogarty, Scott Loss

Assessing the influence of turbulence and olfactory cover at Red-cockaded Woodpecker nesting cavity trees

The Red-cockaded Woodpecker (RCW) is a federally endangered woodpecker native to the southeastern United States with one small isolated population occurring in southeastern Oklahoma. RCW populations have declined and become isolated across their range due to habitat loss, fragmentation, and predation. Predators such as rat snakes (*Pantherophis* spp.) often use olfactory stimuli to detect RCW cavity trees. The detection of olfactory cues by predators are influenced by airflow variables and one way RCW's could potentially prevent detection is by selecting for beneficial orientations or trees. A novel methodology was employed to assess if and how airflow variables such as average velocity, turbulence, and turbulence intensity differed at RCW occupied cavity trees vs. random (unused) trees, and cavity vs. opposite orientation. Airflow measurements were collected using a sonic anemometer during the summer (nesting) season at 28 RCW cavity trees in the Ouachita National Forest in west-central Arkansas. General linear models with Tukey's multiple comparisons procedure were conducted to determine if airflow variables differed at cavity trees from random trees and at cavity orientations from respective opposite orientation. Results from Tukey's HSD suggest that average velocity, turbulence, and turbulence intensity do not differ among trees or orientations. Typically turbulence and turbulence intensity is higher with increased heterogeneity of understory vegetation. However, much of the vegetation around RCW cavity tree clusters is homogeneous due to mowing by the USFS, possibly influencing the airflow variables that we tested. Further, it is possible that RCW do not select cavity trees or orientations based on olfactory cover and select cavities based on other factors.

Fenner, Daniel

Additional authors: Brian Fillmore

A Gene Flow Management Plan for the Federally-Threatened Leopard Darter

The federally-threatened Leopard Darter (*Percina pantherina*) is endemic to the Little River basin of southeast Oklahoma and southwest Arkansas and has always been reported as rare. Reservoir construction and habitat degradation have fragmented the range of Leopard Darter into populations isolated in five major tributaries of the Little River. A recent genetic survey indicates remarkably small effective population sizes for local populations, generating concern for long-term persistence of the species. In particular, an effective population size of only five in the Cossatot River in Arkansas suggests that this unique population may be on the brink of extirpation, which is reflected in results from annual population monitoring. Here, we present a gene flow plan for the leopard darter and discuss pilot work being implemented to inform decision making and improve effectiveness of plan implementation.

Fisher, Jonathan

Additional authors: Daniel Fenner

POPULATION AND COMMUNITY TRENDS OF THE ARKANSAS RIVER SHINER *NOTROPIS GIRARDI* AND PEPPERED CHUB *MACRHYBOPSIS TETRANEMA*

As a part of ongoing assessments of the federally-threatened Arkansas River Shiner *Notropis girardi* and imperiled Peppered Chub *Macrhybopsis tetranema*, the U.S. Fish and Wildlife Service compiled historical survey records from state natural resource agencies, universities, museums, and publications. We retained surveys that occurred within the historical geographic distributions of the two fishes of interest that had either presence/absence or count fish community data. Our current database contains records from over 7,400 collections from the Arkansas, Cimarron, North Canadian, and South Canadian Rivers, and their larger tributaries. Both fishes are pelagic broadcast spawners requiring a natural flow regime and over 120 miles of uninterrupted stream reaches for successful reproduction and recruitment. Altered flow regimes and river impoundments have resulted in loss of suitable habitat, declining stream connectivity, and decreased water quality throughout large portions of these species current and historical ranges. The Arkansas River Shiner and Peppered Chub were likely extirpated from the Arkansas River around 1987 and 2012, the Cimarron River around 1993 and 2011, and the North Canadian River around 1993 and 1982, respectively. We used beta regressions to model the two fish populations, and detrended correspondence analysis to model fish community associations in the South Canadian River during the sample period (1920 to 2016).

Frakes, Adam

Additional authors: Omkar Joshi

Potential Economic Impacts of Management Alternatives & Factors Associated with Visitor Satisfaction at Canton Lake, Oklahoma

Lakes provide several water based ecosystem services often neglected during natural resource decision making. Among commonly overlooked ecosystem services are recreational and amenity benefits of free-flowing waters or man-made reservoirs. In Oklahoma, recent drought conditions have led to water releases from Canton Lake and sparked debates over water allocation within the state. Since the lake serves as a premier destination for walleye fishing and other water based recreation in the state, persistent lack of appreciation in decision making may lead to substantial economic losses in the region. In order to provide local and state stakeholders a more comprehensive accounting of the economic and human dimensions at Canton Lake, we administered a mixed mode survey instrument among lake visitors during summer 2018. Preliminary results indicate that only half of anglers are at least somewhat satisfied with current fishing quality at the lake while around 80% are somewhat satisfied with Canton Lake overall. Data also suggests that the average visitor is around 50 years old, possesses a college degree, and has an annual household income above \$50,000. Trips to Canton Lake generally last two days, originate nearly 80 miles away, and include participation in multiple recreational activities - fishing being the most popular. These results will provide stakeholders, including the Oklahoma Department of Wildlife Conservation, valuable information for future policy and management decisions.

Geik, Adam

Additional authors: Jason Schooley, Brandon Brown

Paddlefish Snagging at Fort Gibson Dam: A Unique Fishery in Oklahoma

The recreational paddlefish fishery at Fort Gibson Dam (FGD) above Webber's Falls Reservoir is unique in Oklahoma in that it has liberal accessibility regulations, fish can be caught well into the summer, and fish could potentially immigrate from four major sources: the Grand/Neosho, Verdigris, Canadian, and Arkansas river systems. Three hundred and one paddlefish were captured with gill nets and tagged with jaw bands in Webber's Falls Reservoir in December 2017 and January 2018, and a creel survey was conducted May through August 2018. Recaptures during the creel were low (1 fish), so netting data was used to estimate population abundance (Chapman adjusted Peterson estimator: N=1794, 95% confidence limits 1165 and 4721). Creel results were combined with mandatory online paddlefish harvest reporting data to estimate exploitation (35%, 95% confidence limits 13% and 53%). Netting and online harvest data revealed paddlefish that had immigrated from three sources: the Arkansas River, the Grand/Neosho River upstream of FGD, and the Verdigris River. Anglers surveyed during the creel were mostly male (92%), from Oklahoma (87%), and local (79%); their primary motivations in choosing the site were bank access and catching a high quantity of fish. We determined that paddlefish are potentially being overharvested at FGD, however, more information is needed on the level of recruitment within the Webber's Falls system and the contribution of immigration to the FGD stock.

Gillman, Kristen

Land Acquisition and the need for public lands and access

In Oklahoma 95.5% of the land is private ownership. The best way to protect habitat and critters from the impact of development, fragmentation, overgrazing, non-native species and other threats, is to own it. The ability for ODWC to directly control and manage large tracts of land is significant for helping us meet our agency's mission as stewards of wildlife. Thus being able to provide recreational and economic benefits to present and future generations of citizens and visitors to Oklahoma.

Gillman, Kristen

Leveraging every dollar to have the greatest impact on the resource.

In recent years the Pittman-Robertson Federal Aid in Wildlife Restoration Act has seen an increase in the excise tax that provides funds to each state to manage wildlife and their habitats. States are struggling to come up

with the 25% match to receive funds. Learn how ODWC is using donations from non-governmental organizations and other funding opportunities to maximize funding and accomplish large scale habitat projects.

Goodman, Laura

Additional authors: Nolan Craun, Jim Neel, Karen Hickman

The diet selection and grazing distribution of beef cattle with varying residual feed intake efficiency scores.

Improved cow efficiency could drastically reduce input costs since feed is the single largest source of input cost in the beef industry. One measure of efficiency, residual feed intake (RFI) is the difference between an animal's actual feed intake and expected intake based on body weight and growth. Little is currently known about if foraging behaviors are associated with RFI and if selection against high RFI cattle could affect cattle diet selection and grazing distribution. This study used global positioning system (GPS) collars to collect spatial data on 38 Angus and 5 Brahman — Angus heifers with known RFI values in a 69 ha pasture in the south-central Great Plains over a 30 day period and DNA-barcoding to identify plant species in their diet. No differences were observed in plant community selection among RFI groups. In addition, low-RFI (efficient) heifers did not select diets that differed in percent crude protein ($P=0.60$) or digestible organic matter ($P=0.38$) from mid-RFI (average efficiency) or high-RFI heifers (inefficient). RFI groups were similar in the amount of protein acquired from each plant family; only two of ten families differed in protein abundance among RFI groups ($P<0.03$) in the conservative classification and in the extreme classification only one of ten families differed in protein abundance ($P<0.01$). High-RFI heifers traveled further ($P=0.04$) than low-RFI heifers from midnight to sunrise and had greater spatial search patterns ($P=0.01$) but had similar distance traveled over the 24-hour period. Area explored, shade use, water use, and slope use were all similar among RFI groups ($P>0.05$). Within RFI groups, low-RFI heifers tended to have greater variability within each distribution variable.

