Wildlife Abstracts

Poster Presentation

Listed Alphabetically by Presenter

Occupancy of Bighorn Sheep in Southwestern Arizona, U.S. and Northern Sonora, Mexico.

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Desert bighorn sheep in southwestern Arizona and northern Sonora, Mexico occupy rugged, mountainous terrain on both sides of the U.S./Mexico border and are exposed to border-related human activity that may be altering habitat selection. We described desert bighorn sheep site occupancy across areas with little or no human activity to areas with high levels of human activity, both in Mexico, and in the U.S. Describing sheep occupancy is difficult due to the natural sparseness of sheep and the intractability of aerial and ground-based surveys for sheep. Fecal pellets serve as relatively long-lasting (>1 month) indicators of site presence and are a low-cost alternative to aerial surveys. We used ground transects along mountain ridges, using sheep fecal pellet counts as indicators of site occupancy and documenting any visual/auditory detections of desert bighorn sheep to quantify the presence of bighorn sheep along each transect. We categorize human activity according to the amount of trash along each section (i.e., no trash, trace amounts of trash, more than trace trash) as a measure of human activity along each transect. Terrain covariates (e.g., elevation, terrain ruggedness, distance from roads) were extracted from a GIS analysis of digital elevation models and satellite imagery. We show that terrain features, common to bighorn habitat selection on both sides of the border, interact with human presence to determine sheep occupancy.

Amphibians, Reptiles, and Small Mammals on the Barry M. Goldwater Range – West

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The Barry M. Goldwater Range-West (BMGR-W) includes 283,280 ha of Sonoran Desert near Yuma, Arizona. The Integrated Natural Resources Management Plan (INRMP) for the BMGR-W requires that baseline conditions for small mammals, reptiles, and amphibians be established so that natural resource managers may determine how best to allocate effort to protect natural resources. Little is known about the small mammals, reptiles, and amphibians of the BMGR-W. What is currently known about these animals comes from either short term surveys at small locations or species-specific monitoring range-wide. We have been conducting an inventory to ensure that wildlife resources will be identified, protected, and managed to comply with regulatory requirements for federally threatened and endangered wildlife species or otherwise

significant or sensitive species. The objectives of this project are: 1) to establish a repeatable baseline monitoring methodology that will capture the diversity found in small mammals, reptiles, and amphibians on the BMGR, 2) develop potential distribution maps for small mammals, reptiles, and amphibians captured on the BMGR, and 3) provide recommendations to monitoring efforts and natural resource stewardship to assist the military mission on the BMGR. We surveyed for amphibians, reptiles, and small mammals by conducting 30,800 km of visual encounter surveys in all five general habitat types present on the range. Additionally, we sampled for small mammals by setting trapping grids of Sherman traps (11,391 trap-nights) and Tomahawk traps (1,092 trap-nights). We sampled for amphibians and reptiles by setting drift fences with box and pitfall traps for a total of 379 fence-nights. Here we document 23 species of small mammals and 40 species of amphibians and reptiles from the range, including several unexpected or special concern species. We conclude with plans and priorities for future work to improve the completeness of this inventory.

Decline of Bird Species Richness in Phoenix Metropolitan Area over Sixteen Years

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Maricopa County has grown considerably in the last two decades, and there is a growing interest in studying how bird populations have been affected. Previous studies conducted in the Phoenix metropolitan area have documented declines of abundance and richness of birds in riparian habitats. Herein, we investigated whether richness also declines throughout urban habitat areas within the Phoenix metropolitan area and what environmental factors may explain this decline. Specifically, we documented, for the first time, (1) how species richness varies across years annually throughout the urban area, and (2) whether richness varies across urban habitats. We used bird census surveys collected over a 16-year period throughout the Phoenix urban area from 2000 to 2016 and conducted Kruskal-Wallis test to determine whether the mean rank of species richness throughout and within urban habitats were the same. Our results showed that there is a change in bird species richness annually throughout the Phoenix metropolitan over a 16-year period. The results of this study are necessary to compare annual changes in species richness as they relate to changes in climate and environmental variables.

