

2017 CCTWS Annual Meeting Abstracts

February 15-17, 2017

PLENARY SESSION

CARNIVORAN ECOLOGY: AN UPDATE

Steven Buskirk, University of Wyoming

Carnivoran ecology has become the most multifaceted and dynamic taxonomic niche of mammalian ecology, for several reasons. The Carnivora are more varied than any other eutherian order in terms of body size, diet, locomotor adaptations, metabolic specializations, and reproductive delays. They interact strongly with other community members: herbivores, vegetation, and other carnivoran species. They alter densities, habitat use and activities of potential prey, with cascading effects to the foods of those prey. They pose mortal threats to members of other carnivoran species, especially those smaller than themselves by a factor of 2.5 – 4. At the same time, they are threatened by carnivores larger than themselves by the same margin. The importance interspecific competition among carnivores depends heavily on morphological/ecological specialization, with some families (e.g. Mustelidae) having up to seven species in local sympatry in North America. Canid species, much more morphologically uniform, are much less tolerant of each other's sympatry. Habitat diversity and physical structure mediate these competitive interactions as well; tree climbing and burrow use allow several species to coexist with potentially deadly competitors. Mammalian carnivores variously complete or interrupt the life cycles of various parasites and pathogens, and may play important roles in the limitation or evolution of important diseases of species of concern to wildlife managers. Carnivores have limited importance in transporting limiting nutrients—nitrogen, phosphorus, and polyunsaturated fatty acids—from aquatic systems to terrestrial ones. With the development of genomic resources, the conservation of some carnivores is taking new and highly technological directions, with the endangered black-footed ferret a candidate for interspecies somatic cell nuclear transfer. If successful, this initiative would require managers to be newly creative in explaining conservation goals and methods to the wildlife-loving public.

OVERVIEW OF COLORADO CARNIVORE RESEARCH

Chuck Anderson, Colorado Parks and Wildlife

Wildlife management programs require solid understanding of population dynamics, predator-prey relationships, and human-wildlife interactions to make informed management decisions. Equally important are the social aspects of wildlife management decisions, especially concerning management of large carnivore species in North America. Historically, carnivore populations in the US were greatly suppressed or extirpated during European settlement, largely due to real or perceived risks associated with livestock conflicts, competition for game species, and threats to human safety. Increased understanding from ongoing management and research efforts, to some degree, along with changing perceptions and shifts from rural to urban dominated human populations have recently provided for increase and expansion of most mid to large carnivore species in the US. Research opportunities have expanded along with carnivore populations, but questions remain and some results have been contradictory. Future investigations will benefit by being applied at appropriate scales with informative study designs while addressing questions using manipulative experimentation where feasible. Addressing the social aspects of carnivore management is a less developed area of research that should be expanded. Enhancing our understanding of wildlife-human interactions, especially as this relates to

carnivore management, will require more formal approaches to investigation, but will continue to be challenging given the strong opinions associated with large, charismatic species.

PREDATOR MANAGEMENT IN COLORADO

Jerry Apker, Colorado Parks and Wildlife

A brief overview of carnivore management activities in Colorado, circa 1970s to the present day is presented. Included in this is a discussion of the evolution of population monitoring methods. The emphasis of this presentation is on game species; primarily black bear (*Ursus americanus*) and mountain lions (*Puma concolor*), but corollaries with swift fox (*Vulpes velox*), Canada lynx (*Lynx canadensis*), bobcat (*Lynx rufus*), and river otter (*Lontra Canadensis*) are provided. The presenter will offer perspectives on some challenges carnivores face in the foreseeable future as well as some challenges facing wildlife managers in Colorado.

AN OVERVIEW OF BLACK-FOOTED FERRET RECOVERY EFFORTS IN THE GREAT PLAINS AND INTERMOUNTAIN WEST

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Despite a successful captive propagation and reintroduction program, the black-footed ferret (*Mustela nigripes*) remains one of the most endangered mammals in North America due to widespread lethal control of prairie dogs (*Cynomys spp.*), diseases such as sylvatic plague, and conversion of rangeland to rowcrop agriculture. Black-footed ferrets have been reintroduced at 28 separate sites throughout the Great Plains and Intermountain West, primarily on public lands. Non-federal rangelands throughout the Great Plains, the historic core of black-footed ferret range, represent a unique opportunity to recover the species, provided that regulatory concerns, financial incentives, disease management, and prairie dog management issues can be addressed to the satisfaction of private landowners, tribal interests, agricultural producer groups, state wildlife agencies, and local governments. We provide an update on the implementation of the Black-footed Ferret Programmatic Safe Harbor Agreement and other regulatory assurance mechanisms, their potential future use, and an update on ongoing challenges to black-footed ferret recovery rangewide.

SWIFT FOX ECOLOGY AND CONSERVATION IN SOUTHEAST COLORADO

Eric Gese, USDA National Wildlife Research Center

The swift fox (*Vulpes velox*) is one of North America's smallest canids and historically inhabited much of the Great Plains. In the mid-1990's, the U.S. Fish and Wildlife Service was petitioned to list the swift fox under the Endangered Species Act. In response to the petition, the Department of Defense, U.S. Army, which owns a large tract of shortgrass prairie in southeastern Colorado, initiated a study to examine several questions, including: 1) what survey methods are best used to monitor swift fox abundance? 2) What is the interaction between coyotes (*Canis latrans*) and swift foxes? 3) What regulates swift fox populations? 4) What is the social and spatial ecology of swift foxes? From January 1997 to August 2004, we captured, radio-collared, and monitored 304 swift foxes on the 1,040-km² U.S. Army Piñon Canyon Maneuver Site in southeastern Colorado. This presentation describes the results of this 8-year study on swift fox ecology and conservation.

CHARACTERIZING HABITAT OF CANADA LYNX THROUGH THE LENS OF HABITAT USE, FUNCTIONAL RESPONSES, AND DEMOGRAPHY

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Based on >20 years of monitoring lynx in the Northern Rockies, we improved current understandings of lynx resource-use by examining habitat selection, availability, and functional responses across scales, seasons, and sexes. In winter, lynx preferentially foraged in multilayer, mature mixed mid and late seral forests dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) in the overstory and midstory. In summer, habitat use expands into younger forest structures. Across seasons, lynx use forests that provide the high horizontal cover necessary to support snowshoe hare (*Lepus americanus*) populations. In addition, we used remotely-sensed covariates of forest composition and structure to evaluate resource use and availability at landscape and home range scales. Our assessment of functional responses in habitat use by lynx provided additional insights concerning lynx ecology. For example, we demonstrated that female lynx during the winter avoided stand initiation and sparse forest, but that avoidance increased as stand initiation and sparse forests were more prevalent in home ranges. In contrast, females exhibited consistent selection of advanced regenerating forest structure across its range in availability (~10-40%); mature forest was used in proportion to its availability, but 66% of female lynx occupied home ranges containing ≥50% mature forest. Finally, to better characterize habitat quality we evaluated the role that habitat condition plays on female reproductive performance. We characterized performance using 2 metrics: 1) produced a litter (yes/no), and 2) litter size. Our analysis concluded that reproductive output of Canada lynx was primarily habitat-dependent, and the important forest attributes were 1) abundant and highly connected mature forest, and 2) low-intermediate amounts of small-diameter regenerating forest arranged in simple shapes. Our research demonstrates the strength of integrating approaches characterizing habitat use, selection, and demography for conservation planning, as well as highlights the strong impact forest structure has on lynx resource-use and demography.