Griffin, Austin

Additional authors: Bruce Hoagland, Kurt Kuklinski

The effect of water quality on the mean relative weight of largemouth bass, crappie, and channel catfish in Oklahoma lakes

This project was comprised of two objectives. The first was the creation of a relational database using existing Standard Sampling Procedures (SSP) data. The resulting database includes approximately 1.6 million records for 150 Oklahoma fish species. The database schema consists of five tables entitled: Abiotic, Biotic, SSP Species List, OBIS Taxonomy, and OWRB Lake Data. The second objective was to employ the SSP database to determine if water quality parameters in 108 Oklahoma lakes influenced the relative weights of largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis annularis* and *Pomoxis nigromaculatus*), and channel catfish (*Ictalurus punctatus*). Discriminant analysis of eight water quality parameters resulted in the classification of said lakes into six classes. Mean relative weights for largemouth bass, crappie, and catfish ranged from 89.84-99.17, 91.99-98.17, and 86.90-94.01 respectively. Salinity, which was the most important explanatory variable in lake classification, ranged from 0.04-0.63 ppt among the six classes. This information could prove useful to the fisheries managers of Oklahoma by reclassifying similar lakes regardless of management region, allowing for a different perspective on management practices.

Hammond, William

Additional authors: Luke A. Wilson, José M. Torres-Ruiz

Kill it without fire: quantifying lethal drought stress for eastern redcedar, *Juniperus virginiana*.

Eastern redcedar, *Juniperus virginiana*, has been extensively studied in recent decades as a century of fire suppression and land use changes led to its widespread encroachment into the Great Plains. Prior to these land-use and fire regime changes, the range of eastern redcedar in Oklahoma was largely confined to riparian areas, which are generally too wet to burn during wildfires. Despite the extreme drought resistance of eastern redcedar, recent drought events in Oklahoma led to drought-induced mortality for large stands of the species, in the absence of fire. Unlike many native species of dry grasslands, eastern redcedar lacks a meaningful means of escape from

extreme drought events and continues to use (rather than save) water during extreme soil and atmospheric drought. If fire has limited the distribution of eastern redcedar in the past, how might extreme climate events (such as recent droughts) limit the ability of this historically riparian species to encroach an ever warming, ever drying landscape? Here, we experimentally determined the lethal threshold for drought-induced water stress in eastern redcedar in a greenhouse drought experiment with eastern redcedar trees (n=50). We initiated drought-induced water stress by withholding water, and re-watering trees along a stress gradient ranging from mild to lethal. During the experiment, and at the re-watering point, we measured many physiological responses of the trees to drought stress. Here we present multiple mortality risk predictors for eastern redcedar from drought stress. We found that eastern redcedar is capable of surviving extreme drought stress, but that canopy die-back was generally proportional to the level of stress experienced. Subsequently, we quantified the impact of increasing temperature on water loss in this species, suggesting that increasing temperatures accelerates water loss in the species, which will likely reduce the time-to-mortality for eastern redcedar under warmer drought regimes.

Harron, Paulina

Additional authors: Omkar Joshi, Shishir Paudel, Karen Hickman

Predicting potential range expansion of invasive *Pueraria montana* in the Southcentral United States under future climate scenarios

Invasive species pose a major threat for biodiversity conservation around the world, and the spread of many invasives are likely to be expedited with global climate change. Invasive species are responsible for reducing native species populations, altering species interactions and ecosystem structure, and impacting human economies and health. One of the world's 100 most damaging invasive species, kudzu (*Pueraria montana*), is of growing concern in the southern United States. Known for its rapid growth and competitive characteristics, this perennial vine has the ability to drastically alter ecosystems, blanket forest canopies, cause infrastructure losses and maintenance costs, and threaten agricultural productivity. The traits of kudzu, along with changing climate, may facilitate its invasion into new areas. Using presence records, computer generated pseudo-absence points, and climate (temperature and precipitation) data from the most recent IPCC Assessment Report and WorldClim database, we used the climate-based distribution modeling approach called Biodiversity Modeling (BIOMOD) to estimate kudzu's potential distribution in the southcentral United States over the next 50-70 years under varying climate scenarios. Our results suggest that due to a predicted increase in average annual temperatures at higher latitudes, kudzu has a high probability of shifting its distribution into more northern regions, such as northern Kansas and Missouri, while retracting from less habitable southwestern portions in its current range, such as Texas and parts of Oklahoma and Arkansas. Due to relatively low annual rainfall and increased frequency and intensity of drought events, there is little to no potential expansion of kudzu into western portions of Texas, Oklahoma, Kansas, or Nebraska. These results demonstrate how climate change will influence the distribution of kudzu in the southcentral United States and can be used to direct management actions to limit future impacts.

Horton, Russ

Additional authors: Jeff Cooper, Virginia Department of Game and Inland Fisheries, Teryl Grubb, US Forest Service, Tricia A. Miller, Conservation Science Global, Inc., Todd Katzner, U.S. Geological Survey

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 5 in 2017. As we reported last year, 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 through Kansas and Nebraska and sometimes even into Minnesota or Canada. 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. Interestingly, of the four 2016 birds that survived into 2018, one died and three made long-distance movements to South Dakota. Likewise, of the five non-dispersers telemetered in 2017, all made long distance movements in 2018, two to Manitoba, one to

Wyoming, and the third and fourth to South Dakota and Minnesota. It is notable that all eagles that lived long enough to disperse, eventually did so in their first or second year. This behavior pattern is unusual and suggests that probability of dispersal may be linked to habitat quality and, potentially, population density.

Howard, Jeff

The Influence of Local Fire History on Sericea Lespedeza Invasion

Sericea lespedeza (*Lespedeza cuneata*) is an invasive perennial legume first introduced to North America from Asia in 1896. The plant is now well established across much of the eastern and central United States in a variety of habitats. Mechanisms of spread however are poorly understood, but evidence suggests a positive fire response. I examined the relationship between fire history and sericea lespedeza cover at two Oklahoma sites, one with a detailed prescribed fire history spanning 30+ years (mostly dormant season fires) and the other with a more seasonally variable fire regime. For the latter site I reconstructed fire histories using sectioned post oak (*Quercus stellata*) trees. My findings describe the relationship between MFI and sericea lespedeza cover and provide evidence of how an invasive plant species can influence important ecological conditions under which native species evolved.

Howery, Mark

Additional authors: Curtis Tackett, Matt Fullerton

Wildlife Diversity Inventories on Oklahoma Department of Wildlife Conservation Wildlife Management Areas

The Oklahoma Wildlife Diversity Program has been working with area biologists on a group of state-owned WMAs to collect information regarding the relative abundances and habitat associations of the nongame wildlife that these areas support. Surveys were conducted to sample all five of the major vertebrate classes in Oklahoma, with a special emphasis on species that have been designated as Species of Greatest Conservation Need in the Oklahoma Comprehensive Wildlife Conservation Strategy. An overview of these survey results will be presented. Across four wildlife management areas, we collected information regarding 23 species of amphibians, 44 species of reptiles, 31 species of fishes, 181 species of birds and 40 species of mammals.

Kaplan, Jeremy

Additional authors: Kristen Baum

***Lespedeza cuneata* density affects carbon, nitrogen, and organic matter in tallgrass prairie ecosystems**

Grasslands are influenced by a variety of processes, including fire and grazing. Legumes can also affect grassland productivity and efficiency of C and N storage, influencing biodiversity, ecosystem processes, plant productivity and N availability. Both diversity of legumes and functional composition of grasslands control N pools where diverse communities use N more effectively and C and N pools are enhanced through biomass of legumes. Thus, it is necessary to evaluate the impacts of community plant species composition, diversity and density on C and N storage in grassland soils. We examined organic matter, total N, and total C (%) in areas containing a native legume (*Baptisia bracteata*) and three densities of *Lespedeza cuneata* (high, moderate, and low) in regularly burned pastures in north central Oklahoma. *Lespedeza cuneata* is an invasive legume that occurs in grasslands throughout the eastern and central United States. A significant relationship exists between organic matter, total N and total C (%) by plant density and between these variables and various combinations of individual density ranges. However, there was no difference between low densities of *L. cuneata* and the native legume or between moderate and high densities of *L. cuneata*. We conclude that invasive N-fixing legumes can increase C and N pools and organic matter in associated soils, which has the potential to decrease heterogeneity in grasslands. This research provides additional insights into how invasive species can modify ecosystems.

Kauffman, Kiera

Additional authors: Dwayne Elmore, Craig Davis, Laura Goodman

Thermal ecology and habitat selection of scaled quail in New Mexico

Temperature is a critical component of habitat. Even small changes in soil type, vegetation characteristics, and disturbance regimes can alter temperature across a landscape and produce a suite of microclimates. These microclimates may provide critical refuge from extreme temperatures, and are likely to influence the space use and vital rates of organisms. Variation in temperature can result from inherent landscape features, such as topography and soil type, or from management actions that alter vegetation structure and composition. Appropriate habitat management should ensure the availability of adequate thermal cover for target species. In the southern Great Plains, management actions aimed at shrub removal have implications for the availability of thermal cover for a variety of species. Scaled quail (*Callipepla squamata*) in particular are known to use shrubs such as honey mesquite (*Prosopis glandulosa*) extensively for both food and cover. To better understand how shrubs influence the availability of thermal cover, we investigated scaled quail thermal selection and evaluated sources of thermal variation across the landscape. Preliminary results indicate that locations of both adult quail and nests tend to have greater shrub cover than random landscape locations. Microsite temperatures recorded across the landscape suggest that greater levels of shrub cover moderate microsite temperatures relative to ambient temperatures. Locations selected by adult quail were cooler on average than random landscape locations during hours of peak heating (1000 to 1400 hours). Nest locations followed a similar pattern, with nest bowls moderating temperature by as much as 6°C compared to microsites 2 meters away. These results indicate that scaled quail may respond to thermal variation at incredibly fine scales, a factor which must be accounted for in order to make effective management decisions in an arid and sparsely vegetated landscape.

