Adhikari, Arjun
Rodney Will, Omkar Joshi, Chris Zou, Ron Masters

Fire and climate impacts on understory productivity across a forest-savanna continuum

Understory non-woody vegetation is an integral component of wildlife habitat and cattle forage. Understory productivity is strongly influenced by fire frequency and overstory canopy cover. In the absence of natural fire, prescribed fire can be a surrogate for this major ecological process to maintain productivity. In addition, inter-annual weather variability can strongly influence aboveground productivity of understory vegetation. To investigate the role of prescribed fire frequency and weather factors on aboveground net primary productivity (ANPP) of non-woody understory vegetation, we studied the response on 150 plots across 24 units throughout in a 35-year-old fire frequency and thinning experiment in southeastern Oklahoma, on the Pushmataha Wildlife Management Area. Fire frequency in experimental plots ranged from annual burning to complete fire exclusion. Monthly temperature, precipitation, and palmer drought severity index were determined from Daymet products. We found that annual burning is optimal for maintaining open forest structure with the maximum understory non-woody ANPP. Across all experimental units, mean ANPP of non-woody vegetation ranged from 15 g/m2/yr (no fire, no thinning) to 340 g/m2/yr (annual burning) and decreased with fire frequency with ANPP values of 237, 222, and 180 g/m2/yr for 2, 3, and 4 years fire return intervals, respectively. Non-woody ANPP had the greatest positive correlation with June precipitation ($r = 0.29$; $p < 0.0001$) and greatest negative correlation with June maximum temperature ($r = 0.23$; $p < 0.0001$). Fire exclusion as well as hot and dry conditions reduce understory productivity crucial for wildlife habitat and cattle forage across forest-savanna continuum. Continuation of this work will examine the resilience of herbaceous productivity following drought and compare the herbaceous and woody responses to fire and climate.

Childress, Will
    W. Sue Fairbanks , Sara Lyda , Kevin Niedringhaus

Mapping the Distribution of the Sarcoptic Mange Mite (*Sarcoptes scabeie*) in Black Bear (*Ursus americanus*) Populations across the United States

After its first appearance in Michigan's black bear population in 1984, sarcoptic mange has become more prevalent in black bear populations across the northeastern United States (US). Little is known about how sarcoptic mange came to infest black bear populations, or even how the mites spread within populations. To date, Pennsylvania has been the epicenter for sarcoptic mange cases in black bear populations. Prior to the summer of 2018, sarcoptic mange was found only in black bear populations in the northeastern US. In the summer of 2018, trapping efforts in Oklahoma's Ozark Highland population were successful in capturing a female with clinical sarcoptic mange. Arkansas also had four confirmed cases of sarcoptic mange in the summer of 2018, three of which ended with the bear being euthanized due to the severity of the mange. To understand the extent of sarcoptic mange in black bear populations, we conducted phone surveys with bear biologists in every US state containing a viable black bear population in order to determine the presence/absence of sarcoptic mange within each state. Our results indicated that 8 out of the 40 states with viable black bear populations, had confirmed at least one bear in their population positive for sarcoptic mange.

Coe, Seraiah
        Jared A. Elmore, Scott R. Loss

Abundance and proportion of sterilized free-ranging domestic cats following five years of a Trap-Neuter-Release program

Increases in free-range cat populations are causing concern for both public health and biodiversity conservation. Cats substantially affect U.S. wildlife, depredating an estimated 1.3-4.0 billion birds and 6.3-22.3 billion mammals annually. Trap-Neuter-Release (TNR), which entails trapping, sterilizing and re-releasing cats with the theoretical goal of reducing populations, has been implement globally, despite limited evidence of its effectiveness. To assess the effectiveness of a TNR program implemented in Stillwater in 2013, we conducted trail camera-based monitoring for three 3-night survey periods from February to April 2018, following a similar 2014 study. Specifically, we estimated changes in cat abundance and proportion of ear-tipped sterilized individuals across 15 locations at or near locations used in 2014. Images were reviewed, and individual cats identified using pelage patterns, presence of collars, and relative size. Preliminary raw counts suggest a slight decrease in abundance (from 47 to 35 cats) and an increase in the proportion of sterilized cats (from 0 to 17%); however, whether these patterns are representative of Stillwater's entire cat population is uncertain. We plan to conduct mark-resight analyses that will generate estimates of cat density corrected for detection probability. These analyses will provide a more reliable basis for inference about Stillwater's TNR effectiveness. Nonetheless, since published studies indicate a sterilization rate of 71-94% to achieve population reduction, our results suggest that TNR is not reducing Stillwater's cat population. Further research is needed to better understand TNR's effectiveness, but the current body of scientific literature indicates this approach is largely ineffective.

