** Investigating the Effect of Forestry Management Practices on Bat Habitat Selection in a Fire Prone Ecosystem

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*Indicates Presenter

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Bats in temperate North America (NA) are suffering from declining populations related to the reduction of roosting and foraging habitat, wind energy development, climate change, and the introduction of disease. Although some information is known about the ecology and behavior of bat species in eastern NA, much less is known about the general ecology and habitat needs of bats in the West. To help fill this gap and understand how bats are using western forests, we are researching bat habitat selection in southeastern Montana, with the goal of understanding how bats respond to forestry management practices utilized by the Bureau of Land Management to minimize stand-replacing wildfires. Bats captured on the landscape were tagged with VHF radio tags and tracked to roosts using both drone-based and ground telemetry methods. With the use of drone telemetry, we tracked bats for thirteen days to 14 unique roosts (rock and snags were used). These data were then compared to forestry treatment methods (control, burn, mastication, and thinning) to understand patterns and trends in bat use. Here we present preliminary results from the 2025 field season, detailing successes and challenges in studying cryptic animals in a vast landscape.

** Understanding Landowner Decisions to Secure Bear Attractants in the Bitterroot Valley

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Human–bear conflict remains a challenge in western Montana, with many conflicts driven by unsecured anthropogenic attractants. While attractant securement is widely promoted as an effective mitigation strategy, less is known about how landowners decide whether and when to adopt these practices. This study examines how reference groups and risk perception influence landowners' decisions to secure bear attractants in the Bitterroot Valley. We conducted semi-structured interviews with private landowners in the Bitterroot Valley. Interviews examined perceptions of bear presence and risk, social influences on management decisions, and experiences with wildlife. Interview data was analyzed using thematic analysis to identify patterns in decision-making related to attractant securement. Emerging findings suggest that perceived risk is strongly influenced by direct experience with bears, particularly knowledge of bear presence on one's property. Landowners who had observed bears or evidence of bear activity frequently described increased concern and greater motivation to secure attractants. Reference groups were largely interpersonal and local, with neighbors and close social contacts serving as primary sources of information and behavioral cues. These social interactions influenced how participants assessed risk and evaluated which attractant management behaviors were necessary or socially appropriate. These preliminary results underscore the importance of accounting for lived experience and local social networks in human-bear conflict mitigation efforts. Management strategies that engage trusted community members and acknowledge experiential knowledge may improve adoption of attractant securement practices.

Movement-Based Parturition Detection Methods for Elk Neonate Captures - A Case Study

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Accurate estimates of neonate survival and mortality rates can provide valuable information to effectively manage ungulate populations. To obtain these estimates, researchers often need to capture neonates, which can be challenging. Typically, researchers capture neonates opportunistically or by deploying vaginally implanted transmitters (VITs) in pregnant females, but these methods are not always effective or feasible. Female ungulates display distinct movement behaviors around parturition, which have been used to identify birth events and locate neonates for capture. To improve efficiency of detecting parturition events and capturing neonates to estimate elk (Cervus canadensis) calf survival in northwest Montana, we developed a movement-based parturition detection workflow. We used a threshold-based approach with four movement metrics (home range size, residence time, velocity, and displacement) to identify potential birth events from collared female elk. We created an automated workflow in R that calculated movement metrics and displayed recent GPS data and combined this workflow with a structured search process to locate elk neonates in the field. Using this movement-based detection method, we detected and captured 41 neonate elk in 2024 and 40 in 2025. Although imperfect, this method of detecting birth events from collared females' movement behavior was more effective in our study area than opportunistic or VIT-based methods. We believe this method could be widely applicable to other neonate ungulate capture efforts and recommend its use as an alternative or addition to existing methods.

Increasing Tolerance for Wildlife on Private Lands in Montana's Great Plains Region

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Private landowners in Montana make critical land management decisions that influence ecological conditions and wildlife coexistence across both private and adjacent public lands. American Prairie's Wild Sky Program works with landowners in Central Montana to increase tolerance for wildlife and incentivize wildlife-friendly management practices through direct economic incentives. The program currently includes 21 participants and more than 80,000 deeded acres. Participating landowners receive payments for wildlife documented on their properties via trail cameras, with incentives ranging from $25 per image of a coyote to $500 for a wolf or grizzly bear. Additional payments support wildlife-friendly practices such as fence modifications, carnivore coexistence agreements, and range riding. In 2025, Wild Sky distributed more than $80,000 to participating landowners. The program is also collecting social science data to assess changes in participant attitudes toward wildlife and coexistence. Together, these efforts aim to strengthen conservation outcomes on working lands while supporting the people who steward them.

Elk And Mule Deer Nutrition Modeled at Landscape Scales Using Machine Learning and Remotely Sensed Data

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The availability and distribution of nutritional resources for elk and mule deer is one of the defining characteristics of their habitat in Montana, representing a key bottom-up factor that drives individual- and population-level responses. Elk and mule deer conservation and management is therefore improved by quantifying the environmental characteristics that drive spatial and temporal heterogeneity in nutritional abundance and quality at landscape scales. Much of the existing work modeling nutritional landscapes has relied on intensive field surveys. In this study, we used data collected in multiple such studies across western Montana as training data to predict the distribution of forage for elk and mule deer across the entire region for each year 2012-2024. While many studies have incorporated remotely sensed data to improve nutritional landscape predictions at large scales, vegetation indices (e.g., NDVI) may not in themselves accurately reflect biologically relevant conditions, especially where dense forest cover precludes direct observation from space. Instead, the best nutritional landscape models likely couple directly measured vegetation characteristics with ancillary environmental covariates that drive vegetation distribution and phenology. We therefore modeled elk and mule deer nutritional landscapes as a function of metrics of land cover, topography, weather, soil chemistry and texture, climatic water balance, and disturbance by fire and timber harvest. We report on the environmental covariates and spatial modeling techniques that contributed to high model accuracy across the region, including maps of interannual variability that may improve our understanding of dynamic nutritional landscapes and inform further efforts in elk and mule deer management.

** The Distribution of Bison Wallows in the Mixed Grass Prairie of North-Central Montana (Poster)

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As ecosystem engineers, plains bison (*Bison bison bison*) shape their environment and increase overall landscape heterogeneity through intensive grazing and wallowing. Wallowing is when bison roll on their backs and sides, creating bare depressed patches of soil. The subsequent wallows have been shown to provide habitat for many organisms including insects, amphibians, and flowering plants. Despite their importance to landscape heterogeneity, it is not well understood what factors influence their distribution across landscapes where bison are present. Our study took place in two fenced bison pastures in north-central Montana managed by American Prairie, which focuses on the restoration of bison to private nature reserves. We collected drone imagery from 45 randomly selected 500x500 meter plots across the two pastures. We annotated the imagery in ArcGIS Pro to identify locations and characteristics of wallowing sites. The drone imagery was then used to calculate bison wallow density. We analyzed the relationships between wallow density, environmental characteristics, and bison movement behavior. The environmental characteristics included presence or absence of other mammal species, slope, and land cover. We estimated bison intensity of use with a dynamic Brownian bridge movement model from over 100 GPS ear tagged bison. These results improve our understanding of where wallows are distributed across the landscape. By uncovering the relationships between bison wallows, environmental characteristics, and bison behavior, we can better predict where and to what extent bison reintroductions will impact landscape heterogeneity.

** Factors Influencing Plains Bison Group Stability and Fission Fusion Events

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Plains bison (*Bison bison bison*), a keystone species in North American grasslands, exhibit fission-fusion dynamics in which they break into smaller groups and coalesce into larger groups over time. However, it is unclear what social and environmental factors drive these dynamics. We utilized movement data from solar-powered GPS ear tags to examine fission and fusion dynamics for three bison herds over multiple years at American Prairie in northcentral Montana. We simultaneously tracked between 25 and 90% of the adult female bison in each herd, allowing us to identify the factors influencing changes in group composition. We classified time steps as either containing a fission or a fusion, characterized by at least two bison leaving or joining a group. Groups were defined based on the percentage overlap of utilization polygons generated with the CTMM package in R. We investigated the impact of environmental and social factors on both the probability that a timestep will contain a fission or fusion event and the duration of a group's stability. Our environmental variables include remotely sensed metrics of forage quality, forage quantity, and landcover. Social variables include group size, composition, and average relatedness. Our results suggest that both social and environmental factors impact fission fusion probability and group size, though different aspects of group dynamics respond to different ecological factors. Since the keystone role of bison is tied to their intensive grazing and collective movements, it is important to understand how the size and composition of groups change over time and environmental characteristics.

Characterizing Reproductive States in Canada Lynx (*Lynx Canadensis*) and Wolverine (*Gulo Gulo*) Using Non-Invasively Sampled Fecal Hormones

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Non-invasively collected samples such as feces and hair are regularly used in wildlife management to identify species' presence on the landscape. In some cases, genetic methods can be used to identify sex and specific individuals from these sample types when materials are high quality. Identifying reproductive state non-invasively is more challenging. We evaluated potential hormonal markers of reproduction for Canada lynx (*Lynx canadensis*) and wolverine (*Gulo gulo*) in non-invasively collected scat. We describe validation of assays for fecal progesterone, prostaglandin metabolites, and cortisol and describe how seasonal patterns of these hormone metabolites are altered by reproductive state. We discuss the utility of endocrine measures for non-invasively monitoring reproductive state in forest carnivores of conservation interest.

Cattle Influence on Ungulate Habitat Use in Eastern Montana (Poster)

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Several studies have explored interactions between cattle and deer, specifically those associated with disease transmission and direct and indirect competition. These interactions may be further exaggerated immediately surrounding shared, limiting resources. In semi-arid prairie ecosystems, where grazing is common and water is limited, riparian sites may increase interactions and fine scale competition between cattle and deer. Understanding spatiotemporal overlap may help inform these potential interactions. For example, past studies highlight behavioral changes in mule deer when cattle are present, suggesting that mule deer shift to a more nocturnal activity pattern. We will examine spatiotemporal partitioning around prairie streams where deer and cattle share habitat. We set 63 camera traps across 5 prairie streams in northeastern Montana from June through September to record crepuscular and nighttime activity, capturing activity from 7pm to 7am nightly. We captured cattle use at 18 sites across 4 streams and deer activity at 48 sites across 5 streams. Image data, including time and location of activity, will be analyzed to assess overlap and partitioning behavior between deer and cattle. Initial results suggest that deer shift their activity patterns in response to the presence of cows.