Kaur, Ravneet

Omkar Joshi, Rodney E. Will

Status of eastern redcedar (*Juniperus virginiana*) encroachment and potential use in future bioproducts industry in Oklahoma

Fire suppression has prompted the growth and encroachment of fire intolerant woody tree species into the native grasslands and forests of the United States. Eastern redcedar, is one such species that has encroached the native ecoregions of many states in the Great Plains including Oklahoma. Eastern redcedar tends to spread rapidly owing to its dispersal by birds, wide adaptability to soil and climatic conditions. Its encroachment into the native prairies and *Quercus* dominated Cross Timbers forests has been an ongoing management concern for decades. While active management activities such as prescribed burning, herbicide application and mechanical removal may be effective for controlling eastern redcedar population, the lack of markets to support harvesting and management may keep the landowners from adopting widespread action. Therefore, our research utilized the Impact analysis for Planning (IMPLAN) platform to perform an economic impact analysis for a new particleboard industry in Oklahoma. We also used the Forest Inventory Analysis (FIA) data to investigate the current merchantable bole volume (5.0-inch d.b.h) of eastern redcedar trees in the state that could be potentially utilized for different bioproducts. We performed a sensitivity analysis to account for the accessible biomass in the region. Our results indicate that if 50 percent of the exiting merchantable eastern redcedar biomass is available for harvest it could potentially support a medium sized particleboard establishment with an annual industrial sale of \$40 million. The model utilizes the Social Accounting Matrix to produce employment results, which shows that such a medium sized facility could provide about 100 full and part-time direct job opportunities with a sustainability of 20 years. The results suggest that the introduction of an eastern redcedar based industry could benefit the state's economy by generating employment and could be an effective approach for managing the species in Oklahoma.

Levesque, Laurence

Additional authors: Daniel Fenner, Mark Horner

HABITAT FACTORS AFFECTING ARKANSAS RIVER SHINER AND PEPPERED CHUB IN SOUTHERN GREAT PLAINS RIVERS-PAST, PRESENT, AND FUTURE

The Arkansas River Shiner (ARS) and Peppered Chub (PC) are small minnows once widespread and common in the western portion of the Arkansas River basin in Kansas, New Mexico, Oklahoma, Arkansas, and Texas, but are now considered extirpated from 83 and 94 percent of their historical ranges, respectively. As part of ongoing assessments of these two fishes, the U.S. Fish and Wildlife Service evaluated these species' needs for long-term population viability and stressors (past, current, and future) that affect those needs. We present out

analysis and results of some of these stressors, including altered flow regimes, stream fragmentation, river channel narrowing, and decreased water quality.

Both the Arkansas River shiner and peppered chub require over 120 miles of unimpounded and connected river for successful reproduction and long-term population maintenance. Over the relatively short period of record, our analysis indicates that flow regimes of rivers in the Southern Great Plains have been significantly altered, affecting the needs of prairie fishes. We also identified river fragments within the Arkansas River Basin by locating instream barriers and river channels known to be dry for significant portions of the year, resulting in only six remaining river fragments providing adequate length for both species.

Our channel width analysis indicates that all river segments narrowed between the 1950s and 2010s, with only one exception. Channel widths decreased 60 percent on average, ranging from a low of 4.5 percent change to over 96 percent loss. Distance to upstream impoundment affected the degree of channel narrowing, in addition to other factors such as water withdrawals and diversions.

Londe, David

Additional authors: R. Dwayne Elmore, Samuel Fuhlendorf

Habitat selection and thermal ecology of greater prairie-chicken.

Alternative management strategies that result in heterogeneous grasslands have been put forward as important conservation strategies for grassland birds. These practices result in grasslands composed of a mosaic of seral stages that differ in vegetation composition and structure and can influence the availability of resources important to grassland birds such as screening cover, thermal refuges, and food resources. In particular, Greater Prairie-Chickens (*Tympanuchus cupido*) have been shown to respond positively to these practices as this species will use different seral stages for different parts of its life cycle. However, relatively few studies have focused on habitat selection of female greater prairie-chickens that are attending broods in heterogeneous grasslands. The objectives of our study are to investigate greater prairie-chicken brood habitat use in grasslands managed for heterogeneity with fire and grazing with a focus on how brood habitat selection for vegetation structure and thermal refuges may shift through the diel cycle. Broods showed strong selection for patches that had been burned and grazed in the previous 12 months. Within recently burned patches, selection for vegetation structure did not differ from what was available on the landscape at locations where broods were located in the mornings; however, afternoon locations had greater grass cover and visual obstruction, and less bare ground than random landscape locations and morning locations. Additionally, brood locations appeared to be thermally buffered compared to morning and random landscape locations, with afternoon sites experiencing fewer temperature extremes. These results underline the importance of grassland heterogeneity for wildlife habitat selection at both patch and within-patch scales and that the variation in vegetation structure that results from the fire-grazing interaction can play an important role in moderating thermal conditions for grassland species.

Lopez, Krisangel

Additional authors: Michael Patten, Scott C. Weaver

Tracking Avian Disease Prevalence Across Environmental Gradients in Oklahoma and East Texas

Emerging infectious diseases represent a significant threat to global health and security. Wild birds play an integral role in pathogen dispersal dynamics. Both Oklahoma and Texas serve as breeding locations and transitory migration routes for a wide range of bird species and potentially their viruses. Various studies have demonstrated that wild bird populations are persistently being impacted by an assortment of encephalitic viruses, with consequences for both wildlife and human health. For instance, the number of human West Nile Virus cases in Oklahoma has doubled since 2016. This study focuses on surveying disease prevalence in Oklahoma and eastern Texas and furthering the understanding of the roles both migrant and resident birds play as amplifying hosts for multiple arthropod-borne viruses (arboviruses). We surveyed three locations in Oklahoma and Eastern Texas in 2017-18. We collected blood serum from over 350 wild caught birds and screened for five encephalitic viruses (West Nile Virus, St Louis Encephalitis, Eastern Equine Encephalitis, Western Equine Encephalitis and Highlands J virus) using Hemagglutination Inhibition tests. Our results demonstrate local circulation of all five viruses in both Oklahoma and Texas. This data will help shed light on the need for year-round surveillance of avian disease specifically arboviruses in the southern great plains.

March, Ferrella

Additional authors: Curtis Tackett

Oklahoma Kill Response Management Team (OKRMT): A collaborative response to fish kills in Oklahoma

The Oklahoma Kill Response Management Team (OKRMT) is an inter-agency and inter-governmental task force created in 2013 in response to major fish kills in the Red River and Salt Fork River. OKRMT uses collaborative strategies to achieve the four Es of success in meeting our mutual goals which include effective response, effective communication, effective training, and effective technical application. OKRMT representatives from the Oklahoma Department of Environmental Quality (DEQ) and the Oklahoma Department of Wildlife Conservation (ODWC) will provide an overview of OKRMT and their respective roles, a summary of fish kills that occurred since April 2018, and highlights from a recent training event held at Lake McMurtry in Stillwater that was featured on Outdoor Oklahoma in September 2018. The purpose of the training was to facilitate staff preparedness when an event occurs such as the fish kill in Tar Creek that triggered a response by multiple state agencies, federal agencies, and tribes.

Martin, Jacob

Additional authors: Charles Gagen

Neosho Smallmouth Bass Spawning Movements and Associated Environmental Conditions in a Seasonally Discontinuous Boston Mountain Stream

Neosho Smallmouth Bass, *Micropterus dolomieu velox*, are a top predator and popular sportfish in Arkansas' Boston Mountain streams. In this ecoregion, Smallmouth Bass are common in headwater streams that are prone to drying during the summer months. Thirty Smallmouth Bass were captured and implanted with radio transmitters in March, and tracked weekly in the Middle Fork of Illinois Bayou through August 2016. Age-0 Smallmouth Bass were collected using electrofishing from May through August 2016, and otoliths were used to back-calculate spawn date. Movement overall was low and minimum daily water temperature was inversely correlated to weekly Smallmouth Bass movement ($r=-0.79$, $p < 0.01$). Peak spawning in this system occurred during 17 days from May 25th to June 10th indicating that individuals that successfully recruited to a catchable size (25 mm) were spawned over a short time-period and the majority of spawning occurred on the falling limbs of hydrographs between 17 and 25. This spawning duration is short compared to what is known about the northern sub-species and spawning occurred at slightly higher temperatures than what has previously been documented.