Hoagland, Bruce
    Todd Fagin

Toward an 1871 land cover baseline: the Public Land Survey plats and bearing tree data in Oklahoma

The plats and survey notes produced by the General Land Office are a rich source for the study of vegetation, settlement, and transportation networks in the 19th century. In 1870, U.S. deputy surveyor Ehud Darling left Fort Arbuckle, headed one mile to the southeast, and erected the Initial Point for the Public Land Survey of present-day Oklahoma. Only lands of the Chickasaw Nation, western Oklahoma, and the tribes in the northeast were included in this first survey. We describe the development of a geospatial database that includes a seamless map compiled from 1,264 plats and 90,000+ attributed bearing trees. All features mapped on a plat were assigned to one of seven landcover categories or 14+ settlement features prior to digitizing. Diameter, distance, direction, and identification of each bearing tree were recorded. We will report the areas occupied by each landcover type and number of settlement feature. Challenges arose when assigning scientific binomials some bearing trees. This database will serve as an important baseline for studies of landcover change and settlement.

Jeter, Shelby
    Michael Porta, Richard Snow

Body size estimation and identification of twelve fish species using cleithrum bones

Diet evaluations are conducted to understand predator-prey dynamics of fish communities. However, unless prey items are extracted from fish immediately after consumption, items can be observed at various stages of decomposition due to digestion. Thus, the ability to accurately measure or identify prey fish is difficult. Fortunately, some skeletal structures, such as the cleithrum bone, are not easily digested and remain in fish stomachs. Cleithra have been used to estimate the total length of a fish by determining the linear relationship between the total length, horizontal length, or vertical height of a cleithrum against known-sized fish from which the structure was taken. We used linear regression to develop equations to estimate body size for twelve common forage species found in Oklahoma reservoirs using cleithrum bones. The morphological characteristics of cleithra are unique, allowing for differentiation among most species. Additionally, we also describe cleithrum characteristics for each of the twelve fish species, such that fish can be identified even when prey items are heavily digested. When used collectively, the regression equations and diagnostic features of cleithra will provide a more accurate description of fish diets and a better understanding of predator-prey relationships.

Kidd, Aaron

Estimating Occupancy of Mesocarnivores through Non-invasive Survey Methods: Pontotoc Ridge Preserve

Apex predator populations are experiencing rapid decline with continued global habitat fragmentation. Mesocarnivores (mid-level predators) are expected to partially assume the ecological niche of once prevalent top predators. Thus, acquiring data regarding the factors that influence whether or not a mid-level carnivore species will exist in a particular location is of significant interest. Difficulty in accurately surveying mesocarnivores derives from imperfect detection methods in which inadequate data can result in false assumptions concerning the presence or absence of a species. Occupancy models address the problem of non-detection error by analyzing detection and occupancy through long-term observation. Occupancy is impacted by site-specific variables, such as vegetation, whereas detection can be influenced by non-constant variables such as temperature or time of day. Twenty-five remotely activated camera traps were placed in Pontotoc Ridge Preserve, Pontotoc County OK, from May 2018 - September 2018. Cameras were baited on a randomly assigned rotation and were checked on a biweekly basis. Preliminary analysis of data suggests detection that is influenced largely by vegetative cover and bait type.

Grassland Restoration Incentive Program (GRIP) for Landscape Conservation in Oklahoma and Texas through the Oaks and Prairies Joint Venture Partnership

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ABSTRACT: Degradation and conversion of functioning native grassland ecosystems in North America have driven significant declines in grassland wildlife populations across multiple taxa. To address declines in grassland habitats of central Oklahoma and Texas, the Oaks and Prairies Joint Venture (OPJV), a public-private partnership of governmental agencies and non-governmental organizations, works to more strategically and collaboratively deliver bird conservation. Using grassland birds as the flagship species, the OPJV has implemented an integrated Strategic Habitat Conservation framework operating at multiple scales to conduct biological planning, landscape conservation design, habitat tracking and population monitoring. The signature conservation delivery program of this effort was the Grassland Restoration Incentive Program (GRIP), which has improved habitat for grassland wildlife on over 75,000 acres (30,351 Ha) of working-lands in focal areas throughout the OPJV geography since 2013. This initiative is supported by an adaptive, "Plan, Do, Learn" cycle that ensures contemporary science and data guided subsequent conservation planning and "Best Management Practices" implemented for grassland habitat restoration in the region. Partners like the Oklahoma Department of Wildlife Conservation, Pheasants Forever/Quail Forever, the American Bird Conservancy, the National Wild Turkey Federation, and many others consult with staff biologists and range managers who work with local landowners to provide habitat management aimed at flagship species through the GRIP. Combining the efforts of diverse partners unites the range-wide population and habitat objectives with on-the-ground delivery of conservation goals. In support of this grassland bird, butterfly, and pollinator conservation effort, the OPJV partners and the Natural Resources Conservation Service (NRCS) have implemented a grassland habitat focused Regional Conservation Partnership Program (RCPP) that provides a federal funding source within the structure of the Environmental Quality Incentives Program (EQIP).