Comparing Camera-Based Ungulate Density Estimates: A Case Study Using an Island Population of Bighorn Sheep

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Camera-based abundance estimators are an alternative methodology of growing interest in both research and management applications. The statistical formulations of camera-based abundance estimators using time-lapse data should theoretically produce precise and unbiased estimates; however, production of unbiased results also requires meeting several important assumptions, and real-world case studies evaluating such results remain relatively few. We applied instantaneous sampling (IS) and space-to-event (STE) estimators to remote camera data collected in April 2021 via time-lapse sampling of closed populations of bighorn sheep (*Ovis canadensis*) and mule deer (*Odocoileus hemionus*) on Wild Horse Island in western Montana, USA, and compared results for bighorn sheep to aerial and ground-based counts. Point estimates from camera-based approaches underestimated bighorn sheep populations by 32–44% (IS estimator) and 62–69% (STE estimator) relative to aerial and ground counts. Patchy spatial distribution and group-living behavior of sheep resulted in a high degree of noise surrounding the IS estimate. In comparison, a low point estimate with relatively narrow confidence intervals suggested potential sensitivity of the STE estimator to violating assumptions of independence among individual animals and sampling occasions. Estimates of mule deer had improved precision over sheep estimates, as indicated by lower estimated coefficients of variation of the mean (CVmean) derived from the analytic SE estimator. Using 15-m viewsheds and the IS estimators, mule deer density estimates came with a 26% CVmean compared to 43% CVmean for bighorn sheep. This discrepancy may be a result of differences in distribution, behavior, and relative abundance between the 2 species. Accounting for group size and increasing time between sampling may improve accuracy of density estimates and adhere better to model assumptions when estimating precision. In addition, factors influencing viewshed and resulting density extrapolations must be considered carefully. While camera-based methods theoretically provide an alternative way to estimate density when traditional methods are impractical, our results suggest that more work is needed to ensure density estimates are accurate and precise enough to inform population management.

Using eDNA to Determine Occupancy of Coeur D'Alene Salamanders

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Coeur d'Alene salamanders (*Plethodon idahoensis*) are found in small, isolated populations in the mountains of Montana, Idaho and British Columbia. Effective conservation of this species hinges upon understanding population distribution and connectivity; however, identifying occupied Coeur d'Alene salamander (CDL) sites is challenging. Surveys in Montana have been haphazard and have involved biologists searching potential sites during rainy nights in the early summer. To evaluate alternative survey methods, we sampled water at known-occupied CDL sites across western Montana to evaluate the efficacy and applicability of using environmental DNA (eDNA) to detect CDLs, as well as covariates that impacted CDL detection. We first developed a species-specific eDNA Taqman® quantitative PCR assay. We then used repeated eDNA sampling to evaluate how different environmental covariates would impact detection probability of CDLs and used these results to recommend a survey protocol. We found that optimal eDNA sampling conditions for CDLs occurred at night, within 50 m of the downstream extent of preferred salamander habitat, and at lower water flow rates. Under these conditions, five,5-L water samples were required to achieve a detection rate above 79%. The results of this study revealed that eDNA analysis is a viable method to estimate CDL occupancy at potential sites across their range; however, eDNA analysis can be costly, so combining this method with visual searches is advised.

** Riparian Songbird Condition Reflects Both Diet Quality and Metal Exposure in the Mining-Impaired Upper Clark Fork River Superfund (Poster)

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Mining contamination is a widespread ecological disturbance with disproportionate effects on river and riparian ecosystems that support breeding birds. Riparian songbirds rely heavily on insects to fuel their breeding seasons, particularly high-quality emergent aquatic insects. Elevated metals from mine waste can cause mortality during insect metamorphosis, limiting the availability of aquatic prey, or they can accumulate in insect tissues, causing toxic metal exposure. Thus, diet mediates a dual risk of metal exposure and nutritional stress for riparian birds, yet the relative importance of these stressors remains unresolved. To evaluate diet-mediated effects of mining contamination, we measured nestling body condition (fat score and size-corrected mass), telomere length (qPCR), diet composition (DNA metabarcoding), and blood metal concentrations (Pb, As, Cd, Cu, Zn, Se; ICP-MS) in four riparian songbird species sampled across the heavily contaminated Upper Clark Fork River watershed in 2022–2023. Blood metal concentrations were highest at the most contaminated sites, with species-specific patterns consistent with predicted reliance on aquatic versus terrestrial prey. Hierarchical Bayesian structural equation models revealed site-specific relationships among diet, metal exposure, and condition. Generally, greater reliance on aquatic prey was associated with higher fat scores and lower metal accumulation. Surprisingly, overall metal burden was not associated with condition; instead, higher lead and copper predicted lower condition, whereas higher selenium and arsenic were associated with improved condition, suggesting antagonistic or protective effects among metals. These results highlight the importance of diet and the complexity of metal mixtures as stressors for riparian birds in mining-contaminated systems.

** Understanding Yellowstone's Loons: an Integrated Approach for Long-Term Monitoring Data (Poster)

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In the Greater Yellowstone Ecosystem, a small, disjunct population of common loons (*Gavia immer*) persists as a unique stronghold amid historical range contraction. Despite being both highly valued by visitors and intensively managed by biologists, little can be said about the population's status or trajectory. We aim to apply an integrated approach to leverage information from disparate datasets into one modeling framework. Using yearly breeding pair counts, chick production numbers, and band resights from marked individuals, we are developing an integrated population model (IPM) to estimate the parameters that drive population change. This work aims to improve managers' understanding of the conservation status of loons in Yellowstone and to inform more effective allocation of monitoring and management efforts.

Monitoring Movements of Montana Bat Species Using the Motus Wildlife Tracking System

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Since 2018, Tetra Tech and MPG Ranch have collaborated to investigate local and migratory movements of bats using the Motus Wildlife Tracking System (Motus) across the Bitterroot Valley and the continental United States. Motus relies on coded VHF radio transmitters and a world-wide array of automated receivers to detect individual movements. Our project, based in the intermountain west, produces key insights that fill research gaps about bats in Montana and the surrounding region. Home ranges are one of many research gaps surrounding local bat populations, and the Motus network's passive monitoring system offers a unique tool to study this important element of bat ecology. The little brown bat (*Myotis lucifugus*) has a relatively small home range and therefore represents an excellent test species. This study provides the first analysis of little brown bat home ranges in Montana, despite the species being widely distributed and relatively common across the state. This research also evaluated how many tagged little brown bats are needed to capture the variation in individual home ranges. Evaluating the best tools to study and monitor this species is particularly relevant given the species is under discretionary review by the U.S. Fish and Wildlife Service for protection under the Endangered Species Act.

** Evaluating the Direct and Indirect Effects of Harvest on Variation in Group Composition and Group Size for Grey Wolves in Idaho (Poster)

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For cooperative breeders, like grey wolves (*Canis lupus*), that live in groups where non-breeding individuals share in the care of offspring, human-caused mortality can affect group members through changes to social hierarchies, reproduction, survival, and other demographic processes that structure groups. Prey availability and competition further influence demographic processes and likely have interactive effects with harvest. Despite extensive research, we still lack a full understanding of the mechanisms through which harvest affects wolf groups, or how these effects may be moderated by prey availability and competition. Our objective is to identify the direct and indirect mechanisms through which harvest most strongly influences different age and breeding classes and determine how prey availability and competition interact with harvest to affect group composition and size in wolves of Idaho, USA. Using an 18-year genetic dataset and a structural equation modelling framework, we hypothesize that beyond direct mortality, harvest most strongly affects 1) recruitment of pups by altering the composition of breeders and non-breeders, 2) dispersal of non-breeders by altering competition for breeding opportunities, and 3) the frequency of multiple breeding individuals in a group through social disruption. We further hypothesize that greater prey availability and competition will mediate these relationships by altering inter-group competition for food, breeding opportunities, and territories. Uncovering the direct and indirect mechanisms through which harvest most strongly influences group composition and size, and how the landscape-level context of resource availability and competition alters these relationships can allow for more informed management decisions and targeted management actions.

Pronounced Effects of Hunter Harvest on Mountain Goats in the Case of Small and Demographically Fragmented Populations

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With spatially patchy population structuring, slow life history, and relatively high vulnerability of reproductive-aged females to harvest, mountain goats are a species where the intersection of small populations and harvest management has important implications. There are rules of thumb for harvest rates of mountain goats, but how to define population units when applying such rules can be unclear. We combined historic data for hunter harvest of mountain goats in Montana with population projection matrix models to explore goat dynamics under harvest management. First, we used historic hunter harvest data to assess the evidence that hunting played a role in native mountain goat population declines. Next, we assessed the implications of spatial structuring of goat populations when applying recommend harvest rates to populations in the future. Rectifying simulated population dynamics with historic hunter harvest data suggests over-harvest to be a likely culprit behind declines in several native populations in Montana, even under an assumption of otherwise favorable demographic conditions. Second, the spatial management of harvest can strongly influence the impacts of harvest going forward, with potential to exacerbate harvest effects if unevenly prescribed across subpopulations.

Migration Patterns of Turkey Vultures and Ospreys and Opportunities for Collaborative Research Using Long-Term GPS Movement Data

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Advances in GPS technology have made it increasingly common for organizations to collect detailed migration data for wide-ranging bird species. These datasets provide extensive information on migration routes and timing, stopover behavior, individual- and population-level variation in migration, and seasonal use of overwintering and breeding areas. Here, we use long-term GPS datasets to show broad migration patterns for two species that breed and migrate through Montana: Ospreys (*Pandion haliaetus*) and Turkey Vultures (*Cathartes aura*). We present visualizations of migration routes, stopovers, and overwintering locations, along with information on migration timing and duration, distances traveled, and the straightness of migratory paths. We also provide comparisons across species, sexes, age classes, and family groups, as well as comparisons within individuals tracked over multiple migration events. Based on patterns revealed in these datasets, we outline future directions for our research. Finally, we invite discussion on how these datasets can be used in collaboration with state and federal agencies, academic institutions, or other non-profits to support informed management and conservation for raptor species in Montana and the western United States.

Factors Influencing Pronghorn Migration Behavior and Plasticity

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Pronghorn (*Antilocapra americana*) exhibit substantial variation and plasticity in migration behaviors, which can enhance population resiliency to unpredictable environmental conditions. Using GPS collar data from 516 adult females across eight herds in Montana (2019–2023), we characterized spring migration behaviors and evaluated environmental, demographic, and anthropogenic drivers of migration behavior, winter range plasticity, and migration behavior plasticity. Most animal-years were non-migratory, with pronghorn remaining as residents (77%) or showing gradual range shifts (11%), while others migrated to single (18%) or multiple (4%) summer ranges. We documented plasticity in both migration behavior and winter range fidelity: 5.5% of non-migrant animal-years switched to migrant behavior, 27.7% of migrant animal-years switched to non-migrant behavior, and 15.4% of animal-years shifting to new winter range than used prior. The probability of expressing a migrant behavior increased with higher winter–spring precipitation and road density and decreased with stronger green-wave dynamics and greater agricultural subsidy. Agricultural subsidy also increased the probability of switching from migrant to non-migrant behavior, suggesting that consistent forage associated with agriculture can reduce the need for spring migration. Together, these results demonstrate that pronghorn occupying montane-valley and prairie environments use a range of migratory strategies and retain notable behavioral flexibility, supporting adaptive capacity in variable and human-altered landscapes. Conservation strategies that maintain landscape connectivity and accommodate diverse, plastic migration behaviors will be critical for sustaining pronghorn populations under ongoing environmental and anthropogenic change.

** Past, Present, and Future of Whitebark Pine in The Northern Greater Yellowstone Ecosystem

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The recent federal listing of whitebark pine as threatened highlights the vulnerability of this species. Because it is imperiled range-wide, it is important to understand the trends and patterns of whitebark pine mortality and natural regeneration at a landscape scale. This can define the magnitude of the problem and inform a management response. Whitebark pine has been the focus of monitoring efforts across its range, including the Greater Yellowstone Ecosystem (GYE). The northern tier of the GYE includes the Absaroka Beartooth Wilderness and adjacent national forest lands, a nearly 1.5-million-acre area with extensive WBP forests. In 1995, a multifaceted whitebark pine monitoring program was initiated by the Custer-Gallatin and Shoshone Forests that is unique in spatial scale and longevity. It assesses whitebark pine condition in the context of landscape level fires and beetle and blister rust epidemics. For three decades, data on forest structure and condition, tree mortality, and seedling establishment was collected during repeat visits at ~2,000 transects across 1.5 million acres. We are conducting final visits to these transects which will complete this comprehensive monitoring program addressing ecological issues tied to persistent management concerns. We will summarize monitoring from 1995 to 2025 and offer preliminary results.