Comparative Analysis of Wing Proteomes and Ecological Functional Traits of Five North American Bat Species

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White-nose Syndrome (WNS) is an emergent disease caused by the skin-loving fungus Pseudogymnoascus destructans (Pd) and is responsible for over 7,000,000 bat deaths as of 2011 since its detection in the US in 2006. Structure and function of bat immune systems, especially in cutaneous tissues where Pd invades, are poorly understood; limiting the ability to predict impacts on species naïve the pathogen. We hypothesize that shared innate skin immune response proteins across multiple bat species are related to their ecological functional traits and are also indicative of resistance against WNS. Using samples from 203 bats, we pooled each individual bat's three 2mm wing biopsies across the following species with varied levels of vulnerability to WNS: Myotis lucifugus, Myotis austroriparius, Eptesicus fuscus, Myotis grisescens, and Corynorhinus townsendii virginianus. Proteins within these pools were extracted and digested with trypsin for mass spectrometry. The proteome was then analyzed and divided into six functional groups: DNA regulation, structural, cellular process, immunity-related, neurological, and protein synthesis. Averages for species traits including longevity, weaning age, neonatal mass, litter size, body mass, range, and forearm length were compiled into a database for comparison. Preliminary results show that WNS-resistant Myotis grisescens wing membranes contain averages of 4.93% immunity-related and 21.3% structure-related proteins. Relationships between protein functional group percentages and functional traits will be further analyzed once all profiles are complete. Given that WNS-related mortality is associated with energy reserve depletion during hibernation, these traits in tandem with key immune components will possibly be indicative of resistance among bats.

Effects of Woody Encroachment on Anti-Predator Behavior and Communication of the Harris' Antelope Ground Squirrel

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Grassland ecosystems are receding worldwide as woody shrubs increase and tip the balance of environmental factors that maintain ecosystem stability. Shifting ecological conditions that favor taller vegetation may affect survival and reproduction of a species if important behaviors no longer function under new conditions. Alarm calls of the Harris' antelope ground squirrel (*Ammospermophilus harrisii*) are adapted to open conditions and dense vegetation may impede the ability of individuals to detect predators. Squirrels are unlikely to vocalize if visual contact of a predator cannot be maintained, therefore increases in woody plants may suppress calling tendencies and increase predation risk for individuals and their offspring. We aim to understand how vegetation change affects calling behavior by comparing call frequency between individuals occupying home ranges of different vegetation densities. If dense vegetation is disadvantageous for detecting and tracking predators, individuals that inhabit dense habitat should call less

frequently than those living in open habitat. We will track individual locations weekly using radio telemetry and quantify vegetation cover and structure within resulting home ranges. After spatial data are acquired, individuals will temporarily be fitted with a collar-mounted microphone-recorder to measure calling frequency. By collecting habitat density and calling frequency, comparisons between individuals occupying differing home ranges can be established. Rapid habitat alterations could have cascading effects on predator-prey dynamics or hinder communication important for resource acquisition and defense. Understanding how anti-predatory behavior and communication are affected by woody encroachment is important to predict consequences and develop conservation strategies for grassland species.

Inventory of Terrestrial Mammals on Inundated Islands and Banks of the Rio Grande in Albuquerque.

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Flooding is a natural occurrence in the riparian forest, locally known as the bosque that lines the Rio Grande in New Mexico. It is important to understand the effects of flooding on bosque mammals because it allows the opportunity to observe how they respond and adapt to this ecological driver. In order to better understand the effect flooding has on local mammals, we surveyed three sections of bosque using track plates and cameras. We examined a flooded island, flooded peninsula, and non-flooded bosque. This allowed us to understand whether mammals were occupying habitats recently flooded compared to adjacent non-flooded sites. We found the most activity on the island site both from tracks and camera footage. The peninsula sight detected fewer animals than the island but more than the non-flooded site. No mammals were detected at the non-flooded site, which could be attributed to the close proximity of the site to a high use human recreation trail.

Urban Ecology of Desert Spiny Lizards on the University of Arizona Campus

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Understanding the effects of urban development on wildlife species and natural habitat limitations is increasingly relevant in order to create areas and buildings that facilitate the preservation of wildlife. An urban population of Desert Spiny Lizards (*Sceloporus magister*) was studied and found to be abundant at several sites on the University of Arizona campus. A total of

27 S. magister lizards were captured and marked with microchip PIT-tags for individual identification. Various data were then recorded, including weight, measurements, sex, temperature and humidity. Small, 1.4 gram radio transmitters were also attached to the backs of appropriately sized individuals, allowing ten lizards to be tracked via radio telemetry from August to October. Up to six different lizards were radio tracked at a time, with surveys occurring six times per week in the morning, afternoon, and evening. UTM coordinates were recorded each time a lizard was located and location data were used to determine activity patterns and home range characteristics. The results indicated that the lizards were more active in the summer than in the fall and that they maintain exceedingly small home ranges, with an average home range of 1,225.87 square meters. Time was also spent observing their behaviors, such as push-ups and head bobs, which are associated with territoriality and courtship. This study will be continued throughout the winter and following year to obtain more data on the urban ecology of *S. magister*.