CONTRIBUTED PAPERS ABSTARCTS

THE BIRDS AND THE BEES... AND THE BATS, BUTTERFLIES AND BRANTS: THE US FISH & WILDLIFE I&M PROGRAM DETAILS HOW TO COUNT THEM ALL

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Bees are among the most prominent pollinators of concern because of their presumed nationwide decline. The US Fish & Wildlife Service Inventory & Monitoring (I&M) Program helps determine how best to survey species on National Wildlife Refuges by encouraging the use of rigorous survey protocols. Development of the National Bee Survey Protocol is a good example of how this is done. The I&M Program determined that many Refuges wanted to survey native bees, and learned that there wasn't a comprehensive, rigorous bee survey protocol. The I&M Program worked with native bee experts to author a national bee survey protocol that meets all the requirements of the USFWS and NPS survey protocol standards. Once written, the survey protocol was sent out for peer-review by experts in bee surveys. The reviews were coordinated and reconciled by the I&M Program and the authors addressed all comments for the final draft of the survey protocol. The I&M Program also built an MS Access database to collect the bee data which will be used for Refuge management and will be uploaded to the USDA national bee database to contribute to regional and national information on native bees. The national bee survey protocol, field sheets, and Access database are available on Data.gov for anyone to use.

ESTIMATING THE ABUNDANCE OF WILD HORSES IN CENTRAL WYOMING

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The Wyoming Department of Agriculture (WDA) was interested in evaluating alternative methods for estimating the abundance of wild horses (*Equus caballus*) in several regions of Wyoming. WEST was tasked with developing, and then implementing, an aerial survey and analysis method for a 6,718 km² area in central Wyoming that contained several Herd Management Areas (HMAs). We used an aerial transect method that has been peer reviewed and implemented for estimating the abundance of golden eagles (*Aquila chrysaetos*) across the western U.S. over the last decade. We found this method useful for estimating the abundance of wild horses within our study area during winter (February) and summer (July) surveys in 2016. Winter surveys resulted in a density estimate of 0.416 horses / km² (2,795 total horses; 90% CI from 2,116 to 3,777), and the summer survey resulted in an estimate of 0.322 horses / km² (2,165 total horses; 90% CI from 882 to 3,663). In addition to estimating abundance, we used these observational data to develop a resource selection function to better understand winter and summer horse distribution.

ACOUSTIC MONITORING METHODS AND UTILITY FOR YELLOW-BILLED CUCKOO, SOUTHWESTERN WILLOW FLYCATCHER, AND NORTHERN LEOPARD FROG.

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Remote, passive acoustic monitoring offers a new technology for monitoring three species of concern: the Federally Endangered Southwestern Willow Flycatcher, Federally Threatened Western

Yellow-billed Cuckoo, and Colorado state species of concern Northern Leopard Frog. Acoustic monitoring can more efficiently and effectively measure the presence or absence of a wildlife species in the landscape because: observer bias is removed as animals are monitored while humans are absent from the area; monitoring can be conducted over days or weeks without the expense, logistics, or energy required for direct observation; animals can be monitored at night, in thick vegetation or poor weather conditions where visual tracking or observation would be impossible or difficult; the need for call playback surveys is reduced, decreasing elements of disturbance and harassment to wildlife; and data are consistently collected and analyzed, eliminating human error. Song Meter terrestrial recorders and Kaleidoscope software developed by Wildlife Acoustics, Inc. were used to record and analyze field recordings for these species. Using a variety of field recordings a “classifier” was created for each species that allows computer analysis of field recordings to rapidly search hours of data to find vocalizations of the species of interest thereby documenting the presence of the species as well as an index of activity levels. This is a relatively low cost technology and has great potential for gathering long-term, consistent presence/absence information in a way that does not disrupt wildlife and that greatly reduces the man-hours needed for typical surveys.

LESSONS LEARNED ABOUT CHRONIC WASTING DISEASE IN ELK AT ROCKY MOUNTAIN NATIONAL PARK

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Two studies at Rocky Mountain National Park, Colorado, have begun to describe the population-level effects of chronic wasting disease (CWD) in elk with historically high densities (≤ 110 elk/km² on some winter range). CWD was first detected there in the early 1980s and by the early 2000s ~50% of female elk found dead tested positive. The first study evaluated rectal biopsy as an antemortem diagnostic test and estimated CWD prevalence. Rectal biopsy, while useful to investigate disease ecology and estimate prevalence, is not reliable for early detection of CWD. Immunohistochemistry of rectal biopsy yielded a test sensitivity of ~70-85% depending on the stage of disease, prion genotype, and number of follicles observed. After including CWD-positive animals that died with disease within 24 months of misdiagnosis, we found a disease prevalence of ~13% (8-19%; n=136) in 2008. Additionally, we estimated that the population growth rate in female elk was flat to declining ($\lambda \sim 1.0$) and that CWD can exceed natural rates of mortality, reduce adult female survival, and decrease elk population growth.

The second study more closely investigated disease dynamics in the population. Preliminary results support findings that CWD reduces adult female elk survival and this increased mortality decreases the population growth rate. Concurrently, elk re-distributed to lower elevations and now exhibit much lower densities within the park. The effects of this on CWD prevalence are unclear; movement may spatially dilute disease across the landscape or may effectively reduce disease pressure. A preliminary estimate of prevalence for 2012-2016 is ~8.5% (4.6-13.3%; n=138).

HIERARCHICAL DISTANCE SAMPLING: NOT YOUR FATHER'S DISTANCE ANALYSIS

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Estimating the number of individuals within a population across time and space is a fundamental task in wildlife ecology. Distance sampling (often implemented as line-transect or point-count surveys) is a popular method that estimates the probability of detection using information contained in the distances measured to observed individuals, thus providing estimates of abundance (or density) that correct for imperfect detection. While conventional distance-sampling approaches (e.g., Program Distance) have a rich history, there are a growing number of methods available for analyzing distance-sampling data, and practitioners may have difficulty determining which method to use in a particular application. We briefly summarize and compare the features of conventional methods to those of a newly developed, hierarchical model framework, popularized in the R package ‘unmarked’ and Bayesian analyses. Our objectives were to 1) compare the features of each method, 2) compare the consistency of estimates by applying each method to an example dataset of line-transect surveys for songbirds, and to 3) recommend which model may be most appropriate for common study designs and goals. When comparing very simple model structures, we found that estimates of abundance were identical or comparable across methods, while the reported precision of the abundance estimate varied by method. The features and complexity of model structures available in each method also varied. We suggest that data from simple study designs can still be adequately analyzed using conventional methods, but we anticipate a growing need for the more-complex and customizable approaches available in hierarchical distance-sampling models.