** Comparing AI-Based Camera Monitoring to Human Bird Surveys at Freezout Lake

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Conventional avian monitoring relies heavily on human observers, which limits temporal coverage and can introduce observer bias. Autonomous camera systems paired with artificial intelligence (AI) offer a potential complement, but few have been directly evaluated against established bird survey methods under field conditions. We evaluated an AI-driven camera monitoring system, Binoculars to Bytes (B2B), by comparing its outputs to professional biologist surveys and citizen-science observations at Freezout Lake Wildlife Management Area, Montana. Cameras operated continuously during migration seasons, generating high-frequency visual data that were processed into standardized survey outputs comparable to human observations. Across seasons, AI-derived species presence patterns broadly aligned with both professional and eBird records, with agreement improving when modest temporal mismatches between surveys were accounted for. The system consistently underestimated counts for large flocks, highlighting an important limitation shared by many camera-based survey approaches. However, continuous operation enabled the AI system to capture phenological patterns—including early arrivals and late departures—not consistently observed during periodic human surveys. Beyond presence and counts, high-frequency sampling supported additional analyses such as sex-ratio estimation, species co-occurrence, and exploratory distance-based detectability. These results demonstrate that autonomous camera systems can complement aspects of traditional avian monitoring by increasing sampling frequency and standardization while revealing ecological patterns difficult to capture with human-only surveys.

** Habitat Patches, Leks, and Nesting Areas Shape Dispersal Movements of Translocated Sharp-Tailed Grouse

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Extensive post-release dispersal has challenged prairie grouse reintroductions, because long movements expose grouse to high mortality. GPS transmitters now allow us to identify ecological drivers of these movements and refine release strategies. We monitored 149 female sharp-tailed grouse released in the Bitterroot and Blackfoot Valleys during 2023–2025 within a 5-year reintroduction effort to evaluate how translocation characteristics and habitat features influenced post-release movements. We distinguished dispersing from settled movements using behavioral change point analysis, then classified dispersal into exploratory and encamped states using hidden Markov models. Dispersal differed between sites: grouse released in the Bitterroot traveled an average of 147 km over 26 days prior to settling, while those in the Blackfoot traveled 47 km over 10 days. As increasing lek attendance provides stronger social attraction, we expected movements in the Blackfoot to decrease over time but observed little interannual change. Translocation attributes – including age, release group size, timing, and source population – did not influence distance moved. During dispersal, grouse moved through valleys using patches of grassland and shrubland as stepping-stones, and 30% of birds in the Bitterroot and 42% in the Blackfoot ultimately settled and established home ranges. Settlement locations were typically in large, continuous grassland or shrubland patches and near leks or nesting areas, and females nested an average of 8 days after settling. Availability and proximity to grassland and shrubland nesting habitat, rather than individual or translocation characteristics, may drive movement distances. Managers should prioritize releasing grouse near leks and established nesting areas.

** Examining Significance of Human Disturbance on Nest Selection in Great Gray Owls (*Strix Nebulosa*) in Southwest Montana Using an Rsf Model (Poster)

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Great Gray Owls (*Strix nebulosa*) are one of the most understudied raptor species in North America. In Montana, there is currently no peer-reviewed research about the species, and many aspects of the species' ecology are not well understood. In this study, we aimed to quantify the effect of human landscape disturbances (roads, trails, recreation sites) on Great Gray Owl nest selection in southwest Montana. We used ten known nest sites with breeding attempts in the last five years that were identified by wildlife managers in southwest Montana. We then used a resource selection function to compare the human disturbance covariates between the used nest sites and randomly generated available points. We used a forward stepwise model selection approach to determine which combination of human disturbance variables best explained the observed data. We found that Great Gray Owls selected for nest sites in areas with higher trail density but found no support for an effect of roads or recreation sites on nest site selection. Latent habitat covariates such as trail construction creating gentler slopes with mixed open/forested areas, or the small sample size could have contributed to the observed results. The positive relationship with trail density could also be attributed to owl nests being more likely to be found near trails than in less accessible areas. Future research using a larger sample size and exploring the effects of intensity of trail use would be valuable to further evaluate the effects of human disturbance on nest selection.

** Are Ungulate Species Variable in Their Habitat Selection in Northwest Montana?

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Understanding animal movement can be important for monitoring design and management decision making. Ungulate movement in the landscape is often driven by the local environment. Most, if not all, ungulate species select for food resources and safety, and their movement is facilitated by landscape structures. However, species do not necessarily respond to their environment in the same way. To quantify variability in species responses to their environment, we leveraged a multi-ungulate system in Northwest Montana. This area is heavily forested but heterogenous as areas of it are subjected to yearly wildfires, commercial logging, hunting, and dissected by roadways. We collared 13 elk, *Cervus canadensis*, 25 white-tailed deer, *Odocoileus virginianus*, and 25 mule deer, *O. hemionus* during 2024-2025. We analyzed GPS fixes (3-hour intervals) using step selection functions. We built single-species models, tested for the effect of habitat features, and compared ungulate habitat selection with the same spatial and temporal extent and resolutions. This comparative study sheds light on similarities, but also differences in ungulate habitat selection. Results may also inform design of camera-trap based monitoring protocols.

** Distance Sampling to Estimate the Urban Deer Density of Bozeman, Montana

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In recent years, deer-vehicle collisions have increased in Bozeman, Montana. A high white-tailed deer (*Odocoileus virginianus*) population has become hard to ignore in southeast Bozeman, contributing to the concerns surrounding CWD and its recent appearance within city limits. While distance sampling is a common sampling method to estimate deer densities, there are limited studies measuring deer densities using this sampling method in urban environments. In part of developing a new management plan for this urban population, we performed distance sampling to estimate Bozeman's urban white-tailed deer density. On December 11th and 12th, two trucks covered 13 road transects of varying lengths during the last three hours of daylight. The transects were divided equally between the trucks, herd size, distance to the center of the herd, and the initial angle of detection were then measured from observers within the trucks. This information was then put through an analysis in RStudio to estimate the urban deer density. The resulting estimate and methodology are expected to contribute to an upcoming, continuous urban deer management plan.

Floral eDNA Rivals Traditional Surveys for Detecting Bumble Bee Species of Concern

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Recent pollinator declines emphasize a need for improved sampling approaches to facilitate efficient monitoring of species of concern. We assessed a new sampling framework consisting of flower collection, qPCR assays to detect environmental DNA (eDNA), and occupancy models suitable for evaluating drivers of species distributions. We tested the performance of this framework for two bumble bee species of conservation concern—*Bombus affinis* (rusty patched bumble bee) and *B. occidentalis* (western bumble bee)—compared to traditional survey methods. Each eDNA sample consisted of approximately 250 mL of flower heads placed in a bag and frozen; multiple eDNA samples were collected from each site. Surveys consisted of repeated 30-minute visual surveys for B. affinis and 45-minute netting surveys for B. occidentalis. For both species, detection and occupancy probabilities derived from eDNA sampling matched traditional 30–45-minute visual and netting surveys. A single eDNA sample had similar detection probability to a 45-minute netting survey for B. occidentalis; for B. affinis, detection via a single eDNA sample was only slightly lower. Detection probability via eDNA was more heavily influenced by bee activity during sampling than by weather variables that may degrade eDNA. Sampling flower species with higher eDNA detection rates and under conditions that heighten bee activity—such as warm temperatures and peak colony activity dates—increased eDNA detection probability. Success with these species shows promise for identifying cryptic pollinator species. Floral eDNA sampling can sometimes outperform traditional methods of bumble bee sampling by reducing fieldwork without compromising accuracy.

Restoring Western Montana's Sharp-Tailed Grouse (*Tympanuchus Phasianellus*): 2026 Progress Report

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Sharp-tailed grouse have been a Montana Fish, Wildlife and Parks priority for 35 years. Through the second half of the 1900s, sharp-tailed grouse populations west of the Continental Divide were considered isolated and extremely small, becoming extirpated by the early 2000s. Sharp-tailed grouse translocations from eastern Montana to the Bitterroot, Blackfoot and Drummond Valleys began in the fall of 2021 with 75 males. Spring 2022 our efforts were shortened due to avian influenza with 22 birds translocated. In 2023 and 2024, 144 and 212 birds were translocated respectively to the Blackfoot and Bitterroot Valleys. In 2025, 199 translocated birds were released in all three western Montana valleys. Translocated females were fitted with GPS or VHF transmitters and monitored during the summer nesting seasons to assess demography and population viability of the reintroduced populations. Most female mortalities occurred in the first 3–4 weeks following release, and survival during the 100 days following translocation was an average 0.48 (95% CI = 0.41 – 0.56) in the Blackfoot and 0.27 (0.19 – 0.40) in the Bitterroot. Survival in Drummond 0.47 (95% CI = 0.35 – 0.65) was comparable to the average survival in the Blackfoot. Nest survival across all years and sites was 0.34 (95% CI = 0.28 – 0.44), similar to established sharp-tailed grouse populations. Brood success at 45 days post-hatch was 56% in 2023, 53% in 2024 and 23% in 2025. We observed 7 newly established leks since 2021 with 79 grouse in 2025. Translocations will occur through 2026 with monitoring continuing 5-years post-translocation.

Evaluating Patterns of Plant Phenological Progression and Pronghorn Movement Behaviors Across Diverse Landscapes

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Many ungulates worldwide exhibit migratory behaviors to track the leading edge of plant phenological progression (i.e., "green wave"); however, it is currently unknown how species such as pronghorn (*Antilocapra americana*), that may experience variable patterns of plant phenological progression, employ movement strategies to exploit these systems. Within 8 pronghorn herd ranges that span heterogeneous landscapes in Montana, our objectives were to 1) calculate and interpret phenology metrics, 2) evaluate spatial and temporal variability in plant phenology patterns, 3) characterize the patterns of plant phenological progression, 4) relate the variability and patterns of plant phenological progression to pronghorn movement behaviors, and 5) evaluate potential nutritional trade-offs between migratory or resident movement behavior. Across these 8 herds, we collected GPS collar location data from 586 female pronghorn during 912 animal-years and processed 12 years of phenology data from 2010-2021. We found variable spatial and temporal patterns and predictability of plant phenological progression across different pronghorn ranges, but no strong evidence of a "green wave" in these systems. Pronghorn employing migrant and resident movement strategies conferred similar exposure to indices of nutrition, which suggests that factors other than tracking indices of nutrition may influence pronghorn movement behaviors and/or remotely sensed nutrition indices may not adequately quantify nutritional-related reasons for migration. Based on these results, and the high proportion of residents in our study, we recommend that habitat conservation strategies focus efforts to increase landscape permeability not only within movement corridors utilized by migrants, but also within ranges inhabited by non-migratory individuals.