Martinez, A. David

Assessment of the conservation status of two freshwater mussels (*Bivalvia: Unionoida*) occurring in Oklahoma: the Louisiana Pigtoe (*Pleurobema riddelleii*) and the Purple Lilliput (*Toxolasma lividum*)

The U.S. Fish and Wildlife Service (Service) is currently reviewing the conservation status of many species that may qualify for protection as federally-listed endangered or threatened species. Species currently under review by the Service and whose ranges extend into Oklahoma include two freshwater mussels (*Bivalvia: Unionoida*), the Louisiana Pigtoe (*Pleurobema riddelleii*) and the Purple Lilliput (*Toxolasma lividum*). The Louisiana Pigtoe's range includes portions of the Little River system in southeastern Oklahoma and the Purple Lilliput's range may include streams in northeastern Oklahoma. The Service's review process often involves performing a particular procedure, termed a Species Status Assessment (SSA). The Service has initiated SSAs on these mussel species and is working to compile and analyze available information on the species' populations and habitats as well as factors that represent ongoing or future influences on the species' condition. In keeping with the standardized SSA framework, the reviews will include forecasts of probable future scenarios and the species' likely responses. Performance of the SSAs for these two mussels is complicated by data constraints, including past confusion over means of distinguishing the Louisiana Pigtoe from sympatric species with very similar morphologies. The Service wishes to incorporate the best available scientific information into the SSAs for these two mussel species, and requests pertinent information from interested parties who may be knowledgeable about the species' life histories, populations, and habitats, and the range of conditions potentially affecting them.

Moore, Desiree

Additional authors: Shannon Brewer

Autumn and winter movement of diminutive prairie fishes

Pelagic broadcast spawning is a threatened reproductive guild of fishes emblematic of the Great Plains. Dewatering, combined with other forms of fragmentation (e.g., large reservoirs), act synergistically to exacerbate the decline of pelagophils and stream connectivity is hypothesized to be important for migrations by some pelagophils. Because low-flow conditions can occur throughout the year, we need to identify the movement patterns of these fishes during periods that have received little emphasis, specifically the non-breeding period. Our study objective is to determine movement by Arkansas River Shiner *Notropis girardi*, Plains Minnow *Hybognathus placitus*, and Emerald Shiner *Notropis atherinoides* during late autumn and winter. We tagged fish at several sites along the Canadian River using both visible implant elastomer and passive integrated transponder tags. Elastomer tags allowed us to examine movement trends of smaller individuals over the non-spawning season, while PIT tags allowed for individual identification. Fish were batched tagged using elastomer so that individuals received specific colors associated with the location of tagging. A pilot study in our laboratory indicated that fish > 50- mm total length were suitable for PIT tagging and that retention and survival were high. Our general approach was to sample sites across the Canadian River including multiple reaches within the same stream segment to determine movement direction, if any, and movement rates expressed over time. Tagged fishes have typically been recaptured in the deeper troughs, slack waters, and side channels. Although the recapture rate has been relatively low, our preliminary findings suggest individuals express both local and longer-distance movements over relatively short time periods. Ongoing efforts to document movement during the winter season will benefit conservation strategies for these small-bodied fishes.

Mosle, Sam

Additional authors: Dr. Dan Shoup

Turbidity Alters Habitat Use by Bluegill

Previous literature indicates Bluegill (*Lepomis macrochirus*) sacrifice optimal foraging 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 under typical field conditions, especially under increasing anthropogenic disturbances. I investigated the effects of turbidity on habitat use by Bluegill under the threat of predation in the laboratory, followed by a corresponding field study. Laboratory trials were conducted in 6.5-m diameter tanks with artificial vegetation on one side and open water on the other. Bluegill and Largemouth Bass (*Micropterus salmoides*; a common predator of Bluegill) were given 18 hours to interact at one of five turbidity levels (0, 5, 10, 30, or 50 Nephelometric Turbidity Units [NTU]), after which a divider was dropped, allowing us to quantify the number of fish on the vegetated and open-water side of each tank. At all turbidity levels above 0 NTU, significantly fewer Bluegill were found on the vegetated side of the tank. However, vegetated habitat was always preferred to open water habitat, regardless of turbidity. In the field, pop nets were used to sample artificial vegetation in the spring of 2018 at Sooner Lake, Stillwater, Oklahoma, USA. Unfortunately, water of the field study was never turbid enough to test the results of the corresponding laboratory study, and no clear trends relating turbidity to the number of fish captured were observed. However, results from the laboratory experiment indicate vegetation manipulation and establishment efforts designed to provide juvenile fish refuge, and to provide fishing opportunities, may be useful for management in systems with turbidities as high as 50 NTU. Habitat additions may be more useful in clear systems, given Bluegill may not use vegetation as a refuge as frequently as when predated under higher turbidities.

Nealis, Ashley

Attempting Biological Control of White Perch in Oklahoma: Setting a Benchmark to Evaluate Success

Invasive White Perch (*Morone americana*) were first documented in Sooner Reservoir in 2006. After observing increasing numbers and negative impacts on sport fish, the Oklahoma Department of Wildlife Conservation (ODWC) conducted a year-long diet study to determine if a viable candidate for biological control of White Perch was present in the current species assemblage, and at what size this hypothetical predator was most successful. The 2016 completion of that study found the foraging success of Saugeye (*Sander vitreus* x *S. canadensis*)

to be significantly higher than that of the other predator species examined, but no significant difference in foraging success between the different Saugeye length groups. Saugeye are currently stocked in Oklahoma to establish recreational fisheries and to control stunted White Crappie (*Pomoxis annularis*) populations, and statewide regulations are based on either of these two objectives. In lakes where White Crappie control is the primary objective, an 18 inch minimum length limit is in place. In all other instances, a 14 inch minimum length limit is used to avoid stockpiling of males who may never reach 18 inches. Stocking Saugeye to control White Perch in Oklahoma is novel and no standard protocol currently exists for stocking rates and length limit regulations. Current plans for Sooner Reservoir include maintaining an 18 inch minimum length limit on Saugeye, doubling Saugeye stocking rates to 40 fish per acre, and halving Striped Bass x White Bass Hybrid (*Morone saxatilis* x *M. chrysops*) stockings to 5 per acre. Baseline growth rates and relative abundance estimates were obtained for White Perch and Saugeye in 2017 and 2018 in anticipation of altering sport fish stocking rates in 2019. Growth rates, relative abundance and size structure will be evaluated for these species annually for five years subsequent to stocking manipulations.

O'Connell, Timothy

Additional authors: Brittany Simons, Samantha Cady, James Giocomo

Interannual variability in abundance of breeding birds in central Oklahoma

Characterization of biotic communities often includes a significant investment in time and effort toward sampling that is sufficient to provide confidence in average or typical conditions. For example, we might describe a bird community across an area by listing its most abundant species, on average. Those characterizations have merit, but perhaps more illuminating is the variability around those estimates. The variability can belie relative stability among different species. Those that express high variability could be the most responsive to land use changes or extremes of temperature and precipitation. We sampled breeding birds from approximately 1000 points in a 10-county region of central Oklahoma to provide baseline estimates of population and distribution for the Oaks and Prairies Joint Venture. Sampling was modeled after the North American Breeding Bird Survey, with roadside point counts sampling grasslands, pastures, croplands, urban areas, forests, etc. along a 40-km route. We found wide interannual variability in detection corrected population estimates, including order of magnitude differences in annual estimates of Northern Bobwhite. Variability notwithstanding, abundance of multiple grassland-breeding birds declined through the five years of sampling.

O'Donnell, Steve

Growth comparisons for Saugeye in Oklahoma Lakes

Simple analysis of abundance data, growth data, and management effort of saugeye lakes clearly determines which lakes should be placed permanently at the top of the stocking list. Lakes with a history of high abundance, not simply presence, of silversides have proven to recruit the best year classes of saugeye. Limited pond space at ODWC hatcheries warrants investigation into the potential stocking of saugeye fry or fish trades for fingerlings unless more pond space is prioritized for saugeye production. Recent fry stockings at some lakes have been successful. Choosing to use the environmental conditions provided daily by the Mesonet to prioritize lakes could enhance survival of both fry and fingerlings. The attainment of reproductive temperature thresholds for forage species combined with environmental stability (the ten day forecast), could provide optimum size forage for saugeye when stocked at the precise time. A portion of saugeye lakes have length limits that are not attained frequently enough to justify stocking. Further sampling is suggested to reevaluate the effectiveness of adult saugeye to control stunted crappie due to poor saugeye growth in many lakes. Reduction of length limits (from 18-inch to 14-inch minimum) in lakes that historically have not been able to sustain populations of large saugeye would add to angler satisfaction and creel.

Premathilake, Dineesha

Additional authors: Victoria Jackson

Does intraguild avoidance occur in mesocarnivores? Temporal activity pattern analysis of mesocarnivores in southcentral Oklahoma

Camera trapping has been increasingly used to monitor different ecological aspects of wildlife, specifically for elusive, large carnivores. Relatively few studies have been conducted on temporal activity overlap between mesocarnivore species using camera-traps, and no such studies have been done in Oklahoma. My study was conducted at Oka'Yanahli Preserve (OYP), located in Johnston County, southcentral Oklahoma. Camera traps were used to collect photographs of mesocarnivores in the preserve during winter (November 2016 - February 2017) and summer (May-August 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 using canned mackerel. A total of 1531 mesocarnivore pictures from winter and 1455 from summer were taken from 25 camera locations in winter and 18 camera locations in summer. Mesocarnivore species identified from both seasons were coyote (*Canis latrans*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), Virginia opossum (*Didelphis virginiana*), and striped skunk (*Mephitis mephitis*). Temporal activity densities were higher for all species during winter than in summer (Circular Kernel Density Estimates) and all species were mostly nocturnal during winter. Temporal activities overlapped largely (0.7) between all species in winter, except for skunk. Contradictory to what I expected, the data show that mesocarnivore species present in this preserve do not necessarily avoid each other, rather they co-exist through resource partitioning. Large temporal activity overlap between species indicate that these species do not temporally avoid each other in this preserve.