Monitoring Spatial Distribution of the Flat-tailed Horned Lizard in Southwestern Arizona

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The Flat-tailed Horned Lizard (*Phrynosoma mcallii*; FTHL) occupies a limited range in the southwestern United States. Human expansion within their historic range has resulted in destruction of their habitat. A collaboration of state and federal agencies formed to create the Flat-tailed Horned Lizard Interagency Coordinating Committee (ICC) and develop a Rangewide Management Strategy (RMS) to allocate measures necessary for the protection of FTHLs and their habitat. The RMS designated five Management Areas (MAs) and one Research Area (RA) of FTHL habitat for long-term occupancy and demography monitoring. In accordance with the RMS, occupancy plots on MA/RAs are surveyed annually to monitor the distribution of FTHL across its range. Biologists follow a standardized protocol to estimate occupancy of FTHLs during their active period. Here we present data from one of the MAs, the Yuma Desert Management Area (YDMA) for 2017. In summer 2017, four observers conducted six sessions of visual encounter surveys on 75 plots. The lowest occupancy probability was .11% during the initial session, whereas the highest occupancy probability was .36% during the final session. The entire season consisted of .65% plots occupied. These data and other range-wide FTHL occupancy and demography data can help managers assess the status of this species.

Novel Aquatic Habitats Change Natural Selection and Ecosystem Processes in Desert Invertebrate Assemblages

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The addition of desert water developments alleviates water stress for a variety of organisms, and is likely necessary for some species as water availability declines with climate change. We assessed whether a novel habitat, the constructed wildlife waters, of the Sonoran Desert function as ecological equivalents of the natural waters and evaluated their effects on macroinvertebrate biodiversity, assemblage composition, and trophic function. We documented an accumulation of ammonia and less diversity and different taxa assemblages in the novel habitat. We also documented a more heterotrophic food web in the natural water basins that are more dependent on resource pulses, and a more autotrophic food web in novel habitats that are more dependent on primary production from the catchment basin. As we add more constructed waters to mitigate for climate change induced declines in water availability, organisms are more likely to encounter these novel habitats as they disperse. Consequently, by increasing the density of these novel habitats we are having a measurable effect on the types of species and trophic groups present and likely altering the trajectory of natural selection as a consequence of the documented differences between natural and novel habitat in the physical and chemical environments.

Assessing Microhabitat Use of Lizards along Perennial and Ephemeral Streams, Chiricahua Mountains, Arizona

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Recent droughts have caused the loss of perennial streams and associated riparian vegetation in Arizona. Riparian areas are important because they provide habitat and resources, such as food and water, to many different species of animals. Lizard communities may be negatively affected by this loss of perennial riparian habitats. As a first step toward understanding how lizards are affected by stream drying, we assessed microhabitat use and abundance of lizards along perennial and ephemeral (dry) streams in the Chiricahua Mountains. Our goal was to determine if microhabitat availability and use differs between three common species of lizards (*Sceloporus jarrovi, Sceloporus virgatus*, and *Urosaurus ornatus*) and how microhabitat availability and use differs between perennial and ephemeral streams. We established six 100 meter study transects, three along perennial streams and three along ephemeral streams. We mapped microhabitats in 5 x 5 meter plots along each transect. For three weeks, we executed a mark-recapture study, marking individual lizards with a paint pen to help with identification. We also recorded the microhabitat where each lizard was first sighted. Preliminary results from two of the six transects show that lizards had clear microhabitat preferences, and those preferences varied by species. Preliminary results also suggested that lizards use more diverse microhabitat types along perennial versus ephemeral streams. We expect to see similar trends at the other sites. This research will help us understand the links between riparian habitats and microhabitat use, and provide insight into how stream drying may affect lizard communities.