Defining Elk Security Habitat in Montana – Ongoing Research and Outreach

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As part of the Montana Statewide Elk Management Plan, Montana Department of Fish, Wildlife & Parks set a statewide objective of resolving conflicts in concentrations, distributions, and behaviors of elk (*Cervus canadensis*), which included a commitment to formally define elk security habitat. Generally defined, elk security habitat provides areas where elk can reduce their susceptibility to being harvested during the hunting season while still meeting their biological requirements. While security habitat has been formally identified and quantified in previous studies in Montana, recommendations for security habitat have varied considerably, causing confusion for wildlife and land managers seeking to implement these recommendations. Our objective is to develop area-specific recommendations for public land management across Montana, based on elk security needs that will encourage elk use of public lands throughout the hunting seasons. We plan to use a resource selection modeling approach with existing elk GPS location data from 32 herds across Montana from 2001-2025 to identify security thresholds for elk and identify landscapes where additional data is needed to inform land management recommendations. To ensure involvement and ownership by state and federal wildlife managers and biologists, we are currently forming a working group that will help provide guidance on study plans and products. We are still in the early stages of this project, so we encourage participation in working group meetings and any additional feedback on the proposed design.

** A Bad Brome-Ance - Invasive Grasses Influence Shortgrass Prairie Songbird Abundance in Central Montana (Poster)

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Grassland birds are one of the fastest-declining avian guilds in North America, having declined by over 40% since 1970. Among this guild are Thick-billed Longspur (TBLO hereafter), a species of grassland-obligate songbird that has experienced long-term population declines of >90% since 1970. A primary driver of this decline is habitat degradation from mechanisms including the spread of invasive plants. To better understand these declines and develop effective conservation strategies, research is needed to understand how landscape attributes such as invasive grass cover are impacting demographics of this species. We are conducting a study in central Montana, an understudied area of the TBLO breeding range, to investigate how invasive grass cover influences longspur abundance and nesting metrics. Preliminary results suggest that TBLO do not use areas invaded by non-native vegetation, while the abundance of generalist grassland birds like Vesper Sparrows does not significantly change between areas dominated by native or non-native vegetation. These findings will help prioritize conservation actions in the region supporting imperiled grassland birds and provide a greater understanding of how specialist grassland species like longspurs interact with novel components of their environment.

From Echolocation to Action: How Montana's Bat Monitoring Program Informs Management

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Montana's Bat Monitoring Program has grown substantially over the past decade as threats such as white-nose syndrome (WNS) have become more prevalent within the state. Several bat species have been listed, or petitioned, under the Endangered Species Act (ESA). In 2025, Montana Fish, Wildlife and Parks (MFWP) and partners continued targeted disease surveillance and monitoring to document the spread of WNS, and the fungus that causes it (*Pseudogymnoascus destructans*; Pd), within Montana. This effort is coupled with surveys, using the North American Bat Monitoring Program, to evaluate disease impacts on bat populations. Data collected during these efforts have been used to model the effect of Pd on WNS-susceptible species and inform species status rankings and the 2025 State Wildlife Action Plan (SWAP) revision. Additionally, monitoring data inform management and conservation decisions. For example, experts identified vaccines as the action most likely to mitigate WNS-driven declines during a structured decision-making process using monitoring data, and the SWAP identifies this conservation action/intervention as a priority. Although this action is infeasible at a statewide scale, MFWP plans to implement oral vaccination to WNS-susceptible bats at select maternity roosts to facilitate persistence of larger colonies during disease invasion and epidemic phases. We will evaluate whether vaccination can help facilitate population recovery in local areas, in collaboration with national efforts to track landscape-level impacts. This will allow MFWP to build on the existing Bat Monitoring Program while undertaking targeted management interventions aimed at preserving large colonies of WNS-susceptible species listed or petitioned under the ESA.

Acoustic Monitoring of Migratory Shorebirds In Montana (Poster)

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Acoustic monitoring is increasingly being utilized to monitor migratory birds on the move, but has typically been applied to landbirds, primarily songbirds. To evaluate the efficacy of acoustic monitoring for monitoring shorebird migration, we trained a shorebird-capable acoustic classifier based on Nighthawk, a deep learning model. The classifier detected tens of thousands of shorebird flight calls in a 2012-2018 acoustic dataset from the Bitterroot Valley of Montana. We analyzed the spatial distribution and phenology of these detections and compared them with visual observations from the participatory science project eBird. Our data suggest that acoustic monitoring has great promise for monitoring shorebird migration, particularly for monitoring underdetected via traditional surveys.

Estimating Mountain Goat Abundance in an Alpine Transboundary Protected Area Using Genetic Data, Community Science, and Spatial Capture-Recapture

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Alpine ecosystems are among the most climate-sensitive environments, yet monitoring wildlife in these remote landscapes remains challenging. Mountain goats (*Oreamnos americanus*), an iconic alpine species, inhabit rugged terrain within the Waterton–Glacier International Peace Park (WGIPP), a transboundary protected area spanning the U.S.–Canada border. Long-term citizen science surveys indicate ~45% declines in goat numbers since 2008, but absolute abundance estimates have been lacking. We integrated noninvasive genetic sampling with spatial capture–recapture (SCR) modeling to estimate population size and spatial distribution while accounting for imperfect detection. Fecal samples (n=556) were collected in 2022 by U.S. Geological Survey, National Park Service, Parks Canada staff, and trained volunteers, with 32% of samples contributed by citizen scientists. Genotyping identified 174 unique goats, with an average recapture rate of 2.8 and 57% spatial recaptures. Detection probability was positively influenced by search effort and habitat suitability and negatively by forest cover. We estimated 1,715 goats (95% CRI: 1,254–2,280) across the state space, including 1,188 in Glacier and 138 in Waterton. Abundance was strongly associated with human habituation and proximity to mineral licks, and negatively with hiking trail density, suggesting complex interactions between resource availability and human use. Our findings highlight the feasibility of large-scale genetic monitoring in alpine environments and underscore the value of citizen science for expanding spatial coverage. Spatially explicit abundance estimates provide actionable insights for managing mineral resources, trail networks, and human–wildlife interactions in transboundary alpine landscapes under accelerating environmental change.

** Conservation Genetics and Movement Ecology of Swift Fox on Fort Belknap Indian Reservation (Poster)

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Ensuring the persistence and expansion of swift fox (*Vulpes velox*) in the Great Plains will require conservation efforts that support a robust, connected population across core prairie habitat. The Fort Belknap Indian Community (FBIC) and Smithsonian's National Zoo and Conservation Biology Institute (NZCBI) partnered to reintroduce 138 swift fox, from 2020 to 2024, to the Fort Belknap Indian Reservation (FBIR). The swift fox holds cultural importance to tribal nations across the Great Plains including both the Aaniiih and Nakoda Nations of the FBIR. The species had not been observed on the reservation for 50 years prior to the project, thus presenting an opportunity to collaborate to accomplish a conservation objective that holds both ecological and cultural value. Initial monitoring efforts demonstrated that swift foxes had established territories and reproduced. Our partnership team of researchers from NZCBI and Montana State University will work with the FBIC to assess the status of the Fort Belknap swift fox population utilizing genetic and movement data. Genetic analyses will assess genetic diversity, kinship to founders, and potential gene flow between the FBIR population and adjacent populations. We will use movement data to analyze habitat utilization and dispersal movements. Our synthesis of the genetic and movement analyses will provide a basis for a conservation plan for the reintroduced population and will speak to factors that impact reintroduction success. Here we present our proposed plans for this research as well as some preliminary observations from our first field season in fall 2025

** Elk Browsing Intensity Impacts Aspen Recruitment on Multiple Use Landscape Over Three Decades

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Quaking aspen (Populus tremuloides) stands are vital to ecosystem health, providing wildlife habitat, water and carbon sequestration, and natural fuel breaks. The Northern Yellowstone Winter Range, hereafter referred to as the northern range, is the wintering ground for the largest Rocky Mountain elk (*Cervus canadensis*) herd in Yellowstone National Park (YNP) and extends outside YNP onto the Custer Gallatin National Forest (CGNF). The northern range elk population, which has historically varied between 5,000 and 19,000 individuals, relies on aspen for winter forage. As of 2024, over 85% of these elk migrate to the CGNF in winter and can have strong impacts on aspen stage structure. Aspen stands are also affected by changes in precipitation and encroachment by conifers. The goal of this study was to relate long-term changes over 34 years in aspen stage structure to precipitation, conifer encroachment, and elk browsing of data collected from over 300 aspen stands on the CGNF. Previous studies concluded that aspen recruitment was increasing on a local scale in a few surveyed drainages, but was not increasing on a landscape scale. We found that aspen stem recruitment is now increasing on a landscape scale following recent elk density decline, with a 90% increase in stem counts since 2006. Stems that have outgrown the upper browse height of elk (2 m) increased the most in aspen stands with greater snow water equivalent, lower browsing pressure, and in stands farther from YNP. These data can be used to identify at-risk stands and prioritize management interventions.

** 30-Year Human Use Trends in the Absaroka Beartooth Wilderness

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Visitation in the Greater Yellowstone Ecosystem (GYE) has significantly increased in recent years. Visitor-use data, such as National Park gate counts and agency campground occupancy numbers, confirms this observation. Several studies are investigating the extent and implications of use at road-side recreational facilities where this pattern is most obvious. However, due to the difficulty of tracking visitor activities in remote areas, little has been reported on changes in backcountry human use. Approximately 26% of the GYE is designated or proposed Wilderness. It is assumed that this landscape is also experiencing an increase in visitor use. To address this data gap, our objective is to assess changes in visitor use in the Absaroka Beartooth Wilderness (ABW) using the Limits of Acceptable Change (LAC) monitoring framework. This monitoring tool tracks human use by recording the distribution of campsites and human-caused resource impacts at each site. We capitalize on these data which have been collected over the past 30-years at over 1,500 sites in the ABW. We used trends and modeling efforts to determine that overall, human impacts have declining over the last 30 years in the ABW. These findings can inform managers regarding educational programs and regulations targeting wilderness-users in the ABW and, potentially, other Wilderness areas in the GYE.

Cougar Behavioral Responses to Drought: Movement, Habitat Selection, and Predation

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Understanding how apex predators respond to climatic variability is critical for anticipating consequences of climate change across trophic levels. We used GPS-collar data from cougars (*Puma concolor*) across 14 independent studies to evaluate the influence of drought on summer ranges (measured as utilization distributions [UDs]), movement rates, habitat selection, and kill rates. We found that regional precipitation patterns modulated drought effects on cougar behavior: in desert regions, cougars moved less per day during drought compared to normal conditions, whereas in wetter ecoregions, they moved more. Cougar UDs did not shift spatially or change in size, rather, resident animals altered their habitat selection within UDs. During drought, cougars selected more strongly for areas near perennial water sources and edge habitats. Kill intervals were modestly reduced under drought, indicating slightly elevated kill rates, but the effect size was biologically negligible. These findings suggest that cougars may have adjusted their hunting strategies or tracked prey behavioral changes to maintain relatively stable predation rates despite potential drought-driven shifts in vegetation and ungulate behaviors. If drought simultaneously intensifies bottom-up pressures on ungulate populations while cougar predation rates remain relatively constant, these combined pressures could interact in ways that impact deer populations that were previously resilient to predation.