NEST SURVIVAL OF BALD EAGLES IN COLORADO

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Colorado Parks and Wildlife has a statewide raptor nest database going back to the 1970s, and contains over 9,000 nest records contributed by a diverse assortment of local, state, and federal sources. Up until now, CPW has primarily used this database at a site-specific scale in the oil and gas comment process. It has also been used by state researchers for small-scale spatial modeling of raptor nests, helping to target appropriate areas for future nest searches. However, the potential of this database to evaluate raptor populations at larger scales, as well as the data collection protocols, have not been thoroughly assessed.

Therefore, an exploratory analysis of the database was performed to identify and prioritize which raptor species have sufficient data for further analysis and which do not. From this initial assessment, it was determined that the nest records for bald eagles were some of the most complete in the database, and were therefore used as the test species to estimate nest survival using known-fate models and environmental covariates. The initial results of these analyses predict bald eagle nest sites with the warmest average temperatures during the entire nestling period to have the highest estimates of nest survival in Colorado.

Ultimately, these analyses will yield information on priority sites for nest monitoring, and what types of information needs still exist that might require different field protocols or additional data collection. This work will allow us to provide much needed guidance with respect to monitoring raptor populations across the state.

EFFECT OF DOUGLAS-FIR BEETLE AND PATCH SIZE ON AVIAN OCCUPANCY AND ABUNDANCE IN DOUGLAS-FIR FORESTS IN THE GUNNISON BASIN, COLORADO

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In this study we analyzed the interaction between avian diversity and occupancy with forest health and structure, as many of the region's Douglas-fir stands are under attack by an insect parasite, the Douglas-fir Beetle (*Dendroctonus pseudotsugae*). Additionally, we looked at the relationships between forest patch size and species richness of birds, as the Douglas-fir (*Pseudotsuga menziesii*) forests of the Gunnison Basin provide a prime application of the Island Biogeography Theory, with discrete forest stands isolated from each other by arid sagebrush high desert.

We conducted surveys in forty-seven patches of Douglas-fir, of a variety of health statuses and patch sizes. In each patch we placed three point count stations, resulting in 141 survey points, from which we collected one to two rounds of bird surveys and also basic vegetation and forest structure metrics. Field work was completed in August 2016 and data analyses are underway. 71 species of bird were detected over the course of the summer's surveys. The data from this study will be valuable to local land management agencies and also private landowners in the management of Douglas-fir stands, and also the added knowledge of their ecological value and significance in the context of avian use of heterogeneous landscapes.

OCCUPANCY OF MAMMALIAN CARNIVORES ON PRAIRIE DOG COLONIES AFFECTED BY PLAGUE

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Prairie dogs (*Cynomys* sp.) are highly susceptible to plague, and epizootics may have cascading effects on other species associated with their colonies. Colorado Parks and Wildlife is involved in a multi-agency study of plague management, in which oral vaccine treatments are compared to placebo baits and insecticidal dusting of prairie dog burrows. As an extension to this project, we have studied the effects of plague and plague management on avian species associated with colonies of black-tailed (*C. ludovicianus*: BTPD) and Gunnison's (*C. gunnisoni*: GUPD) prairie dogs from 2013 to present. In addition to bird sampling, we deployed motion-triggered remote cameras to estimate occupancy of mammalian carnivores, which predate on birds and nests and may also move plague-positive fleas across the landscape. Occupancy analyses are being run in Program MARK, comparing active colonies to those where prairie dogs have been extirpated or severely reduced in number following plague epizootics. In ~11 million photos, we have documented use of our study colonies by eight species of mammalian carnivores, with coyote (*Canis latrans*), swift fox (*Vulpes velox*), badger (*Taxidea taxus*), and striped skunk (*Mephitis mephitis*) being the most commonly detected. These species showed patterns in their occupancy rates that may be associated with changes in prairie dog activity. Occupancy rates also differed by prairie dog species, with swift fox and skunks detected only on BTPD sites and badgers more commonly detected there. Changes over time may also be associated with wetter than average weather in 2014–2015 that exacerbated plague events.

MOVEMENTS OF GOLDEN EAGLES WITHIN (INTO, THROUGH, AND OUT OF...) COLORADO

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Golden Eagles in the contiguous United States generally are thought to be year-round residents, with a portion of sub-adult segment of the population known to occasionally wander. However, recent data gathered from a study in the Four Corners area suggests that ‘wandering’ is very prevalent among Golden Eagles tracked after fledging, and even some territorial adult Golden Eagles that did not nest moved northward during the typical nesting season, strikingly similar to those followed as nestlings. Additionally, many Golden Eagles from northern latitudes migrate to more southerly areas each winter. Therefore, from May to March in any given year, a substantial proportion of non-breeding Golden Eagles may actually originate from outside Colorado. Given the paucity of information on Golden Eagle movements throughout the West and the many threats facing populations, Region 6 of the USFWS “extended” the Four Corners research on Golden Eagle movements and mortalities. Since 2014, we have attached backpack-style 45-g GPS-Platform Transmitter Terminals (PTTs) to adult, sub-adult, and nestling Golden Eagles in Wyoming, Colorado, and western Nebraska, and in 2015, we really focused in on southern and southwest Colorado. We recently concluded tagging efforts, but have already gathered significant survivorship, movement, and mortality data on Golden Eagles in Colorado, which is vital to the conservation and management of the species in western North America. Data analyses for portions of these data are underway, but we continue to gather data on numerous tagged birds in the state.

LAW ENFORCEMENT IN WILDLIFE MANAGEMENT AND A LAW ENFORCEMENT CASE STUDY

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Law Enforcement is an integral component of wildlife management. A subtopic to the presentation is “Poachers Beware!! You can run but you cannot hide”. During the presentation a brief history of wildlife laws will be covered, especially the pertinent ones relating to Colorado. There will be a quick review of the reasons for wildlife laws and review of State government and its importance. A discussion will take place on “What is poaching?” and some of the motives for wildlife violators followed by some of the enforcement tools used to combat poaching and recommendations for good sound wildlife laws. The presentation will conclude with a law enforcement case study which will showcase the impact that poachers have on our wildlife and the impacts on wildlife management.