Assessment of Monarch Presence in Select Habitats along the Rio Grande in Sandoval and Valencia Counties in New Mexico

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We observed and gathered data on the presence of the Monarch Butterfly (*Danaus plexippus*) in two different sites adjacent to Albuquerque, NM. We documented the species presence and life stages as well as non-detection. The Monarch Butterfly is a species in significant decline with decreases of up to 80% or more of populations in the last decade. Within New Mexico there is limited knowledge about the Monarch population, distribution and timing of life cycle events. We sought to add to the existing, limited, database. Our work attempted to add current evidence and data about this species and its utilization of critical habitat. Our sites were located at Santa Ana Pueblo in Sandoval County and a wildlife refuge in Valencia County. We selected these sites because they both exhibited a plentiful amount of milkweed (*Asclepias sp*.) which is an obligate species for Monarch reproduction. Throughout the fall Monarch migration season from September to November we recorded habitat conditions and both juvenile and adult Monarchs at our visited sites. Even though the studied sites were in rich milkweed habitat, our Monarch findings were scarce, leading us to suspect that Monarch populations in our studied areas are experiencing the same trends as those elsewhere. Hopefully our findings can help spur action to improve habitats for and protect this imperiled species.

Fast Food: Serving up the Diet of the Spotted Bat by Barcoding DNA in Feces

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Diet of the spotted bat (*Euderma maculatum*) derived from visual inspection of feces and stable isotope analysis revealed prey as primarily Lepidoptera, predominantly from the moth families Noctilionidae, Geometridae, and Lasiocampidae. However, identification of prey beyond the family taxon is poorly understood. The spotted bat is difficult to capture and its roost habitat, in cliffs and crevices, makes it challenging to collect any remnants of the prey from feeding or roosting sites. However, a noninvasive and potentially more available source for diet information is through genetic analysis of feces collected from the bat. We analyzed fecal samples of 14 spotted bats captured in the southern (Arizona) and northern (Canada) parts of their range for diet content using COI primers that targeted insect DNA for DNA metabarcoding. From 1 individual, we detected 9 species; 3 were identified to genus and included 2 Lepidoptera and 1 Dipteran. Using genetics to determine the content in feces of the spotted bat provided a quick and quantitative assessment of prey. The lack of hard-bodied insects in the diet corroborated observations of the jaw musculature of the spotted bat. The presence of a Dipteran indicated that spotted bats fed over water. Spotted bats can be elusive, but genetic analysis of feces serves up the opportunity to gain a greater understanding of their diet.

Carnivore Activity in Riparian Forests of Southeastern Arizona

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Understanding species occurrence in areas dominated by non-native vegetation is important when determining if management actions should be implemented. Saltcedar (*Tamarix spp.*) is one of the most prevalent non-native trees in riparian areas in the southwest United States and can alter habitat structure. Despite its abundance, little is known about how medium and large carnivores use monotypic stands of saltcedar. The San Pedro watershed in southeastern Arizona is recognized internationally as a hotspot for mammal species. The river is home to at least three riparian forest types: non-native saltcedar stands, native mesquite (*Prosopis spp.*) bosque, and a mixture of native cottonwood (*Populus*) and willow (*Salix*) woodlands. Our goals are to determine the occurrence and relative abundance, richness, and diversity of medium and large mammals across three forest types to explore use or avoidance of non-native stands. We sampled mammals along approximately 16 river miles, using 18 camera traps (six cameras per forest type). We observed 18 species over 98 trap nights, with an average of 5.5 independent detections per 100 trap nights (captures of a species >1 hour apart) in saltcedar, 7.3 in cottonwood/willow, and 20.7 in mesquite. Most observed species is bobcat (*Lynx rufus*), followed by coyote (*Canis latrans*). Gray fox (*Urocyon cinereoargenteus*) and western spotted sunk (*Spilogale gracilis*) have only been observed in mesquite. Other carnivores observed included mountain lion (*Puma concolor*) and black bear (*Ursus americanus*). Data shows a trend towards a significant different between saltcedar and mesquite habitat types, and further data will be collected.

Effects of Urban Development on Snakes and Gila Monsters

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Urban development has various effects on biotic communities, often leading to a decrease in native species, and a loss of biodiversity. This research focuses on the effects of urban development on herpetofauna in Stone Canyon, a residential community and golf course located at the base of the Tortolita Mountains near Oro Valley, Arizona. We conducted nightly road and golf cart path surveys to document snakes and Gila Monsters (*Heloderma suspectum*) throughout the development. We obtained environmental (temperature, relative humidity) and location data (in UTM coordinates) for each capture. We processed snakes and Gila Monsters, which included measuring snout-to-vent length and mass, implanting microchips for individual identification, determining age class and sex, and obtaining fecal and tissue samples. We quantified time spent and distance covered during surveys, which allowed for calculation of animals captured per unit effort. To examine potential relationships between relative abundance of animals with environmental variables, we maintained data loggers and rain gauges at sites on and away from

the golf course to record data on temperature, humidity, and precipitation. We compared data collected in 2017 with our long-term (2002-2014) data set from the same site to make inferences about effects of ongoing urbanization on relative abundance, diversity and distribution of snakes and Gila Monsters. We discuss our results as they relate to anthropogenic change and increased human presence, with an emphasis on information that should lead to more effective conservation and management strategies for herpetofauna living on the urban fringe.