Factors Associated with Elk Distributions During Hunting Season in a Prairie Environment

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Hunting pressure alters habitat selection of elk (*Cervus canadensis*), and understanding responses to hunting is important for effective population and habitat management. Although elk responses to hunting are well-studied in forested and mountainous environments in the western United States, elk-habitat relationships in open prairie landscapes are less understood. Our objectives were to evaluate elk habitat selection during the archery and rifle hunting seasons and investigate relationships between individual selection patterns and risk. We used GPS location data from male and female elk in the Custer Forest and Missouri Breaks areas of eastern Montana, USA, 2021-2024 and built resource selection functions to estimate population- and individual-level selection patterns. At the population level, elk generally selected for increasing canopy cover, terrain ruggedness, and distance from motorized routes, as well as for areas with restricted hunter access. Importantly, we found consistent, strong relationships with canopy cover, highlighting the value of this feature for elk security in landscapes where cover is relatively sparse. At the individual level, elk faced with higher risk (i.e., the proportion of locations on publicly accessible lands) in the Custer Forest tended to increase selection strength for canopy cover, while in the Missouri Breaks, elk tended to increase selection for more rugged terrain but generally did not alter selection for canopy cover. Lastly, we estimated security thresholds based on where most elk use occurred and produced associated maps to provide more concrete information for elk management.

** Bioacoustic Detection and Multi-Scale Habitat Assessment of Breeding Great Gray Owls in Southwest Montana

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Great Gray Owls (*Strix nebulosa*), the largest owl species in North America, are one of the most understudied raptors on the continent. While the use of autonomous recording units (ARUs) has proven effective for assessing occupancy, there remains a need to evaluate how ARUs can be used to locate and monitor Great Gray Owls beyond the pre-nesting period. Additionally, the nesting habitat characteristics of Great Gray Owls have not been empirically evaluated across much of the Rocky Mountain portion of their range. In 2015, the Montana State Wildlife Action Plan designated Great Gray Owls as a species of greatest inventory need, prompting Montana Fish, Wildlife & Parks (MT FWP) to conduct a statewide Great Gray Owl occupancy survey effort. This study builds on MT FWP's occupancy findings, quantifying the habitat characteristics of Great Gray Owl nest sites in southwest Montana and evaluating a novel method to detect and monitor active nests. Here, I will present findings from the 2025 field season on the efficacy of using ARUs to locate and monitor active nests and determine nest outcomes versus ground-based survey methods, as well as a multi-scale nest site habitat selection analysis with both field-based and remote sensing data. This research aims to develop our understanding of Great Gray Owl nesting ecology and improve our ability to locate, manage, and conserve this elusive species. These findings can directly inform ongoing and future forest management actions to better target surveys before treatments and protect active nests.

** A Systematic Literature Review of Social Identity in Wildlife Research

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Social identity theory examines how people's identities are shaped by their affiliations with social groups and, in turn, influence cognitions, emotions, and behaviors. Although social identity in the human dimensions of wildlife likely operates in complex and varying ways, prior research has predominantly focused on differences in attitudes across relatively fixed identity categories. Work in other fields, however, demonstrates that social identities are often fluid and situationally activated, capable of shaping how individuals interpret facts, evaluate their own interests, and engage with others. Depending on context, these processes can inspire in-group solidarity, out-group derogation, and intergroup conflict or cooperation, among other effects. In this study, we conduct a systematic scoping review of the extant empirical literature on social identity theory in wildlife conservation settings. Across 99 refereed articles, our review documents the ways in which, to date, social identity theory has been used to understand human relationships with wildlife. Toward future research, we draw on research from social psychology to highlight promising and underexplored directions for incorporating social identity approaches into future research and conservation practice.

** Missing the Point: Consequences of Behavioral Bias in GPS Telemetry Data (Poster)

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Telemetry units equipped with a global positioning system (GPS) have transformed our understanding of animal movements and behaviors. However, most analyses that use GPS data assume that acquisition success is independent of animal behavior. This assumption may be violated when body position affects GPS antennae orientation which compromises satellite acquisition, resulting in failed fixes that are behaviorally biased. Accounting for this potential bias may be important to enhance inference of animal movement and resource selection studies. Modern GPS collars often incorporate onboard sensors (e.g., activity) which provide auxiliary data streams that can help infer behavior even when locations are missing. We used telemetry and activity data from GPS collared grizzly bears (Ursus arctos) in the Greater Yellowstone Ecosystem to integrate behavioral inferences with fix failures. Failed fixes often occurred during periods of low activity, likely when bears rested in positions that compromised satellite communication. We used a two-stage hidden Markov and state-space modeling framework to interpolate these resting locations and assess how estimating locations of failed GPS fixes propagates through analyses that rely on location data, including movement metrics, behavioral classifications, and resource selection. Characterizing how GPS acquisition failures relate to animal behavior helps reduce the risk of conflating artifacts of data collection with biological patterns, enhancing inference and improving conservation decisions.

** More Tines, More Breaks: Antler Failure Patterns in Western Montana Cervids

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Weapon failure can drastically reduce an individual's lifetime reproductive success as many species cannot repair or regenerate damaged traits. Yet among cervids (i.e. deer), antler failure may only reflect seasonal fitness because males are capable of seasonal regenerative. Antler failure could indicate nutritional or environmental stress but could also reflect species-level differences in weapon investment such as strong combat tools or flashy signals. In this study, we tested the predictability of male age, harvest location, antler point maximum and symmetry on antler failure presence in Rocky Mountain elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*) and white-tailed deer (*O. virginianus*) over two harvest seasons (2024-25) in western Montana. We found elk experience greater antler failure than either deer species, asymmetrical antlers failed more often, and males with more antler points were significantly more likely to experience breakage. We found failure rates differed among harvest locations with greater failures rates near districts experiencing a recent decline in mature bulls (over 6 antler points). Our results suggest weapon investment as durable tools differ among cervids, possibly reflecting greater investment in larger signals among bull elk. Given that harvest-induced demographic shifts may alter mating competition and structural investment in antlers, monitoring antler quality provides a novel approach for understanding cervid population health and behavior.

** Land Use Changes and Temporal Variation in Juvenile Sex Ratios of Three North American Mid-Continent Dabbling Duck Populations

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Sex ratios are often an overlooked, yet influential component of population structure. Over time, changes in sex ratios can inform potential environmental factors that affect sex-specific survival through different life stages. Long-term analyses of sex ratio and land-use changes are rare in the avian community. However, recent analyses estimate the sex ratio of adult North American mid-continent mallards as approaching three males per one female in the fall. Adult sex ratios can be driven by sex ratios at hatch, and sex-specific survival during development. We analyzed long term (1974-2024) data on three species of dabbling ducks in the North American mid-continent to estimate juvenile sex ratios and the effects of acres of crop and the number of ponds on the landscape. All three species indicated an increasing trend in the proportion of the juvenile population that is female at time of banding. We observed evidence for a positive effect of acres of crops, and number of ponds in all three species, where the proportion female increased with increased crop acreage and pond counts. Juvenile sex ratios are not extreme enough to explain the recent marked increase in adult ratios, and we posit that differences in sex specific survival in adults could be driving the observed adult sex ratio skews.

** Variation in Habitat Use of Fauna in Relation to Beaver Dams and Water Availability in Small Prairie Streams in Montana (Poster)

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Colleen Piper, University of Montana, Missoula
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Human activities and climate change continue to impact wildlife and ecosystem integrity in eastern Montana. In the state's semi-arid prairie ecosystems, the North American beaver (*Castor canadensis*) may play an important role in buffering against drought. By impounding water, beaver dams can increase the resilience of water-limited ecosystems and promote species richness for both aquatic and terrestrial species. However, there is still limited understanding regarding the influence of beaver dams on species richness and composition in these semi-arid, prairie ecosystems. Through a camera-trap study, we sought to examine how wildlife species richness and composition in eastern Montana is associated with changes in water availability during the summer. We used 48 cameras that recorded nightly wildlife activity across beaver-dammed and unimpounded sites on four small, prairie streams (7 PM to 7 AM, June through September 2025). Presence or absence of water was determined from photos, which showed drying events occurred at both beaver-dammed and unimpounded sites. To date we have identified 14 mammal species and 5 groups of bird species, including waterfowl and songbirds. For our next steps, we will examine how beaver influences species richness and composition associated with prairie streams. This project will provide useful insights into how wildlife use beaver-dammed and undammed sections of small streams as well as how that use changes throughout the summer in response to changing water conditions in eastern Montana prairies.

** Integrating UAS Thermal Imagery into Sharp-Tailed Grouse Nest and Brood Monitoring (Poster)

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Prairie grouse management requires accurate vital rates, but traditional methods for assessing nest and brood success, relying upon ground-based telemetry of radio-marked hens, are cost and time intensive. We explored unmanned aerial systems (UAS, hereafter "drones") paired with thermal imagery as an alternative or complementary tool to conventional techniques. Our objectives were to evaluate performance of drones and thermal imagery in detecting sharp-tailed grouse nests, to identify mechanisms that modulate detection, and to assess the utility of drones for monitoring broods. We captured 60 female sharp-tailed grouse at 9 leks in Phillips County, Montana, fitted them with VHF and GPS collars, and monitored nesting attempts. During June–August 2025, we conducted drone flights over 17 active nests and 7 broods, collecting thermal imagery and video footage. To identify factors influencing nest detection, we recorded nest site vegetation characteristics, height of flight, time of flight, and temperature. Volunteers reviewed thermal media, and we recorded their responses to measure nest detection and brood counts. Reviewers correctly identified the presence of a nesting grouse in 58% of trials and incorrectly concluded that a grouse was present in 20% of trials. In 60% of trials, reviewers indicated a grouse was absent, suggesting reviewers were more likely to conclude absence than presence. We will present results regarding nest detection performance, mechanisms of detection, and the comparison of telemetry-based and drone-based brood counts to provide guidance concerning drone integration into prairie grouse monitoring.

Montana Natural Heritage Program Information Products (Poster)

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Dan Bachen, Montana State Library Natural Heritage Program, Helena
Braden Burkholder, Montana State Library Natural Heritage Program, Helena
Kyle Kaskie, Montana State Library Natural Heritage Program, Helena
Dave Ratz, Montana State Library Natural Heritage Program, Helena

The data system at the Montana Natural Heritage Program (MTNHP) contains information on over 18,100 different species and habitats that occur in Montana and the data system's 6.1 million plus observations, 515,000 plus structured surveys, predicted habitat suitability models for over 2,300 species, and occurrence polygons for Species of Concern are used by over 1,800 natural resource professionals across the state to inform a wide variety of planning efforts, management actions, and permitting processes. Recently MTNHP has created and updated several key tools and products to support its core mission. Our new website is greatly simplified and mobile friendly. New conservation status rank summaries and reports are available in accounts on the Montana Field Guide for all vertebrates and ecological communities and selected invertebrates and plants. New stewardship responsibility metrics summarize the federal, state, local, private/tribal, and conservation lands/easements responsibility for management of predicted suitable habitat for species in both accounts on the Montana Field Guide and in the Single Species Overview task of our Map Viewer web application. New dashboards summarize information on native species and habitats, the distribution of non-native species in Montana and adjacent to the state's borders, and provide tools for beaver restoration, sustainable forestry initiative certification, and grazing. Finally, we have clarified and streamlined methods for data submission and provide resources for citizen scientists and professional biologists and resource managers to contribute data to the MTNHP via iNaturalist.