SYNTHESIS OF BAT CURTAILMENT STUDIES

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Bat fatalities at wind energy facilities have been widely known since 2003. To reduce bat fatalities operational minimization strategies have been developed and implemented with successful results. In 2015, voluntary operational practices aimed at reducing bat fatalities from wind turbines by up to 30 percent were established by the wind power industry. These strategies will adjust the operation of wind turbines during the fall migration season when bats are at the highest risk of collision with moving turbine blades. Adjusting turbine blade rotation by changing cut-in speed (“turbine curtailment”) does potentially reduce energy generation and therefore leads to monetary losses to wind energy companies,

as well as losses in generated renewable energy which must then be generated by other means.

Here we provide an updated synthesis of results from publicly available turbine curtailment studies designed to reduce bat fatalities at wind energy facilities since 2009. Summaries and evaluations of the studies are provided. A synthesis of the results shows strong correlation between all bat fatality reductions with increasing cut-in speeds at operational facilities in North America. Additionally, studies that include feathering of turbine blades below the normal cut-in wind speed are evaluated and summarized. We provide examples of different curtailment strategies employed at different wind energy facilities and a summary of lessons learned from the most recent curtailment studies to be used for future operational wind facilities.

PRONGHORN MANAGEMENT AT F. E. WARREN AIR FORCE BASE

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The pronghorn (*Antilocapra americana*) (commonly known as "antelope") is a large ungulate found in central and western North America. They are the only extant member of their family and the fastest land mammal in the western hemisphere. Wyoming is home to a large pronghorn population and southeast Wyoming is prime habitat for them. The pronghorn at F. E. Warren Air Force Base present several unique management challenges. These pronghorn provide substantial wildlife viewing opportunities. Limited natural predators exist on Base and a bountiful food supply found on the golf course, lawns, and ornamental landscapes have led to high pronghorn counts (n=439) leading to conflicts. Pronghorn management is necessary to maintain the pronghorn social carrying capacity (n=150-175) of the Base and to ensure a viable and healthy population today and in the future. With mixed results and varying costs, wildlife professionals on Base have historically attempted numerous management strategies. Approaches undertaken have included limited buck harvest, adult capture and relocation, fawn capture and relocation, as well as sharpshooter-based population reduction. To better manage the antelope population on Base, future plans include a new "archery only" hunting season planned for 2017.

POWER LINE INFRASTRUCTURE – BIRD ELECTROCUTION AND COLLISION RISK ASSESSMENTS – MERGING OF POWER IN NORTH AMERICA AND A CHANGING PARADIGM

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Power lines are the common denominator for electric generation, transmission, and distribution, whether it involves renewable or conventional energy development and use. Bird interactions with power lines are multi-dimensional, and have been recognized over the last 25 years; however, the science in assessing bird fatalities from power line electrocutions and collisions has progressed significantly in the last decade. The Avian Power Line Interaction Committee (APLIC) is often cited as a source for conservation strategies, but current approaches in discerning between avian-power line electrocution and collision risks are inconsistent in the U.S. and in North America, and recommended mitigation can be flawed. Bird electrocution risks are dictated by voltage, structure configuration, and potential at-risk species. Bird collision risk applies to a range of voltage classes, typically reflecting site-specific ecological factors combined with infrastructure design. Understanding these variables is integral to the ever-evolving state-of-the-art science relative to birds, power line infrastructure, and regulatory

requirements. We will cover these evolving issues, communication challenges, tools and resources available to assess and minimize avian electrocution and collision risks with power lines, how these risk assessments should be structured, and recommended resolutions moving forward.

RESIDENTIAL DEVELOPMENT AND CLIMATE AFFECT HIBERNATION IN BLACK BEARS WITH IMPLICATIONS FOR HUMAN-BEAR CONFLICTS

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Expanding human development and climate change are dramatically altering habitat conditions for wildlife, but little is known about the effects of these factors on hibernation behavior, a crucial life-history trait for many species. While shifts in animal hibernation can have ecological consequences for seasonal patterns of behavior and demography, they can also influence rates of human-wildlife conflicts, an issue of growing concern for wildlife managers and conservation practitioners. We investigated factors associated with the initiation, duration and termination of hibernation in black bears (*Ursus americanus*), a species that readily forages on anthropogenic resources in developed landscapes and is strongly dependent on weather-related natural food productivity. Using data from 158 denning events of adult female bears, we assessed the influence of anthropogenic food use, natural food availability, and weather conditions on hibernation behavior. We found that hibernation was strongly dependent on local food availability (natural and human) and weather conditions. In the fall, black bears generally delayed hibernation when natural food resources were readily available or when they used anthropogenic food subsidies, and emerged earlier in the spring with warmer temperatures. Our results suggest that future changes in land-use and climate will increase the length of the 'active' season for bears, which is expected to result in subsequent increases in human-black bear conflicts and human-caused black bear mortalities.

DISTINGUISHING THE INFLUENCE OF PREY DISTRIBUTION, LANDSCAPE FEATURES, AND ANTHROPOGENIC DISTURBANCE ON PREDATION RISK

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Human-mediated landscape changes alter habitat configuration, which strongly structures species distributions and interspecific interactions. The impacts of anthropogenic landscape alterations on predator-prey relationships, increasingly recognized as fundamental to community structuring, are less well understood. We determined cause-specific mortality and investigated the relationship between predation sites, habitat features, and mule deer distributions using 313 mortality events and 350,000 GPS locations collected from winter fawns and adult female mule deer. Data were collected 2008–2014 in a critical winter range area of northwestern Colorado, in which two contiguous areas with markedly different degrees of energy extraction and distinct periods of high and low intensity development were leveraged to investigate the impacts of energy development on predation. The distribution of mule deer tended to be more informative of predation site characteristics than the distribution of landscape features alone, which was in support of our hypothesis. Predation risk was reduced in proximity to pipelines and well pads yet increased relative to roads. Snow depth and non-forested habitats were the key natural conditions structuring predation locations, with predation sites occurring in deeper snow and more than expected in non-forested habitats. Anthropogenic features had a greater influence on predation sites in the period of low activity than high activity, and natural landscape characteristics had less of an effect throughout the study, which were contrary to our expectations. The emergence of varied interactions between predation and landscape features across contexts and years highlights the complexity of interspecific interactions in landscapes altered by human activities.

STORIES OF SCIENCE: THE ROLE OF NARRATIVES IN RELATING RESEARCH TO THE PUBLIC

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The human brain evolved with narratives; we have learned for centuries through oral tradition and written stories. But what role can stories play in teaching science?

Narratives are less common in the world of science perhaps because there's a worry that the story aspect can detract from, or undermine, the facts. The facts however, on their own, are often too dry to interest very many people outside the world of research. Presenting research in a narrative format can engage the public—people relate to the characters, become involved in the action, and while they are captivated by the story, they are also learning.

People are fascinated by the world around them; we can capitalize on this interest and use narratives to teach the public about cutting edge research and conservation efforts.

For my talk, I will briefly discuss the research that has been done on how people process written information, explain how I write narrative science stories, and then show researchers how field research lends itself to becoming an engaging and educational story.