Martin, Jacob
    Tyler J Fox, Daniel Magoulick

Modeling Potential Climate Change Impacts on Smallmouth Bass Distributions at the Southern Range Extent

In Arkansas, Smallmouth Bass (*Micropterus dolomieu*) are a top predator and popular sportfish. Understanding how predicted climate change may affect the distribution of this ecologically and economically important species is crucial for their management and conservation. In this region, temperatures are expected to increase by the end of the century, while seasonal precipitation patterns will become more variable (e.g. wetter during the winter and spring and drier during the summer and fall). Maximum Entropy Modeling (MaxEnt) was used to predict distributions of Smallmouth Bass under global climate model scenarios for the year 2070 using species presence data and bioclimatic variables. Predicted occurrence was decreased for all climate scenarios relative to current predicted occurrence. The model predicts steep declines in distributions, however, groundwater inputs may buffer against these changes. Smallmouth Bass distributions at the southern range extent will likely be restricted under future conditions, although more modeling is necessary to better understand to what extent.

Paden, Chloe

Germination techniques in five *Asclepias* species

Plants in the genus *Asclepias* (also known as milkweed) are the larval food source for monarch butterflies and an important nectar source for adult monarchs along their migration route. Because of their importance in the monarch life cycle, *Asclepias* plants are important aspects in restoration projects and pollinator gardens. Whether the habitat is a field, roadside, or pollinator garden in an urban area, milkweed is necessary for healthy monarch habitat because the butterflies only breed in places where there is milkweed available to deposit their eggs on. Monarchs use a variety of *Asclepias* species, and these have varying needs for germination. Five *Asclepias* species native to Oklahoma were cold stratified in wet paper towels or vermiculite, and some were treated with bleach in an attempt to combat mold formation before it infected newly germinated seeds. These seedlings were transplanted and monitored for mortality rate as they grew. This data will help find more effective methods in milkweed restoration across monarch butterfly habitat.

Prentiss, Natasha
W. Sue Fairbanks

Giving up density as an indicator of black bear (*Ursus americanus*) food preference in the Ouachita National Forest, Oklahoma

As black bears disperse into areas dominated by human development, they tend to adopt anthropogenic food into their diet. In eastern Oklahoma, a major form of human-bear conflict is the destruction of wildlife feeders by black bears. We tested whether black bears in the Ouachita National Forest, Oklahoma, preferred anthropogenic or natural food by adapting giving up density (GUD) as an indicator of food preference. GUD is the density of food left after an animal "gives up" foraging. If a food item was preferred, the GUD for the preferred item would be lower than that of the other food option. GUD techniques were employed using paired, modified horse toys each containing equal amounts of gelatin capsules with equal caloric value of food- one containing corn as the anthropogenic food option and the other containing a natural food such as acorns or blueberries. The number of capsules left after manipulation was considered the GUD. Black bears preferred corn to acorns in the early summer but preference for corn over blueberries in the late summer did not differ significantly. Duration of manipulation was also used as an indicator of preference, but the data did not yield any significant differences between corn and natural foods. Bear preference for corn over acorns in early summer corroborates findings from a similar study conducted in the Oklahoma Ozarks. Thus the destruction of wildlife feeders may be a matter of preference for anthropogenic food during certain seasons. As urban areas expand and black bear populations disperse, understanding black bear preference for anthropogenic food will help to mitigate human-bear conflicts, which will improve public perception of bears on the landscape.

Proudman, Nathan
     W. Sue Fairbanks

Assessing the Distribution, Trends and Abundance of Bobcats (*Lynx rufus*) in Oklahoma

Bobcats are often harvested in Oklahoma, yet little is known of the population status and their trends over the last decade. Previous estimates have used data collected from fur harvest sales and roadside kills, but these sources are often highly variable and not necessarily dependent on bobcat population trends. This study aims to determine the trends and ecological patterns of bobcat distributions across the state, whilst also focusing on 3 areas of specific interest from environmentally disparate areas of Oklahoma. Using specifically designed hair-snare cubbies, genetic analyses of collected hair samples will allow the identification of bobcat individuals. Hair-snare cubbies will be deployed state-wide by student volunteers and using occupancy modelling, population trends and distribution of bobcats in Oklahoma will be determined. Using a more intense study grid in 3 specified areas of interests, individual bobcat encounter histories will be analysed in a spatially explicit capture-recapture framework, which will be used to make inferences on the ecological patterns of space-use and resource selection of bobcat individuals. This data will help inform management decisions for an economically and culturally important, heavily harvested fur-bearer species, to which current data is lacking.