** Does Computer Vision Reliably Process Camera Trap Images in Multispecies Systems?

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Camera trap surveys are a useful tool to monitor wildlife populations and collect data to estimate various metrics, including population size. Camera surveys can generate large number of photos across various animal groups, but the time and effort it takes for researchers to process these datasets present a significant barrier to camera-based wildlife research. Artificial intelligence (AI) has emerged as a way to drastically speed up data processing time. However, any limitations to AI's ability to accurately label images might have consequences for estimating population size. In this study, we compare species classification done by AI to a manual review. We use computer vision incorporated into Wildlife Insights to label camera trap images from species with morphological similarities in northwest Montana. The findings of this study help us determine if we can rely on available computer vision tools to classify images, and then use these data to reliably estimate population size.

Large-Scale Camera-Based Monitoring for Ungulates in Northwestern Montana

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Katherine Garrett, University of Montana, Missoula
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Traditional aerial surveys cannot reliably count deer and elk populations in areas with dense forest canopy cover. This information gap hampers the ability of agencies to assess population status, set evidence-based hunting seasons, and evaluate management outcomes. Montana Fish, Wildlife & Parks (FWP) and the University of Montana are collaborating on a 5-year (2023–2028) research project to evaluate remote camera-based monitoring methodologies for northwestern Montana management units. Although camera traps offer a promising alternative to aerial surveys, robust population estimates still depend on meeting key assumptions about animal classification, quantification, and behavior. Challenges related to accurate viewshed estimation, as well as logistical constraints such as access and cost, further motivate a focused evaluation of methods and sampling designs. This project will develop, evaluate, and refine camera-trap protocols to: 1) estimate populations and spring recruitment, 2) evaluate sampling designs to reduce field costs, compare viewshed quantification techniques, and assess how animal behavior affects density estimates, and 3) determine how ungulate distributions change seasonally and respond to forest disturbance, predators, and hunting pressure. Data collection began in summer 2024 and will continue into summer 2026. This work is intended to provide critical population monitoring tools to improve elk and deer management across northwestern Montana. Project objectives, methods, and progress will be discussed.

We're Not As Divided As We Think We Are - Social Identity Effects on Attitudes Toward Wolves

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Justin Angle, University of Montana, Missoula, MT
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Polarization among social groups can threaten the long-term success of conservation efforts. When group identities (defined as aspects of self-concept tied to group membership) are made salient, perceived divisions can intensify, particularly when individuals misjudge the beliefs of others. Despite its importance, the fluid nature of identity and its variable effects on conservation attitudes and outcomes remain understudied. To address this gap, we conducted two randomized controlled experiments with residents of U.S. states where wolves are present (n = 2,296). In Study 1, activating political identity significantly affected attitudes toward gray wolves (*Canis lupus*) and amplified differences between groups. In Study 2, providing a straightforward correction to in-group metaperceptions mitigated these effects by reducing perceived polarization and constraining the influence of identity fusion. In an unrelated third Study of Montana hunters and landowners, we show how even subtle identity cues (e.g., in survey recruitment material) can similarly influence self-reported attitudes toward wildlife. Together, these findings highlight opportunities for conservation policymakers and practitioners to avoid unnecessarily triggering identities commonly linked to conflict and to challenge misleading narratives that overstate social divisions. Addressing inaccurate metaperceptions and incorporating identity-aware communication approaches may strengthen public support for wildlife conservation initiatives while minimizing preventable conflict.

The Ownership Distribution of Private Land/Habitat in MT and Changes From 2024-2023

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In the United States, most wildlife habitat is privately owned, creating challenges for the management of species held in the public trust. In this context, the rights and objectives of private landowners may conflict with those of wildlife beneficiaries. Although recent research has increasingly incorporated private landownership into various analyses, broad-scale evaluations have been limited by restricted access to ownership data and a lack of analytical tools. In this study, we introduce new methods for processing and analyzing cadastral datasets and apply them to examine patterns and changes in private landownership across Montana from 2004 to 2023. Our analysis reveals a high concentration of landownership among a few owners with very large properties juxtaposed to parcelization of medium-sized properties into smaller parcels and a corresponding increase in the number of private owners in these size classes. Ownership has increasingly shifted toward legal entities (e.g., LLCs) away from individuals or families. We review these trends and discuss the implications for conservation and management of wildlife held in the public trust.

** Parasitic Infection Leads to Increased Predator Induced Mortality in a Large Herbivore Population

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The complex dynamics between predators, parasites, and parasite hosts are a crucial part to understanding ecological systems. Some parasites indirectly reduce animal survival through altering host behavior. This is common in trophically transmitted parasites that require an intermediate host to be consumed by their definitive host (e.g., predation). Predators may be able to reduce parasitism within the host population directly through selectively preying on disease individuals. In this study we explored the complex dynamics between predators, including wolves (*Canis lupus*), cougars (*Puma concolor*) and grizzly bears (*Ursus arctos horribilis*), their prey (i.e., elk [*Cervus canadensis*]) and the protozoan parasite *Toxoplasma gondii*, which is capable of altering host behavior. We found that elk infected with T. gondii exhibited risky behavior including increased distance to nearest neighbors and decreased group size. We used proportional hazard models, while accounting for age and migratory tactic, to estimate that infected elk had a mortality hazard rate that was over 6.5 (95% BCI 2.49 – 16.6) times greater than uninfected elk. We estimated that infected elk had a 12% lower average annual survival probability (83%, 95% BCI: 69-97%) than uninfected elk (95%, 95% BCI 87-100%). We used cumulative incidence functions to estimate that T. gondii positive individuals were significantly more likely than uninfected elk to be killed by predators than other causes. Our research represents the first study of its kind to quantify the reduction in animal survival caused by behavioral manipulation of T. gondii and represents an important empirical example of predators keeping the herds healthy.

Does Incorporating Habitat Selection Improve Viewshed Density Estimates Using Camera Traps?

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Camera traps have great potential as a data collection tool to estimate population size of unmarked wildlife populations. Different methods have been developed for unmarked population size estimation, but their performance depends on meeting design requirements and model assumptions. If spatial variation in local abundance is captured by collective viewshed of camera traps, theoretically density estimates can be obtained by relating animal detections to the space sampled by each camera's viewable area. To obtain reliable estimates across the total sampling area, camera locations need to be representative of the study area, so that extrapolating viewshed estimates to the total sampling area is justifiable. This assumption can be met with stratified random sampling, where the full range of population density or the underlying habitats that drive it is sampled proportional to their use. However, random placement of cameras is not favored by practitioners or may be even prohibited in hard-to-access locations. We used simulations and conducted a multi-season camera trapping and GPS telemetry study of a fenced population of white-tailed deer in Wisconsin to demonstrate and evaluate a new approach to account for unmodeled spatial variation in local abundance using the instantaneous sampling estimator. We showed negligible gains by incorporating predicted habitat use into viewshed density estimates. Specifically, weighting density estimates by habitat selection analysis did not reduce bias, but it reduced precision. We discuss our findings and focus on tradeoffs in following randomized sampling designs versus calibration of the estimates using auxiliary information in camera-based abundance studies of unmarked populations.

** The Impact of Plague Mitigation on Vegetation and Soil in Black-Tailed Prairie Dog Town (Poster)

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The black-tailed prairie dog (*Cynomys ludovicianus*) is a keystone species in North American grasslands. Prairie dogs play a crucial role in maintaining grassland biodiversity through their foraging and burrowing behaviors. However, prairie dog populations face a significant threat from sylvatic plague (Yersinia pestis), transmitted by fleas, which can cause population declines and disrupt grassland ecosystem function. Plague mitigation is necessary to conserve prairie dog populations and can increase prairie dog densities and alter foraging and burrowing activity. Changes in prairie dog densities may alter plant composition and cover, which can influence soil nutrient dynamics and insect community structure within the towns. While these efforts support prairie dog populations, the potential consequences for non-target species and ecosystem function remain unclear. This research focuses on the impacts of plague mitigation strategies on plants and soil in black-tailed prairie dog towns. To evaluate the effects of using insecticides to treat plague, we sampled vegetation cover types and soil and plant chemistry across 24 plots in northeast Montana under different plague mitigation strategies. We found that soil and plant nutrients showed weaker and more variable effects than vegetation cover classes. In plague-treated towns, vegetation cover shifted, with reduced grass and sub-shrub cover but increased forb cover. These changes likely reflect the influence of plague mitigation through increased prairie dog grazing pressure in treated towns. This research aims to inform management strategies to conserve prairie dogs and promote ecosystem health and resilience.

Highly Pathogenic Avian Influenza Across Montana and the United States

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Highly Pathogenic Avian Influenza (HPAI) has been a topic of conversation in wild birds and poultry, and as of March 2024, there have been dairy cattle infections as well. Avian influenza viruses move through migratory flyways with wild waterfowl and shorebirds as the reservoir hosts, as they can be infected without showing signs of illness. There is data to confirm the viral spillover into mammals which includes 71 confirmed human cases in the United States since 2024. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service conducts HPAI surveillance methods that are used in sampling wild birds across the country. Routine surveillance conducted during the summer through winter months on live or hunter-harvest waterfowl, morbidity/mortality events, as well as peri-domestic surveillance on HPAI-positive poultry and dairy cattle facilities are methods used to collect samples for testing and sequencing. For surveillance in Montana, there were four watersheds that were sampled for the 2025-2026 sampling season which is determined by the National Wildlife Disease Program. With samples collected from across the state, there have been minimal detections compared to previous years. There has been an overall 317 positive wild bird total in Montana from December 30, 2021 to January 23, 2026. There are tremendous benefits of the active wild bird surveillance efforts, such as early detection, analyze the viral genomes and associated mutations, as well as enhancing biosecurity to protect American agriculture. This presentation will highlight the most current results and findings reported by USDA APHIS Wildlife Services.

Restored Nonperennial Streams Support Higher Breeding Densities with Mixed Reproductive Performance For Two Shrub-Nesting Songbirds

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Anna Noson*, University of Montana, Missoula
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Identifying and restoring high-quality breeding areas for riparian songbirds is critical for conserving declining avian populations in the western United States. Yet, despite their ubiquity in semiarid regions, riparian biota on nonperennial streams have received far less attention than those on perennial flowing waters. Restoration can increase abundances and reproductive success of riparian songbirds, but more evaluative research is needed that encompasses a broader range of hydrologic regimes and landscapes to guide avian conservation. From 2013-2022, we examined the effects of restoration on vegetation cover, breeding densities, rates of brood parasitism, and nest survival in restored and reference sites for two shrub-nesting bird species Lazuli Bunting (*Passerina amoena*) and Spotted Towhee (*Pipilo maculatus*) on nonperennial tributaries of the Bitterroot River in Montana. Over 10 years, shrubs and perennials increased, while bare ground and annuals decreased. As predicted, these changes coincided with increasing breeding densities, but reproductive performance was mixed: 6-10 years after restoration, Spotted Towhees experienced higher parasitism and lower nest survival in restored than reference sites, while Lazuli Buntings experienced higher nest survival in restored sites. Nest characteristics and temporal factors also had a large effect on aspects of reproductive performance for both species. Lazuli Bunting parasitism rates were relatively high (0.56 ± 0.013) and nest survival low (0.11 ± 0.01) across site types. Our findings indicate that restoration of nonperennial streams can benefit songbirds by increasing suitable nesting habitat. However, nest failures may offset these benefits for some species, as previously reported in other human-altered landscapes.