ECOREGIONAL CONSERVATION STRATEGIES FOR GOLDEN EAGLES IN THE WESTERN UNITED STATES

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The vulnerability of Golden Eagles to collision with wind turbine blades, combined with legal protection under the Bald and Golden Eagle Protection Act, has stimulated much research into mortality risk and mitigation strategies for this species. Comprehensive conservation planning for this species, however, is lacking. The U.S. Fish and Wildlife Service established the Western Golden Eagle Team (WGET) to

develop landscape-scale conservation strategies to support management of Golden Eagles in the western U.S. WGET is developing conservation strategies at the scale of the Commission for Environmental Cooperation Level III Ecoregions that can be scaled up to Bird Conservation Regions and Flyways. Each ecoregional conservation strategy consists of two parts: a technical assessment of current information pertaining to Golden Eagles and a conservation strategy to support regional management of the species. The conservation assessment provides information resources, data, and predictive models to support eagle management, including ecoregion-specific modeling of Golden Eagle seasonal habitats (breeding, winter, and movement) and exposure to threats (e.g. electrocution). The conservation strategy is based on research and modeling results compiled in the assessment, and provides risk assessments, spatial prioritization modeling, and decision support tools for energy development, mitigation, and eagle conservation planning. Conservation strategies are being developed in collaboration with numerous stakeholders, including State and Federal agencies, research institutions, industry, Tribes, and NGOs for integration with other regional conservation planning efforts. We will discuss the conservation strategy approach, showcase model results, and highlight the locally relevant High Plains and Southwestern Tablelands ecoregions.

ELK MANAGEMENT IN THE NATIONAL PARK SERVICE: TWO CASE STUDIES IN THE USE OF PUBLIC VOLUNTEERS

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The National Park Service (NPS) has recently engaged in new elk management programs at two national parks, Rocky Mountain (CO) and Theodore Roosevelt (ND). Both parks used public volunteers to cull elk and assist park managers in meeting specific elk population management goals. Each park implemented their volunteer elk removal programs in uniquely different ways based on the ecological and socio-political environments in which they reside. We interviewed NPS and state wildlife agency employees directly involved in the planning and execution of these programs, analyzed their interpretation of how key decisions were made in each situation and summarized implementation costs. Differences and similarities of each program including economic costs, how volunteers were engaged, as well as ecological, political and social outcomes are highlighted. Both programs were successful in removing elk and achieving management objectives and all agencies involved felt volunteers contributed to beneficial outcomes. We suggest that when the removal of ungulates from national parks is a necessary management action, public volunteers serving as park stewards and assistants may be a useful means to achieve desired management goals.

UNGULATE MIGRATIONS IN WYOMING: INCORPORATING NEW SCIENCE INTO WILDLIFE POLICY AND MANAGEMENT

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The cumulative effect of landscape scale development threatens the integrity of long distance ungulate migrations. The Wyoming Migration Initiative (WMI), in cooperation with the Wyoming Game and Fish Department (Department) and multiple partners, uses data from GPS collared ungulates to map migration corridors. Animals are captured and fitted with GPS collars and multiple locations are collected daily throughout an annual cycle of migration. With an adequate and representative sample of the population and through the use of Brownian Bridge Movement Models it is possible to statistically map migration corridors, stopover habitats and migration bottlenecks. The Wyoming Chapter of The Wildlife Society, WMI, and others helped the Department develop defensible definitions for each of these migration habitats. After an extensive public outreach effort, the Wyoming Game and Fish Commission designated migration corridors, stopover habitat, and bottlenecks as “Vital” in their mitigation policy. This policy directs the Department to work with project proponents on a case-by-case basis, “to recommend no significant declines in species distribution or abundance or loss of habitat function.” The Department is working to officially delineate migration habitats so that land management agencies and project proponents can consider these important landscape features in project planning.

THE INFLUENCE OF GREATER SAGE-GROUSE MANAGEMENT ON GOLDEN EAGLES IN THE WESTERN UNITED STATES

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Landscape-scale conservation strategies are currently underway to protect Greater Sage-Grouse (*Centrocercus urophasianus*) across vast areas (~310,000 km²) of the western United States (U.S.). Golden Eagles (*Aquila chrysaetos*) inhabit much of the sagebrush steppe where Greater Sage-Grouse occur and are also a species of conservation interest in the West. Because there may be substantial overlap between important habitat for Greater Sage-Grouse and Golden Eagles, and because both species face similar threats in parts of their range, there is an opportunity for Golden Eagles to benefit from Greater Sage-Grouse management. Our objective was to determine the amount of overlap between areas managed for Greater Sage-Grouse and seasonal habitats of Golden Eagles in the western U.S. We calculated the amount of spatial overlap between habitats protected by federally designated Priority Areas of Conservation (PACs) for Greater Sage-Grouse and relative habitat suitability models for Golden Eagles during the winter and breeding seasons using GIS. We found that Greater Sage-Grouse PACs contained a relatively large portion of Golden Eagle winter and breeding habitat, and that the amount of overlap varied among ecological provinces. Management actions on PACs may benefit Golden Eagles by preserving habitat and prey resources that may otherwise be lost without proactive management. Our work provides a spatially explicit framework for identifying areas where Golden Eagle conservation may be augmented by efforts to protect Greater Sage-Grouse, as well as areas where high quality Golden Eagle habitats could potentially be at risk if development and land-use impacts shift to areas outside of PACs.

STATE-AND-TRANSITION SIMULATION MODELING: A TOOL FOR ASSESSING THE INTERACTING EFFECTS OF CLIMATE, ECOLOGICAL PROCESSES, AND MANAGEMENT ON WILDLIFE HABITAT

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Scientific tools allow us to look far into past and future climates with increasing resolution. Despite the utility of these tools for anticipating future changes and contextualizing current observations in terms of broad-scale patterns, there is often a substantial gap between the science of climate and its ecological impacts, and more immediate and localized resource management challenges. Resource managers are frequently tasked with meeting seasonal, annual, or decadal management goals within specific management units and with limited resources. We describe two case studies that demonstrate these challenges and our approach to addressing them: the management of whitebark pine in the Greater Yellowstone Ecosystem (a key food source for grizzly bears) and rangelands in Southwest South Dakota (habitat for American bison). Our results suggest that state-and-transition simulation models (STSMs) can help reconcile the different scales, interactions, and nuances of climate science and resource management decision-making due to their ability to integrate data, represent specific management units, and explore “what if...?” climate and management scenarios. In addition to projecting future ecological conditions, STSMs can also be used for documenting assumptions about how systems work and identifying key information gaps (i.e., variables that are both uncertain and impactful). We conclude with a brief description of a related hands-on training session that will occur in Fort Collins in the summer of 2017.