How Management Strategies in the Rio Grande Riparian Forest Affect Small Mammal Populations

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We assessed small mammal populations in 6 Bosque Ecosystem Monitoring Program (BEMP) sites in the Albuquerque (NM) metro area. All BEMP sites were in the bosque, a wide stretch of riparian forest that reaches from north to south along both sides of the Rio Grande. One site served as a minimally disturbed control and five had been subjected to different management strategies; agriculture, flooding, mowing, fire, and exotic tree removal with wood-chipping, We used sets of 45 Sherman traps across three trap nights at each sites to capture small mammals. All captured animals were identified to species level and standard measurements were recorded. From all of the data we collected from the six sites we found that there were significantly less small mammals in the managed sites rather than the minimally disturbed control site. With this information we can conclude that to maintain large small mammal populations it is likely important to maintain and preserve minimally disturbed wildlife habitats so that crucial animal species can thrive.

Differences in Terrestrial Invertebrate Communities along Perennial and Ephemeral Streams in the Chiricahua Mountains, AZ

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Invertebrates play important roles in most food webs because they consume basal resources and in turn are consumed by larger species. Southeastern Arizona has a high level of invertebrate diversity, especially in riparian areas along streams. These invertebrates likely play a key role in providing nutrients to riparian animals, such as lizards. However, terrestrial invertebrate communities may differ between perennial (i.e., wet) and ephemeral (i.e., dry) stream beds due to differing levels of moisture, resource availability, and habitat complexity. These differences in invertebrate diversity and abundance could result in varying levels of prey being available to riparian lizards. In this study, we surveyed riparian invertebrates along three perennial and three ephemeral 100-meter stream reaches in the Chiricahua Mountains of southeast Arizona. In each reach, we collected terrestrial invertebrates at 25, 50 and 75 meters along the perennial or ephemeral streambed at three lateral distances (5, 10 and 15 meters) away from the streambed. We predicted that: 1) a greater abundance and variety of invertebrates would be found along

perennial streams compared to ephemeral streams and 2) a greater abundance and diversity of invertebrates would be found closer to the stream bed than further away. Preliminary analyses suggest support for both of our predictions, but there was high variability among sites. These results will help us predict how riparian food webs might change if drought and water withdrawals cause perennial streams to become ephemeral and subsequently how lizard nutrition would change as well.

Relationships Between Species Distribution Models and Expert Opinion Models for Desert Bighorn Sheep in Arizona

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The desert bighorn sheep (*Ovis canadensis mexicana*, *O. c. nelsoni*) is a fascinating large ungulate and is the focus of considerable conservation and management actions. Habitat quality models that evaluate the suitability of geographic areas to supporting desert bighorn populations are a commonly used management tool. These habitat quality models include expert-opinion models, which characterize desert bighorn sheep habitat based on qualitative or quantitative descriptions using informal or formal methods. Species distribution models are another type of habitat quality model, but differ fundamentally from expert-opinion models, as they use a statistical function based on relationships between a response variable and a set of explanatory variables to explore empirical correlations between species distributions and environmental variables. It is important to establish the efficacy of expert-opinion models versus species distribution models for desert bighorn sheep management. Therefore, I used the Maxent software, occurrence records from 6 desert bighorn sheep populations, and 13 environmental variables to develop a species distribution model for desert bighorn sheep in Arizona, and compared this species distribution model with 2 expert-opinion models currently used for desert bighorn sheep management in Arizona. Overall, the species distribution model may be more reliable in identifying empirical relationships between desert bighorn sheep distribution and environmental variables. However, the species distribution model may not perform as well as the expert-opinion model in areas outside the model training region, and may not take into account some environment predictors relevant to desert bighorn sheep management.