Rajala, Kiandra

Additional authors: Michael G. Sorice

Woody plant management in the Southern Great Plains: Understanding the goal intentions and management actions of private landowners

Conversion of grasslands through the expansion of trees and shrubs is a global phenomenon that threatens the integrity of grassland ecosystems, provision of important ecosystem services, and sustainability of many rural livelihoods. In the Southern Great Plains, the actions of private landowners are paramount to sustaining grasslands and preventing woody invasions. Understanding the drivers of adaptive woody plant management is increasingly important given patterns of land ownership change shifting the social landscape of rural rangelands. Through a mail survey of 2,993 private landowners in 53 counties within the Edwards Plateau (TX), Central Great Plains (OK), and Flint Hills (KS), we examined the drivers of landowners' management goals for cedar (*Juniperus spp.*) and their current use of five adaptive brush management practices. Based on a 35% response rate, most landowners (75%) had a goal intention to lower cedar and were currently engaged in brush management (73%). Using a series of regression models, we found that the goal intention to reduce cedar was driven by dissatisfaction with unacceptable levels of change, followed by perceived goal feasibility and personal and social norms. In turn, landowners' goal intention to lower cedar and degree of normative goal-frame were both significant predictors of using brush management practices. Despite uncertainty regarding landowners' orientation towards grassland conversion and woody plant expansion, this research demonstrates that most landowners in the Southern Great Plains want to control or remove cedar and are actively engaged in management behaviors to achieve this goal. For application to other invasive species issues or unwanted ecosystem transformations, these results suggest that dissatisfaction and normative influences play a large role in people's goal intentions to intervene, and that goal intentions and normative considerations of what is appropriate relate to higher levels of adaptive engagement.

Rodger, Anthony

Additional authors: Trevor Starks, Donnie King

Assessing potential effects of nonnative Rainbow Trout on seasonal diets of Neosho Smallmouth Bass and Redspot Chub

The introduction of nonnative salmonids in North America began prior to the 1900s in order to provide additional recreational opportunities for anglers. The body of literature surrounding effects of nonnative salmonids on aquatic ecosystems is prolific, but conclusions from these studies are often conflicting, which suggests ecological responses may not be generalizable across systems. Recent paradigm shifts in fisheries management have moved away from single-species management towards a holistic approach that values native fish communities. However, wildlife agencies continue to receive pressure to stock nonnative salmonids. Recently, a stocking permit was requested to provide Rainbow Trout angling opportunities for private anglers on Spavinaw Creek. The stocked trout will range in size from 254-432 mm. Spavinaw Creek is a spring-fed, Ozark Highland

stream in northeast Oklahoma that supports a diverse native fish assemblage, which includes several state species of conservation concern and the popular sportfish Neosho Smallmouth Bass. A multi-year, multi-faceted, field and laboratory study was developed to assess the potential effects of this stocking on the native fish assemblage. As part of the broader study, seasonal diet habits of Neosho Smallmouth Bass and Redspot Chub will be collected for one year prior to trout stocking and continue one year post-stocking. Diet contents will be evaluated to determine potential shifts in native predator prey use post-stocking. After stocking in the winter of 2019, Rainbow Trout diet data will be collected to determine their seasonal diet habits in Spavinaw Creek and analyze potential overlap with native species. Data from this project will guide management decisions regarding stocking Rainbow Trout in spring-fed Oklahoma streams.

Rogers, Brad

Prioritizing Conservation Efforts for Maximum Water Quality Benefits in Little Beaver Creek Watershed, OK

Little Beaver Creek (LBC), one of two major tributaries for Waurika Lake, the watershed ranked highest on Oklahoma's updated Unified Watershed Assessment (UWA). LBC is listed as impaired for turbidity, Enterococcus and E coli, and Waurika Lake is impaired for chlorophyll A, and turbidity. The Oklahoma Conservation Commission (OCC) in cooperation with the Natural Resource Conservation Service (NRCS) are developing a watershed-based plan to focus conservation efforts for maximum benefits on water quality. The Soil and Watershed Assessment Tool (SWAT) and a qualitative riparian assessment were used to identify areas most likely contributing to the water quality issues in the watershed. Outputs from SWAT will be analyzed to determine critical source areas (CSA's), the areas disproportionately contributing to water quality issues. Results will be used to target and prioritize conservation efforts to achieve desired reductions in sediment, bacteria and nutrients.

Roselli, Megan

Additional authors: Scott R Loss, Bruce H Noden

The ecology of tick-borne diseases and the role of wildlife hosts in the Oklahoma City metro area

Tick abundance and tick-borne pathogen prevalence have increased in many U.S. urban areas. Tick-borne diseases have a strong link to urban natural resource management because ticks respond to habitat management in parks and greenspaces and feed on urban wildlife that are pathogen reservoirs. Despite their growing importance to public health and land management, little is known about tick-borne pathogen ecology in central U.S. urban areas. To identify factors influencing the abundance of ticks, prevalence of tick-borne pathogens, and role of deer and birds in carrying ticks, 16 Oklahoma City parks capturing a gradient of urbanization intensity were sampled in 2017-2018. CO2 traps and flagging were used to collect ticks, and temperature and relative humidity data were collected simultaneously at each site. We also conducted vegetation surveys, mist-netted birds and checked them for ticks, and estimated deer abundance with trail cameras. Adult ticks were tested for *Rickettsia* sp., *Ehrlichia* sp., *Anaplasma*, *Borrelia*, and *Francisella*. Preliminary results indicate a risk of encountering ticks and tick-borne pathogens across the entire urbanization gradient from outlying exurban areas to the city's urban core. Notably, we found evidence that 2 pathogen-carrying ticks increase with eastern red cedar cover and that leaf litter, woody vegetation, and temperature also predict tick numbers. We found some association between deer abundance and tick populations, but proportion of birds carrying ticks also increased with urban intensity. These results suggest ticks may be managed by managing red cedar but also that management should be specific to each tick species. Our results also suggest that deer by themselves are unlikely driving tick abundance in Oklahoma City. This multi-scale information will allow natural resource managers to conduct habitat management that balances provision of habitat for birds and other wildlife while minimizing tick-borne disease risk to humans.

Schmidt, Paige

Additional authors: Jesse Burton, Glen Hensley, Darrin Unruh, Amber Zimmerman, Rick Cantu, Shane Kasson, Damon Taylor, Rachel Schutes

Implementation of a national survey protocol to inform and evaluate local management: Integrated Waterbird Management and Monitoring at Four National Wildlife Refuges in Oklahoma

The Integrated Waterbird Management and Monitoring (IWMM) program was initiated by conducting structured decision-making workshops to develop an operational framework for management and monitoring of waterfowl, shorebirds, and wading birds, collectively referred to as waterbirds, at local, regional and flyway spatial scales. Through these workshops the IWMM initiative provided a multi-scaled adaptive management process to inform local and regional managers about how they can best support the needs of local populations of migrating and wintering waterbirds. The program includes a monitoring component that assesses how well managers are meeting their management objectives and an adaptive feedback loop that allows strategies to be adjusted to improve management performance.

Currently, National Wildlife Refuges (NWR) adopting the IWMM protocol framework require information about waterbird use (numbers) for three main purposes: to understand how birds respond to habitat conditions, to inform decision making in a strategic manner, and to assess the efficacy of/improve conservation actions and planning. In this instance, 4 refuges in Oklahoma: Sequoyah NWR, Tishomingo NWR, Salt Plains NWR, and Washita NWR, identified a need for a waterbird monitoring protocol and decided to step-down the national IWMM protocol-framework to a local, site-specific approach. Resulting data may be used for: wetland and farmed field-specific abundance information; documenting migration chronology; annual waterbird habitat assessment; and, exploring relationships between waterbird numbers and unit conditions and threats.

Schooley, Jason D.