THE USFWS WESTERN GOLDEN EAGLE TEAM: AN OVERVIEW

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U.S. Fish and Wildlife Service Regions 1, 2, 6 and 8 established the Western Golden Eagle Team (WGET) in 2013 to proactively address energy-related conservation needs of Golden Eagles (*Aquila chrysaetos*) in the western continental U.S. by developing landscape-scale conservation strategies. Development of conservation strategies will be informed by: 1) spatially explicit predictive models of golden eagle distribution and habitat; 2) spatially explicit assessments of threats; and 3) information resources to support management of Golden Eagles and their prey. Together, these products will allow identification of important areas for, and risks to, Golden Eagles, as well as ways to improve their management. Complete or near-complete WGET projects/products include: 1) ecoregion-based models of breeding habitat; 2) West-wide model of winter habitat; 3) West-wide analysis of golden eagle prey community composition and variability; 4) assessment of land management strategies for important prey species 5) Colorado/Wyoming landscape scale model of electrocution hazard; and 6) model to assess and rank electrocution risk of individual power poles. Projects in progress include, but are not limited to: 1) ecoregion-based conservation assessments and strategies for golden eagles 2) electrocution hazard models for Montana, Great Basin, and Columbia Plateau; 3) telemetry-based models of movement/migration patterns; 4) reviews and field assessments of contaminant and disease threats; 5) home-range, territory, and core area review; 6) population ecology review; 7) review and expert elicitation on disturbance effects and buffer distances; and 8) analysis of eagle mortalities at previously retrofitted power poles.

POSTER ABSTRACTS

TEN NEW LOCATIONS OF THE ENDANGERED NEW MEXICO MEADOW JUMPING MOUSE DETECTED ON TRIBAL LANDS IN SOUTHWESTERN COLORADO

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We conducted live-trapping presence surveys for the federally endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) in summers 2014 and 2015, and fall 2016. We focused our surveys in suitable habitat on the Southern Ute Indian Reservation in southwestern Colorado. As a result of these trapping efforts, we documented ten new localities along the Pine, Animas, Florida, Piedra, and San Juan Rivers or their associated tributaries within the Southern Ute Indian Reservation. Identification of these new populations is significant because this subspecies was previously known from only two locations in Colorado where the subspecies was inadvertently discovered during live-trapping surveys in 2007 and 2012. In 2014, the U.S. Fish and Wildlife Service reported only 29 populations of New Mexico meadow jumping mice were known to occur within its distribution. These included the two Colorado populations, as well as 15 populations in New Mexico and 12 in Arizona. If we assume each of the 10 new locations we documented represents a population, our discoveries increase the known populations of New Mexico meadow jumping mice by 33%.

PHYLOGENETICS OF CANINE DISTEMPER VIRUS (CDV) IN MESOCARNIVORES FROM NORTHERN COLORADO

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Canine Distemper Virus (CDV) is a highly contagious pathogen affecting wildlife and domestic animals. Peridomestic animals such as raccoons (*Procyon lotor*) experience outbreaks with high mortality. Clinical symptoms include anorexia, fever, respiratory infection, and neurological complications that may appear similar to rabies. CDV is not zoonotic, but poses a high risk to unvaccinated domestic animals. From 2013-2016, we opportunistically collected wild and domestic carnivore specimens through an enhanced rabies surveillance program in northern Colorado. Brainstem and cerebellum tissue samples were independently tested for rabies and CDV by Fluorescent Antibody Test (FAT). A total of 478 specimens were tested for CDV, comprised of 10 wild and domestic species. Raccoons and one coyote (*Canis latrans*) tested CDV positive, for a prevalence of 31% and 4% respectively; no co-infections were observed among rabies and CDV positive animals. RNA was extracted from positive tissues, and reverse-transcription polymerase chain reaction (RT-PCR) was used to create cDNA. The hemagglutinin (H) gene was amplified from 60 CDV-positive tissues, and products were cleaned and sequenced for phylogenetic analysis. A median joining network and maximum likelihood phylogenetic tree revealed two major lineages among samples. An online search using the Basic Local Alignment Search Tool (BLAST) in GenBank indicated the two major lineages are most similar to CDV strains found commonly circulating in North America: 1) the A75/17 ($n = 55$) and 2) Rockborn-Candur ($n = 5$) CDV strains.

In conclusion, the results indicate two distinct genetic clades of CDV overlapping geographically and temporally among raccoon populations in northern Colorado.

TESTING PERCH DETERRENDS AND SUPPLEMENTAL PERCHES DESIGNED TO MITIGATE RAPTOR ELECTROCUTIONS

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Avian electrocution is of global conservation concern. Electrocutions occur because most overhead power lines are constructed with bare wire, which reduces costs, but can place birds at risk of electrocution. Mitigation focuses primarily on covering energized wires and equipment. Sometimes covering components is infeasible, so perch deterrents and supplemental perches are used to shift raptors away from high risk points. Because perch management has met with limited success, we are working to identify strengths and weaknesses of the approach. We have completed two year-long studies, and are currently conducting another, evaluating effectiveness of perch deterrents and supplemental perches on mock power poles within a flight enclosure at the Rocky Mountain Raptor Program. To test a spiked perch deterrent designed to prevent raptor perching between insulators, we evaluated perching by 16 raptors; deterrents were perched on less than expected given their proportional availability. To test a supplemental perch, we compared perching on crossarms with and without a supplemental perch; the 17 raptors we tested used the supplemental perch more than expected given its proportional availability. These data demonstrate that at least in a captive setting, raptors can be shifted from high-risk perching locations on a pole. Our ongoing study builds on the two completed projects by evaluating the effectiveness of a combined perch deterrent and supplemental perch. Our poster will summarize and illustrate methods and results of all three studies.

EVALUATION OF POPULATION MONITORING STRATEGIES FOR GREATER SAGE-GROUSE (*Centrocercus urophasianus*) IN NORTHWESTERN COLORADO: GENETIC MARK-RECAPTURE AS AN ALTERNATIVE TO TRADITIONAL LEK COUNTS

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Recent declines in greater sage-grouse (*Centrocercus urophasianus*) populations and substantial restriction of pre-settlement distribution of the species have been observed nationwide. To better understand the status of greater sage-grouse and effectively manage the species and its habitats, researchers, managers, and policymakers require accurate and defensible population estimates based on sound monitoring techniques. For this reason, the development of innovative methods to evaluate the lek count index and monitor greater sage-grouse populations has been called upon as a focus for researchers.

We employed a non-invasive, genetic mark-recapture (GMR) method to estimate abundance and pre-breeding sex ratio of a small, low-density population of greater sage-grouse in northwestern Colorado. Surveys to locate and sample flock locations were conducted during two consecutive winter seasons from 2012-2014. We collected nearly 2,500 fecal pellet and feather samples to identify individual birds and their recapture histories using DNA extraction, polymerase chain reaction (PCR), and fragment

analysis methods developed by the USGS Molecular Ecology Laboratory in Fort Collins, CO. Population abundance and sex ratio estimates were obtained using closed mark-recapture models in Program MARK. We will be presenting our final analysis and conclusions from this study.