** Temporal Avoidance by Gray Foxes Reflects Growing Pressure From Expanding Coyotes in the Neotropics (Poster)

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Coyotes (*Canis latrans*) are rapidly expanding their range through Central America towards South America, potentially threatening the world's highest canid diversity. A better understanding of their interactions with native species is needed to anticipate and mitigate impacts. In Costa Rica, native gray foxes (*Urocyon cinereoargenteus*) likely occupy a similar niche to the coyote, yet little data exists on their interactions in tropical ecosystems. As species occupying similar niches must partition resources to coexist, I hypothesized the two segregate temporally, given preliminary data suggesting high spatial overlap. Analysis using camera-trap data revealed a moderate temporal overlap ($\Delta 4 = 0.607$). Overall temporal distribution differed between species (Watson-Wheeler: $p < 0.001$), and detection frequencies also varied across diurnal, crepuscular, and nocturnal periods (Chi-square: $p < 0.001$), with the strongest interspecific contrast between diurnal and nocturnal detections. Most notably, permutation analysis (10,000 iterations) revealed significant temporal segregation in site use. Observed medians for time-to-encounter were significantly longer than expected by chance for both coyote-to-fox (27.0 days; $p = 0.0056$) and fox-to-coyote sequences (8.54 days; $p = 0.0028$). This asymmetrical site-reuse delay suggests that coyotes exert high levels of interference competition on foxes. These dynamics may mirror coyote-driven pressures on Montana species like the swift fox (Vulpes velox). Ultimately, while these results suggest broadly overlapping activity patterns, the two species may maintain coexistence through active avoidance and delayed site reuse. Such interference competition may aid in facilitating coyotes into South America, potentially exerting novel competitive pressures on native canid communities.

** How the Past Impacts the Present: A Case Study of Bighorn Sheep Acclimation Following Translocation

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Past conditions or events can have pronounced effects on current or future dynamics of wildlife species. When exploring such effects of the past, researchers often use covariates that characterize either a single instantaneous effect (e.g., when a translocation occurred) or an aggregated measure (e.g., total precipitation in the past year). Both cases assume a simple, linear relationship between the response variable and the covariate, regardless of how far in the past the covariate was collected. However, previous conditions can have effects that vary as time passes, sometimes called lag effects. Many different ecological phenomena can be considered lag effects, and distributed lag models provide a framework to investigate lag effects while removing the assumption of linearity between covariates and response variables. Using distributed lag models, we conducted a simulation study to model the acclimation of bighorn sheep following translocations. We found our model could accurately characterize simulated patterns in data, and we then applied the model to data collected between 2021 and 2022 to characterize acclimation of bighorn sheep following translocation to the Tendoy Mountains. Our goals are to show the utility of distributed lag models through simulation and application along with examples of problems they can be used to solve.

The Battle Pasture's Habitat Response to Rest-Rotation Grazing

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In 1987, Montana Fish, Wildlife & Parks (MFWP) acquired the Robb-Ledford Wildlife Management Area (RLWMA) located along the western slopes of the Snowcrest Mountains in southwestern Montana. Shortly after acquisition, MFWP altered livestock grazing from season-long annual use to a rest-rotation system. Across the 39-year period of rest-rotation grazing, MFWP has monitored rangeland and riparian condition trend and further modified the system in response to those trends. In 1999, 2005, and 2010, riparian assessments were completed across all or portions of grazing pastures within the RLWMA using the Ecological Health Assessment Method for Lotic Habitats. Rangeland habitats were assessed using the Ecological Health Assessment Method for Upland Habitats in 2010 only. In 2024 and 2025, the 2,729-ac Battle Pasture was reassessed. Results highlighted slight reductions in riparian vegetation scores (61.5% vs 56.9%) due to reduced woody recruitment and elevated introduced grass composition. However, physical scores improved (50.2% vs 90%), resulting in greater overall ecological function scores (51.2% vs 67.9%) along the riparian area. Between 2010 and 2025 assessments, upland habitats had no difference in vegetation scores (82.8% vs 82.9%), while physical and overall ecological function scores improved (88.6% vs 95.1% and 85.2% vs 88.7%, respectively). The reduced or limited vegetation response across the Battle Pasture highlights legacy land practices that enduringly alter vegetation communities and physical features. These results highlight that rest-rotation grazing is appropriate for improving the broader ecological function of habitats within the RLWMA, though it lacks the ability to revert legacy vegetation impacts in short timelines.

Should I Stay or Should I Go? Dispersal Dynamics in Gray Wolves Using Genetic Methods

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Dispersal shapes ecological and evolutionary dynamics, yet its patterns in cooperative breeders are not always clear, especially dispersal under human-modified conditions. Gray wolves (*Canis lupus*) face a choice: remain in natal territories to support kin and queue for a breeding position or disperse to seek breeding opportunities elsewhere. We investigated how human-caused mortality (hunting and trapping), as well as ecological and social factors influence dispersal dynamics for wolves in Idaho, USA. Specifically, we asked 1) what population level factors trigger wolf emigration, and 2) what group level factors influence immigration into groups? To assess state level emigration away from natal territories, we used a novel genetic approach to identify dispersers through sibling relationships using the Idaho Department of Fish and Game wolf SNP panel and DNA from wolves harvested across Idaho between 2017 and 2023. We identified 86 dispersers and evaluated how sex, prey biomass, wolf density, and harvest influenced emigration probability. Sex did not influence emigration. Prey biomass positively influenced emigration, whereas wolf density had a negative effect, and harvest showed no effect. We also used 18 years of life history data from non-invasive genetic sampling to examine disperser immigration at the group level. Male breeder turnover had the strongest positive effect on immigration probability, and disperser settlement was further shaped by an interaction between group size and harvest. Together, these results demonstrate how genetic, demographic, and ecological data can be integrated to identify drivers of emigration and immigration in group living carnivores.

** Built to Last? Using Remotely Sensed Data to Estimate Occupancy and Persistence of Beaver Dams in Prairie Streams

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Drought and extreme precipitation events are projected to increase in frequency and severity across arid and semi-arid ecosystems globally. In response, beavers (*Castor canadensis*) and beaver-based restoration practices have gained attention for their potential to enhance ecological resilience by retaining water and moderating hydrologic variability. However, most studies informing these approaches have focused on systems with perennial flow, low confinement, and abundant woody vegetation, leaving uncertainty around applicability to prairie streams. We used a 100 x 100-m grid-based sampling approach with remotely sensed data to detect beaver dams and estimate relationships between dam occupancy and persistence with channel characteristics, peak flow events, and availability of woody vegetation across streams in northeastern Montana. Based on a multi-season occupancy model that accounted for false-negative and false-positive detections from images in 2017, 2019, 2021, 2023, beaver dams were estimated to occur in 3.6% (95% CI = 3.3–3.8%) of our sampling grid, and two-year persistence probabilities ranged from 17.1% to 40.7%. Our estimated occupancy translates to ~0.4 dams/stream km across the study area, which is within the range of densities measured in other prairie systems (0.08–1.40 dams.km) and lower than densities from montane systems (3.4–11.4 dams/km). Higher dam occupancy and persistence were most strongly associated with lower channel confinement and lower peak flows. Upstream catchment area was negatively associated with dam occupancy and persistence, whereas woody vegetation was not associated with persistence. Our results illustrate the important role that hydrologic and geomorphic drivers play in structuring beaver dam dynamics in prairie streams.

Evaluating the Impacts of Riparian Restoration on Climate Resilience, Biodiversity Value, and Productivity in Grasslands

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Temperate grassland ecosystems are the most threatened ecosystem type in the world, and 62% of North American temperate grasslands have been lost. Within grasslands, mesic and riparian areas serve as critical habitat for many local and migratory species, however, many of these systems are highly degraded. Low-tech process-based restoration (LTPBR), which includes construction of beaver dam analogs (BDAs), is an attempt to restore degraded stream ecosystems by slowing water down and retaining moisture further into the summer season. While LTPBR has been effective in wet climates and montane ecosystems, it is unknown how this restoration strategy changes biodiversity value, productivity, and climate resilience of the riparian areas of a dry grassland ecosystem such as the Northern Great Plains. To evaluate whether LTPBR increases thermal refugia and soil moisture and assess how these changes influence the biodiversity value in riparian areas, we leverage a suite of low-cost automated tools, including microclimate and soil moisture sensors to assess climate resilience and productivity, and autonomous recording units (sound) to assess biodiversity at paired restoration and control sites. We collaborate with a diverse set of partners and private landowners to construct LTPBRs and implement this 5-year monitoring evaluation. We will present the results from our first season, which includes bioacoustics data from 10 sites and microclimate data from 14 sites. The results of these monitoring efforts will help inform future restoration strategies and help conservation practitioners to allocate resources towards riparian restoration.

** Estimating Contact Rates of Deer Mice from Long Term Trapping Grids to Track Sin Nombre Virus Transmission

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Contact rates between animals are key factors in disease transmission, and are one of the fastest and easiest interventions for disease prevention or control. However, quantifying contact rates in any population of wild animals is challenging, especially for small or cryptic rodent species. Sin Nombre Virus (SNV), a North American hantavirus that causes a chronic infection in deer mice (*Peromyscus maniculatus*) but can be fatal in humans. Despite being common hosts for zoonotic diseases around the globe, small rodents like deer mice have been excluded from more rigorous contact studies due to their size and the limits of tracking technology. We estimated contact rates of deer mice using capture-mark-recapture data collected on long term trapping grids in Montana over 8-10 years. The first step is to determine the deer mouse home range size, and whether sex, age, season, conspecific density and SNV status influence mouse behavior. Our results show that males have larger home ranges than females, but females are more likely to be found near the center of their home ranges. Mouse density was not positively correlated with home range size, suggesting density dependent transmission may be responsible for SNV transmission. We will use this information to predict home range overlap as a proxy for contacts between individuals. Our approach to track potential contacts between cryptic individuals will potentially allow us to predict trends in disease transmission of SNV and other similar systems. As trapping grids are common techniques to monitor small mammals, this approach is applicable in taxa and disease systems beyond SNV in deer mice.

Lesser Prairie-Chicken Movement Under Differing Grazing Management Strategies

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Understanding how prairie grouse respond to different grassland management practices is required for continued viability of populations, especially for species dependent on working lands. The lesser prairie-chicken (*Tympanuchus pallidicinctus*) relies on grasslands used primarily for cattle grazing, with the majority of its remaining habitat existing on private lands in Kansas, USA. These grasslands are traditionally managed through season-long continuous grazing, but there is increased interest in rotational or patch-burn grazing as alternative management strategies that produce variation in vegetation composition and structure. Patch-burn grazing mimics natural disturbance cycles through the reintroduction of within-pasture fire, which can increase vegetation heterogeneity and resource availability within pastures. To understand potential differential response to patch-burn versus rotational grazing by lesser prairie chickens, we compared movements of female lesser prairie-chickens under both grazing scenarios during different life-history periods. We hypothesized that the greater availability and accessibility of resources within the patch-burn system would require lesser prairie-chickens to travel less to meet their resource needs, resulting in shorter and more concentrated movements. To test these hypotheses, we used GPS data from 91 female lesser prairie-chickens captured 2013–2018 in the mixed-grass prairie ecoregion of southcentral Kansas. We compared movements between management practices by fitting Bayesian treed Gaussian process movement models and deriving individual and period level movement metrics within each grazing system. Preliminary results show that breeding period influences the effect of patch-burn versus rotational grazing on lesser prairie-chicken movement.