Additional authors: Adam Geik, Josh Johnston, Dennis Scarnecchia, Kelly Bostian

Insights on High-Profile Tournament Bowfishers

Despite the growth of bowfishing among angler constituent segments, little is known regarding the impacts of the sport on fisheries resources. Bowfishing participation primarily occurs at night, introducing challenges for standard creel or angler survey methods. However, bowfishing tournaments hosted by high-profile sponsors have provided a unique opportunity to learn about this sport and its participants. Oklahoma Department of Wildlife Conservation partnered with Bass Pro Shops® for the 2018 U.S. Open Bowfishing Championship to perform an angler survey, supervise weigh-in, and record the catch of each team. The tournament hosted 170 watercraft with teams of 2-4, however only 148 teams weighed their catch of up to 20 fish per team. In total, 2,765 fish were weighed totaling 10,999kg and comprising 54.5% native buffalo (50.8% Smallmouth *Ictiobus bubalus* and 3.7% Bigmouth *I. cyprinellus*), 25.4% native gars (22.5% Longnose *Lepisosteus osseus*, 1.8% Shortnose *L. platostomus*, and 1.2% Spotted *L. oculatus*), 17.0% non-native carps, and the remaining 3.1% comprising other native, nongame species. Team captains completed an angler survey on behalf of 516 bow anglers (500 male, 16 female) originating from 13 states. An estimated 1,919 culled fish were discarded on the water or on site prior to weigh-in. Anglers bowfished a combined 4,953 hours on 32 water bodies in Oklahoma, with 51.6% of teams fishing multiple water bodies (2-4) and four teams reporting fishing >322km from the weigh-in site. Nearly half of teams reported a preference for shooting gars (49.7%), while 35.9% and 11.7% reported preference for carps and buffalo, respectively. This disconnect between reported preference and composition of weighed-in fish may reflect opportunism among bowfishing tournament anglers, difference in species composition from their preferred fishing areas, difficulty with fish identification, or a confirmation bias based on possible ecological or moral consequences of the sport.

Sherrill, Cooper

Additional authors: Sam Fuhlendorf, Laura Goodman, Bob Hamilton

Analyzing *sericea lespedeza* (*Lespedeza cuneata*) management practices: Can herbicides be used to enhance invasion mitigation provided by ecological processes?

Sericea lespedeza [*Lespedeza cuneata* [Dum.Cours] G. Don; SL] is invading rangelands of the southern Great Plains and is believed to have negative impacts on livestock production and biodiversity. Historically, research efforts have focused largely on testing the efficacy of selective herbicides and more recently, the use of prescribed fire to alter grazing patterns on SL (patch burning). Our objectives are to 1) Determine the extent of SL invasion and 2) Determine if large scale herbicide application can be used to enhance the invasion mitigation provided by patch burn grazing without causing damage to the native plant community. We address our objectives using two unique long-term data sets on landscapes where patch-burn grazing and herbicides have been variably applied. Our research was conducted at the Joseph H. Williams Tallgrass Prairie Preserve (TGPP) and at OSU's

Range Research Station (RRS). At the TGPP, we re-sampled 151 permanent vegetation monitoring plots. At the RRS, 3 patch burn pastures and 3 traditionally managed pastures were sampled to determine the extent of SL invasion. Previous research at the RRS has shown that patch burning, was more successful in slowing the invasion rate of SL when compared to that of the traditionally managed pastures. Our research supports this trend, with the patch burn pastures having a SL canopy cover of 8.3% and the traditionally managed pastures having a SL canopy cover of 19.6%. At the TGPP large-scale applications of herbicide have been variably applied, with the objective of maximizing SL control while minimizing collateral damage to native forbs. Initial analyses show SL canopy cover has increased from 0.05% to 8.9% despite vast amounts of resources being spent on herbicide applications. Our data shows that herbicide applications may only be effective up to one year post-treatment. The data also shows no ill effects to the native plant community due to the herbicide applications nor to the presence of SL.

Standage, Richard

The Results of the Leopard Darter (*Percina pantherina*) Monitoring Program 1998 to Present

Beginning in 1998 through 2018, the U.S. Fish and Wildlife Service, Tulsa Oklahoma Ecological Services Field Office and the USDA Forest Service Ouachita National Forest have provided highly experienced personnel for a range-wide monitoring program for the Threatened Leopard Darter (*Percina pantherina*) throughout the Upper Little River drainage. One week each July, 18-20 permanent sites with five permanent transects each are surveyed by a crew of five highly experienced snorkelers. One or two of the sites also have a depletion conducted for just Leopard Darters to quantify the visual counts of the species. Permanent transects are swam by the same individual annually to avoid duplicate counting of fish and coverage of the same area for each site. Permanent site data is pooled at each site for counting times and the darters seen. Annual pooled counts per pooled time by site surveyed, drainage and year are compared as well as their variability. Trends in abundance for the Channel Darter (*Percina copelandi*) and the Johnny Darter (*Etheostoma nigrum*) are also examined as part of the Forest's monitoring program and to help interpret the Leopard Darter data. Currently all three darter species are positive but have not always been over since 1992. A hypothesis for population fluctuations is given. The Robinson Fork of the Rolling Fork River population of Leopard Darters is likely extirpated and the Cossatot River population appears to be quite small and widely dispersed. Genetic studies have shown that all populations are in trouble due to lack of diversity within each population due to lack of connectivity.

Standage, Richard

Additional authors: Ken Collins

The Evolution of the Leopard Darter (*Percina pantherina*) Monitoring Program 1992 to Present

Prior to the Endangered Species Act listing of the Leopard Darter (*Percina pantherina*) as a Threatened Species in 1973, a number of surveys had taken place throughout the Upper Little River drainage. These surveys were mostly to determine the status of the species to assess proposed reservoir impacts. Until the 1990s, surveys for the species were sporadic with few repeat surveys. In 1992, the Oklahoma Ecological Services Field Office, US Fish and Wildlife Service (FWS) contacted the Ouachita National Forest, US Department of Agriculture, Forest Service (FS) to see if there was interest in conducting joint Leopard Darter surveys. That spring several FS and FWS biologists began conducting annual surveys. Snorkeling counts based on time began in the Mountain Fork and Cossatot Rivers in Arkansas in the vicinity of the Forest. The survey expanded into Oklahoma for a range-wide survey of the species in 1995. Biologists from the Arkansas Game and Fish Commission and Oklahoma Department of Wildlife Conservation also assisted with the surveys. As the crew size expanded over the years, logistics of the survey and questionable results evoked a review of our methods. Beginning in 1998 the monitoring program was reorganized. The first week, 18-20 permanent sites with 5 permanent transects each, are surveyed by a crew of 5 of the most experienced snorkelers. One or two of the sites also have a depletion conducted for just Leopard Darters to quantify their visual counts. During a second week of sampling, temporary sites are sampled and often repeated every 3 to 5 years. The second week's crew is supplemented by additional state, FWS and FS personnel. Permanent site data is pooled at each site for counting time and darters seen. Permanent transects are swam by the same individual annually to standardize counting of fish and coverage for each site. Annual pooled counts per pooled time by site surveyed, drainage and year are compared and their variability.

Stubbs, Kevin

Additional authors: Jonathan Fisher

American Burying Beetle Species Status Assessment - Current and Projected Status and Risks

the Oklahoma Ecological Services Field Office (OKESFO) initiated a species status assessment (SSA) for the endangered American burying beetle (ABB) to support future decisions and recovery planning under the Endangered Species Act (ESA) as they relate to the ABB. The SSA includes an assessment of current and future risks to the ABB and climate change appears to be a significant risk to nearly all existing ABB populations. Future land use effects appear to be relatively minor and potential climate changes overwhelm any land use effects for most populations analyzed in the SSA. The Southern Plains analysis areas (KS, OK, AR, TX) are at high risk of extirpation due to climate changes under both the moderate (RCP 4.5) and high emissions (RCP 8.5) scenarios by 2039-2069. This is based on an analysis of 20 climate models and an assumed threshold (June-August Mean Maximum of 95 °F. ABBs in the Northern Plains analysis areas (SD, NE) are also at risk of extirpation due to climate change, but on a longer time frame. Temperatures in the Northern Plains approach, but are not predicted to reach, potential threshold levels under the moderate emissions scenario, but would exceed the threshold by the 2070-2099 timeframe at the high emissions level of climate change. Under the high emissions scenario all known populations, except the New England Analysis Area, would exceed temperature thresholds by 2099. Current climate trends are similar to changes predicted by the high emissions models and potential impacts under this scenario appear to be a realistic option for future conditions. The New England populations are not threatened by climate related increases in temperatures because the islands temperatures are moderated by the Atlantic Ocean. The best available information would indicate that long term survival/recovery would require reestablishing ABB populations in portions of their historic range that are not predicted to exceed any climate related limitations in the future.

Swedberg, Dusty

Additional authors: Robert Mollenhaur, Shannon Brewer

Estimating detection probability using multiple gears to sample Least Darter

Low detection probability during sampling can prevent our understanding of the actual species distribution and mask important ecological relationships. The issues associated with low detection can be exacerbated for relatively rare species. Least Darter (*Etheostoma microperca*) is a stream fish species of conservation concern that has been historically sampled from only a few locations, despite having an assumed broad distribution in two ecoregions of Oklahoma. Our study objective was to estimate detection probability for Least Darter, in the Blue River basin. We sampled in summer 2018 using repeat surveys with two gear types: snorkeling and seining. At each site, we measured a variety of physicochemical conditions that we hypothesized would affect Least Darter detection. Although seining typically resulted in higher detection than snorkeling, using both gears increased our overall detection. We found detection probability decreased with channel width and depth, though detection probability was relatively high at occupied sites. Our modeled estimates indicated relatively high uncertainty, but we anticipate that our uncertainty will improve after completion of another year of sampling. Sampling efforts will also include streams of the Ozark Highlands, but 2018 surveys resulted in zero Least Darter detections in that ecoregion. Ultimately, we will also model the occupancy process, while considering detection, to estimate physicochemical factors associated with Least Darter occurrence. This information will be beneficial to improving conservation strategies for this species.