NATIONAL WILDLIFE DISEASE PROGRAM ARCHIVES

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Wildlife Services developed the National Wildlife Disease Program (NWDP) to protect human health, agriculture, and ecosystems by conducting wildlife disease surveillance and monitoring across the United States. The program's Wildlife biologists collect thousands of samples annually across the country from a variety of wild birds and mammals that carry pathogens of concern to humans, livestock, and wildlife. The NWDP maintains a number of archives containing samples that are routinely tested for diseases which have the potential to affect one or more of these sectors. The programs archives are unique in their quantity of samples, diversity of species, broad geographic range, and consistent sampling effort over time. The archives also serve as a repository available to any federal, state, or tribal agency, university or nongovernmental collaborators to use for additional pathogen testing and research. Examples of past testing and collaborations include emerging disease diagnosis, wildlife health studies, and assay method validations which continue to support the NWDP's mission of providing a nationally coordinated system of surveillance for diseases of concern in wildlife.

LITTLE BROWN BAT (*Myotis lucifugus*) MATERNITY COLONY MONITORING IN THE YAMPA VALLEY: SITE FIDELITY AND EARLY EFFORTS TO ASSESS TAG LOSS

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North American populations of the little brown bat (*Myotis lucifugus*) have undergone precipitous declines due to White Nose Syndrome (WNS). Most of these population impacts have been in eastern North America, but WNS appears to be moving westward. The dramatic population declines at cave and mine hibernacula have made the severity of WNS clear, yet there are many regions of North America where bat roosts are more dispersed and less conspicuous, making it more challenging to document population-level impacts. In western North America there are fewer known hibernating colonies that would allow diagnosis of dramatic population changes. Thus, monitoring maternity colonies may be a valid method of documenting persistence of western populations. We have conducted mark-recapture of two little brown bat maternity colonies in the Yampa Valley of northern Colorado, USA. In the third year of the project we provide insights into little brown bat roost site fidelity, and discuss temporal roost use patterns for individuals. Additionally, we document preliminary efforts to determine passive-integrated transponder tag loss by using a catalog of wing photographs for individual bats.

EFFECTS OF SOURCE POPULATION AND RELEASE STRATEGY ON SURVIVAL AND DISPERSAL OF TRANSLOCATED SCALED QUAIL IN TEXAS

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Scaled quail (*Callipepla squamata*) have experienced a steep, range-wide decline within the last 50 years. Similar declines have been documented in many species of gallinaceous grassland birds and the most widely accepted drivers are loss, fragmentation, and degradation of grassland habitats across the continent. Habitat loss that has contributed to scaled quail decline also inhibits recolonization. Translocation has become an increasingly popular tool to reestablish populations for recreational or conservational purposes. Overall success rate of translocations is low and has prompted research into factors that contribute to the establishment of a self-sustaining population. Source population and release strategy are two translocation tactics that may influence the success of scaled quail translocation efforts. Best practices for translocation are often species and location specific and, thus, it is critical for translocation techniques to be tested across a variety of species and landscapes. Our objective is to evaluate survival and dispersal of wild-caught, translocated scaled quail sourced from two distinct ecoregions in Texas and released using a delayed strategy consisting of 4-8 week holding period treatments. We will use a multi-state framework in Program MARK to estimate weekly survival and movement probabilities of radio-tagged hens for 9 months post release.

CALCIUM INCREASES REPRODUCTIVE SUCCESS IN NESTING TREE SWALLOWS

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Understanding the role that nutrients, such as calcium, play in the reproduction and fitness of organisms is important to conservation efforts and management. Calcium is necessary in avian egg production and chick growth and has been shown to be a limiting factor in many systems. We used calcium supplementation as a means of assessing the extent to which calcium availability affects Tree Swallow reproduction in a high altitude, non-acidic environment. At the start of nest construction, nest boxes at the study site were randomly assigned to either a calcium treatment or a control treatment. Calcium treated nests were supplemented with crushed oyster shell in a tray on the top of the nest box, while control nests had the same tray and were instead supplemented with sand. Throughout the breeding season, reproductive parameters including clutch size, egg volume, and hatching success were measured.

For calcium supplemented nests, hatching success was nearly 20% higher and clutch size increased by 0.5 eggs than controls. Increased reproductive parameters for the calcium treated nests may imply that calcium is a limiting factor for Tree Swallow reproduction, especially in a high-altitude environment where effects of calcium availability may be amplified by the harsh environment and short growing season. Knowing that higher calcium availability increases reproductive success and fitness of this population can aid in the conservation for this species, as well as all aerial insectivores whose populations have been declining.

SWARMING SURVEYS IN COLORADO: STANDARDIZED SAMPLING AND EVALUATION AS A POTENTIAL VECTOR FOR THE TRANSMISSION OF WHITE-NOSE SYNDROME IN BATS

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Information on roost usage by bat species, particularly those used as hibernacula and for swarming, is needed before making management decisions, particularly those related to White-nose Syndrome (WNS). Swarming in bats is thought to occur when individuals aggregate, typically at a cave, and interact through repeated circling, diving, chasing, and landing events. The behavior could serve multiple social purposes including mating and orientation of young bats for migration or with potential hibernacula. The objectives of these surveys were to determine to what extent swarming occurs at caves in Colorado with known bat use, to quantitatively evaluate swarming activity at sites where it does occur to establish relative indexes of swarming activity, and to simultaneously examine swarming levels between closely situated caves. We conducted swarming surveys on 12 nights at 15 caves during the autumns of 2011-2014. At the cave portal bat passes were tallied. Internal counts of chasing, landing, and copulation were collected. Most caves previously known to be used by bats exhibited at least some swarming and 4 copulation events were noted. High activity levels occurred at multiple caves in the same area simultaneously indicating that one group of bats isn't moving between sites and accounting for all of the activity. At the same time, marked individuals were sighted visiting more than one cave in the same night. Swarming may act as a vector in the transmission of *Pseudogymnoascus destructans* and spread of WNS as bats often land on walls and ceilings, and interact directly during such activities.

SPATIAL PATTERNS OF HABITAT USE BY INCUBATING MOUNTAIN PLOVERS IN A MIXED HABITAT AND OWNERSHIP LANDSCAPE

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The mountain plover (*Charadrius montanus*) is a migratory shorebird that breeds in rangelands of the western Great Plains. Populations have declined sharply since the 1960s and the species is of conservation concern in most states and provinces where it occurs. Nesting behavior involves an unusual split-clutch mating system; females typically lay 3 eggs in a nest tended entirely by the male, before laying another 3 eggs in a different nest for the female. Mated birds do not provision each other during the incubation and brood-rearing periods (~29 and ~35 days, respectively). Because of this, nesting habitat must also provide efficient foraging for incubating adults. Nesting has been documented on fallowed cultivated fields since the early 1990s, but specific information about behavior and habitat use during incubation of cropland nests is lacking. To determine how incubating plovers use habitat in a mixed habitat and ownership landscape, we deployed and recovered 11 miniature global positioning system (GPS) dataloggers on plovers incubating nests on agricultural fields, prescribed burns, and active prairie dog colonies in Weld County, Colorado. We programmed the dataloggers to collect approximately 120+ locations randomized across ~6+ days. Nine of 11 plovers used >1 habitat type and property under multiple ownerships during incubation. These data will help understand how landscape level habitat fragmentation brought about by changes in farming economics, energy development, and/or climate may impact mountain plover breeding biology.