New Mexico Turtle Species Diversity in Ponds along the Rio Grande in Northern Albuquerque

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We studied turtle species composition and distribution along the Middle Rio Grande through Albuquerque. With climate and habitat changes, along with the known introduction of exotics, little work has been done in recent decades to document present turtle populations in this region. Working within the Bosque Ecosystem Monitoring Program (BEMP), we trapped in various riverside ponds to collect demographic data to determine population ratios, especially comparing

exotic to native species. We caught four species: the red eared slider (*Trachemys scripta elegans*), the painted turtle (*Chrysemys picta*), common snapping turtle (*Chelydra serpentina*) and the spiny softshell turtle (*Apalone spinifera*). Turtles were trapped with hoop net traps, baited with sardines, shrimp, and beef liver. We also reviewed and compiled BEMP data on turtle trapping done in other Albuquerque area ponds across a two year period. Our work documents about an equal number of exotic to native turtle species in this region. This information proves valuable because it assists the efforts of local herpetologists and their ongoing research to help manage and protect these species.

Understanding factors influencing visibility in the Northern Mexican Gartersnake (*Thamnophis eques megalops*)

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Given that an understanding of species distribution and population sizes are essential to managing threatened and endangered species, improving the efficiency of survey and monitoring techniques is necessary. While methods such as trapping and visual encounter surveys are popular sampling techniques, they tend to be costly and may have low detection rates for cryptic ectothermic species such as snakes, resulting in a need for improving these techniques. Since environmental, physiological, and temporal factors influence snake activity, and therefore visibility, we collected data on surface and ambient temperature (microclimate), body temperature (Tb), date, and time of detection from 13 telemetered active adult female Northern Mexican Gartersnakes (*Thamnophis eques megalops*) at Lower Tonto Creek, Gila County, Arizona. To estimate body temperatures, we used the pulse interval rates of temperature sensitive SB-2T transmitters using calibration curves generated by Vinny Graphics 2.06. We will analyze the relationship between estimated body temperatures and these factors with visibility through an Analysis of Covariance (ANCOVA). Applying the results of our analyses to future surveys may be helpful for improving detectability of these, and similar cryptic snake species.

Applications of conservation physiology in the narrow-headed gartersnake

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Conservation physiology is an inter-disciplinary field that integrates physiology and conservation by applying physiological tools in a conservation context. While captive breeding programs facilitate persistence and recovery of imperiled species, species-specific husbandry and management practices often take time to understand and implement. Conservation physiology

can speed and refine this process by using techniques in endocrinology to better understand the needs of imperiled species. Quantifying hormone levels in response to change, or over time, can inform; husbandry practices, current and future population health, seasonal patterns of life history characteristics, and the timing of sexual maturity. Noninvasive hormone measurement using fecal or keratinized samples is particularly useful for sensitive species of conservation concern like the narrow-headed gartersnake (*Thamnophis rufipunctatus*). Captive husbandry and breeding programs for *T. rufipunctatus* were established in 2014 in response to range-wide population declines, but this species is difficult to keep in captivity due to its specialized nature. The project in progress will utilize corticosterone in shed skin and fecal samples from captive *T. rufipunctatus* to; 1) quantify suitability of husbandry conditions for captive recovery programs using corticosterone as an indicator of stress, 2) understand sex- and age-specific differences in circulating corticosterone levels, and 3) establish a seasonal profile for corticosterone in this species. Applying these techniques in conservation physiology to the *T. rufipunctatus* will streamline husbandry practices at Northern Arizona University and aid in species recovery efforts.

My Nest is Best: Analyzing Nest Composition of the Endangered New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*)

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The endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) is endemic to riparian zones in Arizona, New Mexico, and southern Colorado. Jumping mice are nocturnal and use herbaceous nests that they construct along riparian areas for daytime shelter. However, little is known about the composition, structure, and properties of these nests. In late October and early November, following the active summer period for jumping mice, we collected known nests used by jumping mice during a radio telemetry study on the Santa Fe National Forest (n = 3) and the Apache-Sitgreaves National Forests (n =11). We measured and visually assessed composition of plant species that jumping mice used to used to construct nests. To better identify plant materials of nests, we applied DNA metabarcoding for genetic identification applied DNA metabarcoding for genetic identification. However, many plant species in the southwestern United States were not DNA barcoded, so initially we could only identify some plants to genus level (e.g., Poa). Our process of identifying nest materials therefore included barcoding herbarium specimens to add to the Barcode of Life Database, a repository for DNA biodiversity. Barcoding these plants not only elucidates composition of nest materials, it also supplements our understanding of diet of the jumping mouse.

Is a Common Skin Test Wsed to Assess Immune Responses in Wildlife Useful for Predicting Disease Resistance?