Tanner, Evan

Additional authors: Jeremy P. Orange, Craig A. Davis, Samuel D. Fuhlendorf, R. Dwayne Elmore

Life-history strategies as a potential mechanism for linking demography to habitat suitability indices

Habitat suitability indices (HSI) have been used to predict the probability of species occurrence based on environmental conditions. However, the relationship between HSI and demographic parameters are often complicated and ambiguous. Previous explanations for this ambiguity have focused on either temporal variability, density-dependent processes, or disparity between environmental variables predicting both suitability and demography simultaneously versus variables solely predicting suitability. An additional, yet previously untested

explanation, is that life-history strategies may confound links between demography and HSI. For instance, species that typically have a large number of offspring and reduced adult survival may make decisions that benefit offspring survival in exchange for increased adult risks, thus potentially complicating such a link. To better understand how such a strategy might confound this link, we studied the brood survival and space use of two sympatric ground-nesting bird species, the northern bobwhite (hereafter: bobwhite; *Colinus virginianus*) and scaled quail (*Callipepla squamata*). We estimated habitat suitability for both species and determined how adult space-use of these areas influenced individual chick survival and parental risk. The proportion of a brood's home range containing highly suitable areas significantly influenced bobwhite chick survival. However, this relationship varied across years, in which the relationship was negative in 2013 ($\hat{I}^2 = -1.39$, SE = 0.51) and positive in 2014 ($\hat{I}^2 = 1.23$, SE = 0.42). Conversely, brood habitat suitability did not influence scaled quail chick survival during our study. Furthermore, parental risk for bobwhite was greater for broods that used greater amounts of highly suitable brood habitat ($\hat{I}^2 = 0.24$, SE = 0.09, P = 0.01). Our research illustrates the importance of understanding life-history strategies and how they might influence relationships between HSI and demographic parameters.

Thornton, Anthony

Additional authors: Craig A. Davis, Brooks Tramell, Sarah Gallaway

Validation of a Rapid Assessment Method for Determining the Condition of Floodplain Wetlands in Oklahoma

Continuing wetland loss and degradation make it important that we be able to effectively assess the condition of remaining wetlands. Such assessments provide assistance in mitigating further loss of wetlands as well as provide guidance for restoring the functional capacity of degraded wetlands. Rapid Assessment Methods (RAMs) have been developed throughout the U.S. to better assess the condition of wetlands. The benefits of RAMs are that they can provide reliable measures of wetland conditions without being prohibitively costly. While many RAMs exist, they are either too broad in scope to be useful at for assessing Oklahoma wetlands or they are too specific to cover the range of wetlands found in Oklahoma. Recently, a RAM (Oklahoma Rapid Assessment Method [OKRAM]) has been developed for Oklahoma wetlands. However, it has not been calibrated or validated for all wetlands in the state. The objective of this research is to apply OKRAM to floodplain wetlands across the state to determine the OKRAM's effectiveness. In the first year of the study we assessed 30 floodplains on 2 river systems in the Great Plains and Cross Timbers ecoregions of Oklahoma. One river was an incised channel stream and the other was a meandering stream, these two being the major stream types found throughout the state. This first year was used to determine useful metrics and to calibrate the OKRAM. We assessed each site using three assessment types. A Land Development Index (LDI) was calculated for each wetland using the Oklahoma Vegetation Project raster layer in GIS. Then, OKRAM was applied at each site. Finally, a biotic assessment was conducted at each site sampling vegetation and soil. Vegetation is our primary biotic indicator and soil will be analyzed to determine cause of differences in sites expected to be similar. In year two we will validate OKRAM at 50 - 60 sites throughout the state using these same assessment types. I will be presenting preliminary assessment results from year one.

Torquato, Patricia

Additional authors: Chris B. Zou, Rodney E. Will

Encroachment of redcedar in the Cross Timbers oak forests - the cause and consequence

While less obvious than encroachment into grasslands, recent forest surveys showed that eastern redcedar (*Juniperus virginiana*) has invaded the mid-story of the oak-dominated Cross Timbers of north-central Oklahoma. However, it remains mostly unknown how this evergreen conifer establishes and thrives under the oak canopy and the hydrological impact of the transition of a deciduous oak forest to an oak-juniper mixed forest.

We measured xylem water potential (ψ), net photosynthetic rate (Pn), and sap flux density of redcedar and post oak (*Quercus stellata*) in a pure oak stand, pure redcedar stand, and an oak and redcedar mixed stand from May 2017 to May 2018. We also measured soil water content throughout the soil profile during the study period.

The ψ , Pn and water use efficiency (WUE) of redcedar in the mixed stand were not significantly different from those in the redcedar stand. Redcedar exhibited a large decline in ψ to sustain Pn during dry periods. Sap flow density of redcedar was significantly greater than oaks and the water use of redcedar was greater than oak of the same DBH on annual basis. The Pn of oaks was always greater than that of redcedar. When soil moisture was

low, oaks in the mixed stand had significantly less negative predawn water potential compared with oaks growing in the oak only stand.

Our preliminary results suggest that the performance of redcedar seems not to be affected by co-existing oak and that redcedar is a strong competitor of soil moisture through its strong anisohydric traits during water stress. An oak-juniper mixed forest may lead to the increase in water use in ecosystem level.

Vesy, Miranda

Additional authors: Raymond Moody, Jen Mook

Monitoring and Management of the Texas Horned Lizard on Tinker Air Force Base, Oklahoma City using Harmonic Radar Tracking Technology

The Texas Horned Lizard (*Phrynosoma cornutum*), commonly known as the horny toad or horned frog, is a Species of Greatest Conservation Need in Oklahoma and considered Threatened in Texas, facing declining populations throughout its range. Since 2003, a small population of Texas Horned Lizards on Tinker Air Force Base in Midwest City, Oklahoma has been studied actively. Research to date has investigated population demographics, survival rates, habitat requirements, and general behavioral characteristics. A life-stage simulation analysis found that recruitment had a greater effect on population growth than adult survival. Specifically, hatchling survival had the strongest relationship with population growth; therefore, increasing the survivorship of hatchling horned lizards has the potential to boost existing population numbers. Unfortunately, the ability to monitor young horned lizards via traditional tracking technologies, such as VHF transmitters, has been a challenge due to their small size. Recently, a new tracking technology, known as harmonic radar, has proven to be an effective, alternative method for monitoring hatchling and juvenile horned lizards on Tinker Air Force Base. Harmonic radar systems can be applied easily to monitoring and management studies of other small and threatened species. During the first monitoring season of hatchling activity (2016), our results estimate survival rates between 0.55-0.75; similar results are expected for the 2018 activity season. Low sample sizes for the 2017 season prevented analysis. This study has resulted in the first estimation of hatchling survival for Texas Horned Lizards at Tinker Air Force Base based upon active field tracking as opposed to population modeling techniques. Furthermore, the new technique will contribute to baseline information and future conservation efforts for this threatened vertebrate species in the southern United States.

Watters, Jessa

Additional authors: Elyse Freitas, Tamaki Yuri, Cameron Siler

Preliminary results of environmental DNA (eDNA) screening for reptiles and amphibians of Oklahoma

Our planet is experiencing a continuous decline in biodiversity worldwide. Plants and animals are decreasing at an accelerating rate due to natural or human-mediated disturbances, such as habitat modification, invasive species, and the spread of infectious diseases. Currently, most conservation strategies depend on large-scale, time-intensive, monitoring programs to collect data on species distributions and population sizes. As the geographic and taxonomic scale of conservation has increased rapidly, so has the need for more efficient alternative methods for monitoring biodiversity across landscapes. One promising sampling technique involves environmental DNA (eDNA), which is genetic material left behind in many forms (e.g. urine, feces, hair, and skin) as individuals interact with their environment. Sampling eDNA is a cutting-edge, non-invasive approach for biodiversity monitoring that can be applied broadly across aquatic water systems. This allows us to screen for the presence of rare or enigmatic species that are hard to find through traditional survey methods. Here, I present the findings of eDNA research across water bodies in eastern Oklahoma from 2017-2018 for the following species: Blanchard's Cricket Frog (*Acris blanchardi*), Crawfish Frog (*Lithobates areolatus*), Ringed Salamander (*Ambystoma annulatum*), Three-Toed Amphiuma (*Amphiuma tridactylum*), and Chicken Turtle (*Deirochelys reticularia*). A total of 80 water bodies were sampled in 11 counties, resulting in 845 eDNA samples that were screened, with positive observations (species presence) recorded for all four taxa.