IMPACT OF HUMAN RECREATION ON TEMPORAL ACTIVITY OF AMERICAN BLACK BEARS

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Low densities combined with large home ranges, use of inaccessible habitat, and reclusive behavior make it difficult to monitor populations of black bear (*Ursus americanus*) in Colorado. An alternative to estimating black bear populations has been to monitor the impact of human disturbance on black bear behavior. A total of 5 remote-triggered cameras were deployed at Hall Ranch and Walker Ranch simultaneously to determine the frequency at which black bears utilized hiking trails and if trail use varied temporally based on dog-policy. Both parks yielded 70,136 images of recreationists and wildlife. A total of 10 black bears were detected at Hall Ranch, while only 2 black bears were detected at Walker Ranch. The results indicate that black bear activity at the two parks does not vary temporally. The low detection rate at Walker Ranch could be explained by the higher percentage (30%) of recreation use, as well as dogs being allowed on trails. Research into how black bears are utilizing Open Space Parks could aid wildlife managers in determining future park policies and future trail planning.

FULL LIFE-CYCLE MONITORING OF BURROWING OWLS (*athene cunicularia*) IN SOUTHEASTERN COLORADO

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Burrowing owls are in steep decline in many portions of their range in western North America. However, over the past 20 years, burrowing owl populations within the shortgrass prairie region have been stable or increasing. One possible explanation for this may be differences in migratory habits of populations within the shortgrass prairie. In recent years there has been increased attention focused on full life-cycle monitoring of birds to assess whether differences in migratory paths and wintering locations may help explain regional variation in population trends seen on the breeding grounds. In 2015 we initiated a project in Pueblo County, Colorado to monitor burrowing owl movements between breeding and wintering grounds. Two female burrowing owls were fitted with satellite transmitters (solar PTT tags) in June of 2015 at Pueblo Chemical Depot, and we successfully tracked movements across multiple seasons (one individual's PTT is currently still transmitting). Migratory paths were similar between individuals within the United States, though paths diverged dramatically once individuals reached Mexico. One individual wintered near Mexico City, which is one of the southern-most records for a wintering burrowing owl from the United States. This project is part of a larger, multi-partner effort to assess migratory habits of burrowing owls across the western United States and Canada. Additional PTTs will be deployed in summer 2017.

THE USFWS WESTERN GOLDEN EAGLE TEAM: AN OVERVIEW

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HABITAT CHARACTERISTICS AND HIBERNATION EMERGENCE OF THE FEDERALLY ENDANGERED NEW MEXICO MEADOW JUMPING MOUSE IN SOUTHWESTERN COLORADO

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In southern Colorado, only one study of New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; hereafter NMMJM) provides a general description of its habitat in this part of its distribution (Jones 1999) and until recently, only two confirmed populations of NMMJM were known to occur in Colorado since 2005 (USFWS 2014). Since 2014, ten new locations of NMMJM have been detected on tribal lands in southwestern Colorado (Zahratka et al. in review), thereby underscoring the importance of understanding the vegetation characteristics of habitat where this subspecies occurs. Therefore, to support recovery of NMMJM in Colorado, we investigated habitat associations, as well as hibernation emergence patterns of NMMJM at Sambrito Wetlands Area, one of the two previously known locations of NMMJM in Colorado. We conducted live-trapping and vegetation surveys in 2014 and 2015. The overall vegetation attributes we measured at capture locations are consistent with previous assertions that herbaceous vegetation >61 cm in height is a necessary component of suitable habitat for NMMJM. However, our vegetation data suggest that within the riparian corridor (i.e., 5 meters of flowing water for our study), slightly taller horizontal cover about 1 meter in height is important, and standing vegetation (i.e., grasses, sedges, and rushes) may be more important to NMMJM than forbs. The earliest emergence observed was May 21 for males and June 6-11 for females, suggesting a minimum 16-day hibernation emergence lag between the sexes – a lag time slightly longer than previously recorded.

CINNAMON TEAL NESTING SUCCESS IN THE SAN LUIS VALLEY

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Cinnamon teal (*Anas cyanoptera*) are an iconic species of the west and breed in higher densities in Colorado than nearly any other state. The foundation of effective waterfowl management is an abundant and resilient waterfowl population, which begins with an understanding of what drives population size and growth. Population growth rate is the product of a number of vital rates, all of which remain relatively unknown for cinnamon teal. In order to augment the information that currently exists, we are in the process of investigating several environmental (e.g. visual obstruction rating, clutch size, and distance to water) and temporal factors (e.g. nest age and timing of nest initiation) affecting nest success of cinnamon teal on Monte Vista National Wildlife Refuge. We found 40 cinnamon teal nests in both 2015 and 2016 with nest success rates of 14.4% and 16.0%, respectively. Nest initiation date and visual obstruction rating had the largest influences on nest success, with earlier nests and nests surrounded by higher vegetation having higher probabilities of success. These results will inform management practices throughout the San Luis Valley refuge complex, for whom cinnamon teal are a focal species. This research project is ongoing and more nests will be monitored during the 2017 breeding season.

SHOREBIRD USE OF MILITARY LANDS IN INTERIOR ALASKA

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Shorebird populations are declining globally and little is known about the use and distribution of breeding species in interior Alaska. The Program for Regional and International Shorebird Monitoring (PRISM) has developed shorebird survey methodology, with most effort in the Arctic and less effort in the boreal forest region. We fill this information void by using PRISM methods to estimate shorebird use of military lands in interior Alaska on Tanana Flats Training Area and Donnelley Training Areas (Fairbanks and Delta Junction, Alaska). We conducted surveys to (1) identify shorebird species using military lands, and (2) create occupancy/use models for these species and determine associated habitat covariates. We predicted species-specific covariate relationships (e.g., elevation, shrub height, distance to water). In general, we predict that shorebirds would more likely use open shrub and wet grassland Viereck habitat classifications. Using a stratified random sampling design, we surveyed 78 plots (400x400 m) twice. We found 6 shorebird species of moderate to high conservation concern as listed by the Alaska Shorebird Conservation Plan and 4 species of conservation concern as listed by the USFWS. For Lesser Yellowlegs, Wilson's Snipe, and Spotted Sandpiper we will present correlations of use with variables of interest derived from occupancy/use models.