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Emerging infectious diseases of wildlife are on the rise. To effectively target management efforts aimed at protecting wildlife from infections, host immune responses reflective of disease resistance must be understood. Predicting host response to pathogen exposure requires methods that test immune responses similarly involved in effective clearance of the pathogen. Stimulating components of the immune system using mitogens (i.e. molecules that induce cellular proliferation), including the lectin phytohemagglutinin (PHA), may help uncover relevant aspects of immunity. Such tests are commonly used to estimate host immunocompetence, or capacity to mount appropriate immune responses leading to clearance of pathogens. Considering that correlations between responses to PHA and specific pathogens are not well defined, we critiqued all available papers that include use of PHA to test immune responses and also measured disease severity upon pathogen exposure. Out of 260 papers critiqued, only five studies demonstrated PHA as a significant predictor of disease severity. Notably, many studies neglected to consider multiple variables when measuring host immunity to pathogens (i.e. failing to compare PHA response with response to more than one pathogen). With this evidence, we do not conclude PHA as a poor predictor of host immunity to disease. Rather, we call for more thorough consideration of experimental design when attempting to predict responses of a host species to a certain pathogen. Immune responses to PHA must be directly examined in host species of concern and weighed against the likely immune responses reflective of clearance before drawing inferences on disease resistance and employing widespread testing.

Coordinating Bridge Design with Bat Habitat Management: Ina Bridge Bat Boxes

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Roadway bridges are known to provide bat roosting habitat throughout Arizona. Unfortunately, many of these bridges are slated to be replaced within the next several decades. Bridges provide suitable bat roosting habitat because they offer refuge from the external climate. Thus, any created bat habitat must provide a similar refuge to be successful. Traditionally when a roadway bridge is replaced the bat habitat it provides is not. Some recent bridge designs do allow for the post hoc attachment of bat habitat boxes. These boxes are not incorporated into the bridge structure and generally do not provide the same climate refuge as the original bridge. The Ina Bridge in Tucson currently provides roosting habitat for up to 25,000 Mexican free-tailed bats (Tadarida brasiliensis). In order to mitigate this bat habitat loss the Regional Transportation Authority and the Arizona Game and Fish Department designed the new bridge with bat habitat in mind. This a priori approach was based on a microclimatic assessment of the old bridge bat habitat. We then used this habitat assessment to design the new bridge bat habitat. We coordinated with bridge engineers (Arizona Department of Transportation) and bat box builders (Modern Bat) at the project design phase in order to integrate the bat habitat into the bridge design and not as an afterthought.

Urban Coyote Dependence on Anthropogenic Foods in Albuquerque, NM.

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Coyotes (*Canis latrans*) are one of the most successful generalist species which have adapted to living in human influenced environments. Coyotes are often disregarded as pests due to them being common in urban settings. Because they often live in close proximity to humans it's important to understand their behaviors and diets. The goal of this project is to study coyotes to see how dependant they are on human food sources in Albuquerque's (NM) urban environment and its associated riparian forest, the bosque. To determine diet I compared the isotopic composition of coyote hairs I collected with that of voucher samples. To collect hair from non-captive coyotes I built wire brush scratching boards, scented with canine lure, and placed flatly on the ground where coyotes were known to occur. Voucher samples consisted of plant, animal, and human hair. Collected coyote hair samples and vouchers were analyzed at the University of New Mexico Stable Isotopes Lab.

Detection and persistence of soft ticks in an abandoned prairie dog town in eastern New Mexico

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Soft ticks (Family Argasidae) are a cryptic and long-lived group of arachnids that differ from hard ticks in many structural and biological characteristics. They are restricted to sheltered microhabitats and harvest blood meals quickly. This makes soft ticks particularly hard to monitor and studying their ecology remains a challenge. Soft ticks represent an import human health concern as they are known vectors of bacterial pathogen that causes relapsing fever in humans. For these reasons, we focused on soft tick surveys among prairie dog towns in eastern New Mexico to learn more about their ecology and distribution. In the fall of 2016, we discovered soft ticks in a recently abandoned prairie dog town in Roosevelt County, which represents the first time that soft ticks were discovered directly in prairie dog burrows. Based on this initial discovery, we sought: 1. to evaluate how long soft ticks persist in this town over time, and 2. to use game camera traps and detect which potential hosts soft ticks feed on. In the spring 2017, we detected soft ticks in 3% of the surveyed burrows while in the fall 2017, ticks were detected in 63% of the surveyed burrows. The number of ticks per infested burrow varied from 1 to 154 per survey occasion. We found that many vertebrate animals serve as potential hosts and dispersers of ticks across the landscape. We speculate that soft tick detection rates become higher as the ticks increase their search for blood meals.