Wedgeworth, Maeghen

Additional authors: Robert Mollenhauer, Shannon K. Brewer

Local colonization and extinction of Prairie Chub *Machrybopsis australis* across wet-dry cycles in the

upper Red River Basin

Streamflow is a “master variable” that largely governs stream ecological processes. The upper Red River basin is a variable, extreme environment, where periods of both excessive rainfall and drought are common. Human alterations to the Red River stream network have placed additional stress on aquatic organisms by exacerbating extreme flow events. Prairie Chub *Machrybopsis australis* is a federally listed vulnerable pelagic-broadcast spawning cyprinid endemic to the Red River basin. The vulnerability of Prairie chub to changes in flow alteration is thought to be largely attributed to its reproductive ecology. The reproductive strategy of Prairie chub is common among prairie stream fishes and relies on adequate discharge for successful recruitment. Examining discharge requirements for Prairie chub can inform management regulations on water use that may have broader implications for this reproductive guild. We compiled Prairie Chub sampling data for 437 hydraulic response units (HRUs) in the upper Red River Basin from 1984-2016. Five seasons were delineated based on wet (1984-2001, 2007-2009, and 2015-2016) and dry periods (2002-2006 and 2010-2014). We modeled Prairie Chub colonization and extinction probabilities in relation to flow regime metrics, while accounting for imperfect detection. Extinction rates increased over time and were associated with the decreased frequency and increased duration of low flows and decreased stream connectivity. Higher colonization probabilities during dry seasons were associated with HRUs with higher baseflows, but there was no relationship with streamflow magnitude during wet seasons. Our findings emphasize the importance of maintaining stream connectivity and minimizing water withdrawals during periods of drought to facilitate stream fish persistence. Our results are important for developing sound Prairie Chub conservation actions and establishing regional water-use policies that incorporate minimum ecological flow requirements.

Whisenhunt, Chris

The Creation, Design, and Implementation of the Oklahoma Department of Wildlife Conservation’s Online Interactive Fish Attractor Map

Artificial fish attractors have long been used to concentrate fish into areas to be exploited by anglers. For decades, the Oklahoma Department of Wildlife Conservation (“ODWC”) has been active in creating and placing fish attractor structures in lakes across the State of Oklahoma. One of the major difficulties with fish attractors is advertising and explaining to the angling public where to find the structures within the lake. Marker buoys are often employed to mark locations but often need to be replaced if they become damaged or missing due to age, boating incidents, or lake level fluctuations. Over recent years, technology has advanced enough where ODWC could give anglers fish attractor coordinates using latitude and longitude locations on a spreadsheet that anglers could download and store on their fish finder units, but this service was limited to only those anglers who had or could afford the devices that included GPS capabilities. Beginning in late 2017, using ArcGIS software, ODWC is able to conveniently store and regularly update statewide fish attractor information on an interactive online map that the public can access almost anywhere and anytime using a computer, tablet, smart phone, or other device with data capabilities. By creating this interactive map, we are making the information readily available to almost any angler wanting to know where fish attractor structures are located within bodies of water across the state.

Wilson, Luke

Additional authors: William M Hammond, Henry D Adams

It's a dry heat: quantifying effects of increasing atmospheric moisture demand on native Oklahoma trees

Anthropogenic climate change is predicted to alter precipitation frequency and intensity across Oklahoma in the coming decades, leading to an increase in the frequency, intensity, and duration of extreme events such as soil drought. Concurrently, temperature is predicted to continue rising, causing an ever-increasing atmospheric demand from plants. While the effect of soil droughts has been extensively studied in recent years, the impact of ever-increasing atmospheric droughts on trees is less characterized. Trees regulate photosynthesis through the interactive effects of availability of soil water (supply) and atmospheric demand for water (Vapor Pressure Deficit, VPD). Using recent innovations, and a novel experimental design, we set out to test gas exchange response for three native Oklahoma tree species to varying levels of VPD, with the hypothesis that drought adapted species would be less sensitive to increasing VPD. Two of the species, *Quercus stellata* and *Quercus marilandica*, often occur on unfavorable dry sites, while *Cercis canadensis* is found in riparian areas and wet forest interiors. We

exposed six trees of each species to a range of VPDs, between 1kPa and 3kPa, at a constant temperature under well-watered conditions. We measured rates of carbon assimilation and stomatal conductance at five intervals across our VPD measurement range using a LI-COR LI-6800 infrared gas analyzer. Relative rates of carbon assimilation and stomatal conductance decreased as VPD increased across taxa. However, *C. canadensis* decreased carbon assimilation much quicker than the *Quercus* species as VPD increased in support of our hypothesis. Our results provide a preliminary understanding of photosynthetic response across a range of VPDs for deciduous forest trees in Oklahoma. Additionally, our methods provide a clear and repeatable way forward, as we aim to disentangle the effects of soil and atmospheric drought on photosynthetic rates in future experiments.

Wolf, Skylar

Robert Mollenhauer, Evan Tanner, Sam Fuhlendorf, Shannon Brewer

Seasonal Microhabitat Selection by Native Fishes in Ozark streams

Selection of unique microhabitats by stream fishes is influenced by the need to conserve energy, optimize growth, avoid predation, and successfully reproduce. The addition of non-native fishes may limit native species from using key microhabitats, but this effect may only be seasonal. Our study objective was to determine seasonal microhabitat selection by several native stream fishes prior to the stocking of non-native Rainbow Trout *Oncorhynchus mykiss* in an Ozark stream. We studied Smallmouth Bass *Micropterus dolomieu*, Creek Chub *Semotilus atromaculatus*, Redspot Chub *Nocomis asper*, and Redhorse *Moxostoma* spp. We characterized depth, velocity, cover, substrate and temperature at each of our sites across four seasons (autumn, winter, spring and summer). We analyzed our presence-availability data using a generalized linear mixed model framework. We show that microhabitat use varies by species and season. Across seasons, depth, substrate, and cover were strong predictors of microhabitat use. We observed seasonal shifts, particularly selection of deeper-water habitats and cover by several species during the winter months. Our results provide baseline data that will allow us to infer displacement of native fishes by Rainbow Trout from their selected habitat.

Xiao, Xiangming

Additional authors: Yuanwei Qin, Jie Wang, Xiaocui Wu, Russell Doughty

Oklahoma Observatory for Agriculture, Forestry and Water Resources: An update in 2018

The Oklahoma state has diverse agriculture, forestry and water resources over the large spatial domain. Accurate and updated data, information and knowledge on agriculture, forestry and water resources are essential for natural resources management. Our capacity in monitoring, reporting and verification of agriculture, forestry and water resources in Oklahoma remains to be very limited. There is a need to develop an integrated and multi-scale Oklahoma observatory for agriculture, forestry and water resources in Oklahoma. In an effort to work toward developing such integrated observatory, the researchers from the Earth Observation and Modeling Facility, the University of Oklahoma have been integrating both satellite remote sensing and in-situ data collection, including crowdsourcing and citizen sciences. We have developed several state-wide data products of agriculture, forestry and water resources with provisional data quality and scientific data quality. In this presentation, we will provide an updated report on our data products, including forests, eastern redcedar forests, and open surface water body at high spatial resolutions (10-m to 30-m spatial resolution).

Zentner, Doug

Additional authors: Shannon Brewer, Dan Shoup

Age and growth of Catistomids in the Ozark Highlands

Catistomidae is distributed throughout North America; however, little is known about the ecology of species that comprise this family. Sucker gigging is emblematic of the Ozark Highlands region and considered a culturally-significant past time. Harvest limits on many sucker species are often nonexistent or liberal, despite the regional importance of this fish to anglers. Ecological information is needed to ensure that these liberal harvest allowances are sustainable. The overarching goal of this study is to better understand the ecological importance, population dynamics, and harvest rates of members of the family *Catistomidae* in the Ozark Highlands. Our first objective was to examine population demographics of multiple Ozark catostomids. Sucker lengths and aging

structures were collected in 2017 and 2018 from tournament-harvested fish. Two separate readers were used to assign ages to each structure. Spotted Sucker, Northern Hogsucker, White Sucker, and Black Redhorse had maximum estimated ages of 20, 10, 8, 14, respectively. Total length and estimated age were then used to develop Bayesian von Bertalanffy growth curves for each species. Estimates of asymptotic maximum length, growth coefficients, and length at age-0 were compared between species using 95% credible intervals. Preliminary data suggest asymptotic maximum length is larger for Spotted sucker, than Northern Hogsucker in Spavinaw Creek, with maximum length other species being intermediate between these two species. More data are needed to confirm variable estimates for all species. Accurate age and growth information for these species will be an integral part of our final harvest models as growth rates heavily influence modeled yields.

Zhong, Yu

Additional authors: Chris B. Zou, Rodney Will, Adrian Saenz, Gopal Kakani

Increase in soil moisture and runoff after eastern redcedar removal - a paired watershed study

A broad swath of the grassland and forest ecotone within the central Great Plains is marginal for crop production but is moderate to highly suitable for herbaceous-based biomass production systems. However, the same region has been under rapid encroachment by eastern redcedar (*Juniperus virginiana*) leading to the loss of many ecosystem services. It remains mostly unknown the environmental impact of mechanically removing redcedar to reclaim heavily encroached land. We used a paired watershed approach to directly quantify the changes in soil moisture and event-based runoff under natural recovery to prairie and under switchgrass monoculture establishment after redcedar removal in northcentral Oklahoma.

Results showed that removal of redcedar increased soil water storage irrespective of restoration to prairie or switchgrass monoculture. Runoff coefficients from the restored prairie and the established switchgrass watersheds both increased compared with the pre-treatment period. After conversion to prairie or switchgrass monoculture, runoff increased by 4 and 3 fold, respectively. These results indicated that restored prairie or switchgrass monoculture establishment following mechanical removal of redcedar woodland allows restoration of the hydrological function by increasing soil water storage and runoff.