Schmidt, Kathryn
    Rodney E. Will, Chris B. Zou, Elaine Stebler, Luke Zhong

Tradeoff between water yield and biomass production associated with eastern redcedar encroachment into grassland ecosystems of northcentral Oklahoma

Over the last several decades, eastern redcedar (*Juniperus virginiana*) has increased at the western edge of the eastern deciduous forest largely due to fire exclusion. Ecosystem conversion from grass-dominated prairie to an evergreen forest impacts productivity and water cycling which has important implications for biomass and water availability for human use. To test the effects of ecosystem type and land use change on runoff and biomass production, we removed redcedar from two encroached watersheds in northcentral Oklahoma, converting one watershed to switchgrass (Panicum virgatum) and allowing one watershed to undergo succession back to native tallgrass prairie. In addition, we continued to monitor intact redcedar and prairie watersheds. Aboveground net primary production (ANPP) and whole watershed evapotranspiration (ET) were measured for three years in converted and intact watersheds. Standing biomass of redcedar watersheds ranged from 52-94 Mg/ha and native prairie produced 5.2 Mg/ha/year and switchgrass produced 7.2 Mg/ha/year on the former redcedar watersheds. Water yield increased by 450-1000% the first year after cutting redcedar from encroached watersheds. Two years post-removal, water yield was 350% greater on the recovered prairie and planted switchgrass than on intact redcedar watersheds. We expect to find that annual productivity is higher, but water use efficiency is lower for redcedar woodland compared to grassland systems. Reversion of encroached redcedar areas back to grass-dominated ecosystems has the potential to increase water quantity at the cost of reducing biomass production. This tradeoff is an important consideration at the drier, western edge of the southern forest region.

Shephard, Noah
Casey Meek, Omkar Joshi, Rod Will

Drought, fertilization, and thinning effects on mid-rotation growth and canopy production in Pinus taeda plantations

Understanding the interaction of fertilizer and soil water availability can improve management of loblolly pine (*Pinus taeda*) in response to climate change. As part of the USDA-NIFA funded PINEMAP (Pine- Integrated Network: Education, Mitigation, and Adaptation Project), the Oklahoma Tier III study was installed in 2012 (fifth growing season) in a loblolly pine stand approaching crown closure near Broken Bow, OK. Treatments receiving fertilizer were treated in early spring 2012 and throughfall excluders for treatments receiving throughfall reduction were complete in mid summer 2012. Throughfall reduction significantly reduced both diameter at breast height (dbh) and leaf area index while fertilization significantly increased dbh growth and leaf area index. Annual volume growth was significantly reduced by throughfall reduction by 20% in 2013, 9% in 2014, and 14% in 2016. Fertilization significantly increased volume growth by 11% in 2013 and 20% in 2014. No significant effects were measured in either 2012 or 2015 growing seasons. Fertilized and throughfall reduced plots demonstrated growth and canopy characteristics similar to control plots during the 2013 and 2014 growing seasons. These results indicate that fertilization can help reduce the effects of reduced water availability. Stands were refertilized in spring of 2017 to determine if nutrient benefits continue in throughfall reduced plots as stand dynamics progress. Additionally, one half of each plot was thinned in spring 2017 by stem injection of herbicide to determine if the response of persistent throughfall reduction and nutrient availability changes with stand density and tree size. The stands were measured following the 2017 and 2018 growing seasons.

Whiteman, Alyssa
    Omkar Joshi

Preventing the further spread of Kudzu in Oklahoma: A stakeholder perception analysis on best management practices (BMPs).

Kudzu, (*Pueraria montana*), is an invasive vine that has expanded in Oklahoma due to cumulative effects of change in management practices and changing weather patterns. Recent studies have suggested the implementation of an Early Detection and Rapid Response (EDRR) program, including the use of best management practices (BMPs), can be effective in controlling its future distributions. We sought to understand stakeholder's perceptions of the strengths, weaknesses, opportunities, and threats associated with implementing BMPs to prevent the expansion of kudzu. Stakeholders surveyed ranked strengths (36%) of using BMPs with greatest priority, followed by opportunities (25%), threats (19%) and weaknesses (19%). These results suggest a consensus amongst Oklahoma stakeholders for a need to utilize BMPs to control the expansion of kudzu. However, some opinions were contrasting, as landowners prioritized threats associated with BMPs greater than government agency officials and non-government organization professionals. Study results suggest a need for outreach and extension to ensure the proper implementation of BMPs in Oklahoma and neighboring states that have similar socio-climatic realities.