Factors Influencing Calf Bed Site Selection in a Landscape Changed by Wildfire and Restoration

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Due to historical land use and fire suppression, forests in northern New Mexico are at abnormally high risk for catastrophic wildfires. In response, a coalition of agencies under a USDA Collaborative Forest Landscape Restoration Project began restoring 210,000 ha in the Jemez Mountains to the historical fire regime via thinning and prescribed fire. As part of these restoration efforts, we are monitoring the responses of radio-collared Rocky Mountain elk (*Cervus canadensis*) and their calves to changes in vegetation resources. In 2017, 20 elk calves born to cows were captured or confirmed dead within 48 hours of parturition. If captured (n = 11), their survival was monitored and bed site characteristics were assessed (e.g., visibility, ground cover, obstructions). These habitat data were compared to bed site data collected on elk calves captured and monitored in 2011 to evaluate the effects of post-restoration vegetation growth on calf survival and bed site selection. Calf captures will continue in 2018, but initial results suggest predator-specific calf vulnerability (35% survival 2-3 months following parturition) may have changed, along with vegetation characteristics associated with calf bed site selection. This may be due to vegetation succession and overall differences in sites chosen by cows following wildfire and restoration. This research will assist state and federal managers in evaluating the influence of large-scale restoration activities on elk calf survival and habitat use.

Range expansion of Mexican ducks and mallards in Arizona

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The Mexican duck (*Anas platyrhynchos diazi*) has expanded its range in Arizona beyond its historic distribution to include the Sonoran Desert, primarily due to human-altered wetlands such as urban parks and sewage treatment ponds. These recent habitats have not only influenced Mexican duck distribution but have also altered mallard (*Anas platyrhynchos platyrhynchos*) migration patterns. As a result, both of these forms of the mallard (*Anas platyrhynchos*) are now migrants and winter visitors to formerly vacant nesting habitats. Substantial hybridization is evident between mallards and Mexican ducks. The objective in this 3-year study was to document the yearlong presence of Mexican ducks and hybrids at rural and urban ponds in the Sonoran Desert of central and southern Arizona. Mallards were generally absent during the

nesting season, with the exception of urban ponds. Therefore pairing of mallards with Mexican ducks was limited during summer but may be prominent in the winter months. Although hybridization between the two forms may be increasing in these new subtropic habitats, the lower number of mallards present prevents genetic swamping. Rural and remote areas, where mallards are few or in low numbers, were generally populated with Mexican duck phenotypes. The above phenomena were attributed to the influence of nutrient-rich water treatment ponds on Mexican duck and mallard recruitment. The role of human-altered habitats and the effect on range expansion and reproductive success of both taxa warrant further investigation, including banding studies.

Improving quality of life through enrichment activities for captive Mexican Grey Wolves

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In partnership with the United States Fish and Wildlife Service, we created and evaluated different enrichment items placed in pens of captive held Mexican Grey Wolves (*Canis lupus baileyi*) at Sevilleta Wildlife Refuge (NM). This work took place weekly for two months and involved three wild-born wolves in two different pens. We observed that without enrichment elements, the wild wolves often just walked, ran, or laid around in their pens. We attempted to see if natural items could be added to the pens to better engage and reduce stress for those animals. We set three different natural food items in novel ways within the pens and then observed both in daylight and at night, either directly, from a wildlife blind, or remotely, using motion sensor cameras, to see and record the wolves' reactions. Although the wolves took interest in each of the provided enrichment elements, time spent with each was limited.

Rio Grande cooter (*Pseudemys gorzugi*) natural and life history observations in New Mexico

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Freshwater turtles of the American Southwest remain largely under-represented in the primary literature. The Rio Grande cooter (*Pseudemys gorzugi*) is one of the least studied species in the region, and very little is known about its biology. The species is listed as threatened in New Mexico, concurrent to its review for federal listing by the United States Fish and Wildlife Service. Human habitat modification and population-level effects due to historic commercial harvest and the pet trade represent potential threats to the species across its range. There is an

increasing need for information on this species in order to further existing conservation measures. Here, we summarize short-term and single time observations during methodical surveys conducted along the Black River, New Mexico in 2016 and 2017. Specifically, we report our findings on the maximum clutch size, annual growth rates, and melanism in males. We also point out additional threats due to recreational practices. Given freshwater turtle longevity and late maturity, only long-term studies (i.e., >10 years) can reveal information on Rio Grande cooter demography and ecology. Nonetheless, our findings reveal previously un-reported observations such as fish hook ingestion, which is relevant to evaluating conservation measures.