Understanding Harvest Impacts in the Context Of Density-Dependence and Decision Making

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The harvest of wild organisms is an important component of human culture. In the 19th and early 20th centuries, commercial harvest of wild organisms led to major population declines and even extinction events. In response, state and federal wildlife agencies developed harvest management tools to regulate harvest in response to population changes. When population size is high, harvest regulations are typically laxer and harvest effort is typically higher. Conversely, when population size declines, harvest is often restricted and harvest effort declines as well. As a result, population size and harvest effort and regulations are often collinear. This can create substantial challenges for inference, particularly when models used for setting regulations do not incorporate density-dependent processes. We use long-term (1960-present) data on blue-winged teal (Spatula discors), mallard (Anas platyrhynchos), and northern pintail (Anas acuta) to demonstrate that estimates of harvest effects can be severely biased when density and regulations covary. Troublingly, when populations decline and harvest is restricted in response, models often underestimate harvest effects. Conversely, stable (mallard) or increasing (blue-winged teal) populations with liberal harvest regulations often result in the overestimation of harvest effects, leading to overly restrictive regulations.

** A First Look at Parasite Co-Infection with Sin Nombre Hantavirus in Montana Deer Mice (*Peromyscus Maniculatus*) (Poster)

Madeline Rowland*, University of Montana, Missoula, MT
Angela Luis, University of Montana, Missoula, MT

Wildlife populations are exposed to diverse communities of interacting parasites, where co-infection is the rule rather than the exception. As human activities alter parasite distributions, it is increasingly important to understand the mechanistic effects of co-infection on disease dynamics in wildlife populations. This requires moving beyond the traditional focus on single pathogen - single host systems. For this study, we use infection of Sin Nombre hantavirus (SNV) in deer mice (*Peromyscus maniculatus*) as a model system to determine mechanistic effects of co-infection on disease dynamics of SNV in its reservoir host. Here, we estimate direct and indirect effects of co-infecting parasites on one another with host condition and immune response as mediators. Methods include small mammal capture-mark-recapture, removal and dissection of deer mice to identify and quantify adult helminth infection, corresponding fecal flotation to detect helminth eggs, a serological assay to determine SNV serostatus, white blood cell differentials to assess immune response, and structural equation modeling to estimate condition. Of the total sample collected (n = 1,065), SNV serostatus has been assessed for 1,054 individuals to date, of which 79 were seropositive (7.5%). Among the 319 deer mice dissected to date, 181 (57%) had at least one helminth infection. Pooled sensitivity and specificity of egg detection by fecal flotation are 11% and 98%. Results from this study will improve our understanding of within-host interactions of co-infecting parasites in the deer mouse – SNV model system and advance our knowledge of the mechanistic effects of co-infection on disease dynamics in wildlife populations.

** Who Let the Dogs Out? Grizzly Bear Conflict Prevention (Poster)

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Historic practices to reduce dangerous interactions between people, livestock, and large carnivores are returning alongside the recovery of some large carnivore populations. Emerging novel scenarios where people and carnivores interact make it important to identify nonlethal tools to reduce risk to people and facilitate coexistence. We tested an ancient practice in a novel way by placing livestock guardian dogs (LGDs) at farmsteads (i.e., areas with a family home and grain bins) with chronic interactions with grizzly bears (*Ursus arctos*). Grizzly bears are attracted to spilled grains around storage bins, causing concern over human safety near homes. Although we were only able to place five LGDs at four farmsteads, we found several lines of evidence supporting the use of LGDs to deter bears and protect people. There were 58-fold fewer camera-trap detections of bears visiting farmsteads with LGDs and an increase in behaviors suggesting bear discomfort compared to paired neighbor farmsteads that did not receive an LGD (i.e., control sites). After LGDs were deployed, there was an 87.8% reduction in GPS-collar locations of bears within 300 m of farmsteads relative to before. Farmers had a positive experience using LGDs and would recommend them to others. Our results suggest LGDs could serve to protect specific locations and offer a new use of an old tool, but we recommend further research to broaden the scope of inference because of the small sample size of this study.

Dancing in the Moonlight- Common Poorwill Movement Patterns During the Breeding Season in Western Montana

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Nocturnal birds are challenging to study because of the darkness. Many species are understudied, and the few existing studies mainly focus on vocalizing males. We used the Motus Wildlife Tracking System to analyze Common Poorwill movements in the Bitterroot Valley during the 2024 and 2025 breeding seasons. By examining signal strength over short time intervals, we assessed how poorwills move in relation to nighttime, moonlight, and breeding activity for both sexes. Our results show poorwills are active for only a small part of the night, peaking at dusk and dawn, with seasonal shifts linked to lunar and breeding phases. We present preliminary results from our ongoing Motus data analysis for this cryptic, nocturnal species.

Evaluating Recent Critiques of Wolf Abundance Estimation in Montana

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Estimating abundance of low-density, wide-ranging carnivores is inherently challenging. In Montana, gray wolf (*Canis lupus*) abundance is estimated using an integrated Patch Occupancy Model (iPOM), which combines a false-positive occupancy model with submodels for territory size and group size. iPOM has been criticized in the scientific literature and in non-peer-reviewed analyses as biased, unvalidated, and unsuitable for management, and these critiques continue to influence policy debates, litigation, and public trust in wolf management. Here, we clarify the inferential scope of iPOM and address these critiques. We show that these claims rely on factual inaccuracies, evaluations of quantities iPOM does not estimate, and methods incompatible with its structure, including incorrect assertions about data availability and validation. Using published validations and independent data, we show that iPOM's submodels produce realistic estimates with appropriate uncertainty. Taken together, our results demonstrate that iPOM provides a scientifically defensible and operationally feasible framework for estimating wolf abundance under real-world monitoring constraints.

Management Strategy Evaluation for Informing Decisions About Wolf Management and Conservation

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Kevin Podruzny, Montana Fish, Wildlife and Parks, Helena
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Decisions about wildlife conservation and management are often challenged by limited information about how potential actions may impact management goals. Adaptive management can reduce this uncertainty and lead to better outcomes by iteratively applying management, monitoring outcomes, updating models, and making management decisions based on the updated information. Management strategy evaluation (MSE) is a simulation approach for evaluating the efficacy of various management actions under different states of the world within an adaptive framework. To demonstrate MSE use, we present a case study of the wolf harvest and management decision problem in Montana. Given the large suite of management objectives articulated for wolves in Montana, we present methods and results as they relate to wolf population objectives.Methods include projection models for the wolf population, simulation of data collection and fitting of estimation and projection models, identifying management decisions based on harvest control rules, and implementation of the decisions. We discuss how additional fundamental management objectives will be incorporated as this work progresses. Our application shows how incorporating social and ecological aspects into a MSE framework, along with all relevant forms of uncertainty, can offer insight into how management goals are likely to be influenced by various management actions over long time scales.

** Dynamic Snow Properties, Vegetation Access, and Fencing Shape Pronghorn Winter Habitat Selection Across Montana

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Jesse DeVoe, Montana Fish, Wildlife, and Parks, Bozeman, MT
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Pronghorn demographics in winter are thought to be determined, in part, by spatiotemporally dynamic access to high-quality forage, exposure to severe snow conditions, and landscape barriers that restrict movement. The effects of these energetic constraints can be understood through the lens of behaviorally informed habitat selection in which pronghorn may minimize their exposure to challenging conditions through movement. Using GPS-location data across four winters and ca. 1600 unique individual pronghorn winters, we developed step-selection functions to examine the effects of environmental factors related to forage availability and mobility on pronghorn space use across Montana, USA. In other species, snow depth and snow crusts mediate space use by restricting access to forage resources. We (1) quantified the effects of snow depth and severity of wind and melt-freeze crusts on pronghorn selection of vegetation resources, (2) examined functional movement responses to vegetation availability, and (3) quantified the effect of crossing roads and fences on the disruption of these behaviors. Our findings suggest that pronghorn winter habitat selection is driven by forage availability and the avoidance of crossing roads and fences. In this presentation, we will also share preliminary results on the direct and indirect effects of snow properties on pronghorn behavior, and how fencing mediates these relationships. Our findings can facilitate winter range conservation, landscape connectivity, and predict pronghorn behavior in response to dynamic, changing winter conditions.

Listening After Dark: A Statewide Assessment of Breeding Common Poorwills in Montana

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Dan Bachen, Montana Natural Heritage Program, Helena, MT
Allison Begley, Montana Fish, Wildlife & Parks, Helena, MT
Braden Burkholder, Montana Natural Heritage Program, Helena, MT
Kristina Smucker, Montana Fish, Wildlife & Parks, Helena, MT
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Common poorwills (*Phalaenoptilus nuttallii*) are nocturnal aerial insectivores that inhabit semiarid grasslands, shrublands, and open ponderosa pine and juniper woodlands. Although the species is currently considered secure at a global scale (Global Rank = G5), growing concern exists over recent, widespread declines documented among aerial insectivore populations. In Montana's State Wildlife Action Plan, common poorwills are designated a Species of Greatest Inventory Need (SGIN), indicating a lack of baseline data necessary to evaluate population size, trends, and distribution. Due to their nocturnal behavior, common poorwills are poorly sampled by traditional monitoring programs such as the Breeding Bird Survey and are infrequently detected through incidental observations (e.g. eBird). In 2024 and 2025, Montana Fish, Wildlife & Parks, in collaboration with partners, conducted a statewide survey to establish a population baseline and assess species distribution. A total of 79 survey routes were established, resulting in detections of over 100 individuals. These data provide critical baseline information to support future population trend assessments and enable a proactive management approach, including early identification of potential conservation threats.

Assessing the Mitigated Loss of Grassland Bird Habitat Through Conservation Easements and Leases in Eastern Montana

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Kristina Smucker, Montana Fish, Wildlife & Parks, Helena
Allison Begley, Montna Fish, Wildlife & Park, Helena
Justin Gude, Montana Fish, Wildlife & Parks, Helena
Hannah Specht*, Montana Fish, Wildlife & Parks, Missoula
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Land set-aside programs have been identified as key to the future of wildlife populations. Conservation easements and leases, both of which function to minimize habitat conversion for a typically decades-long period, impact wildlife populations through prevention of potential habitat loss. The conservation benefits of easements and leases are thus relative to the site-specific risk of habitat loss and the duration on the landscape. We combined spatially explicit data on conservation easements and leases with models of habitat conversion risk, wildlife density, and population trend – while also accounting for the growing impact of easements/leases with time – to approximate the loss of wildlife populations that has been averted by conservation easements and leases. We applied this framework to grassland songbird species (Baird's sparrow, chestnut-collared longspur, Sprague's pipits, thick-billed longspur) in Eastern Montana. We estimated that rangewide populations are 5-7% greater now due to the potential loss mitigated by conservation easements/leases. We also used population projections to assess the impact of additional anticipated investment in easements/leases across focal areas in eastern Montana. We found that the relative contribution of Montana easements and leases towards maintaining core populations of grassland bird species is expected to grow over time and play a critical role in reducing extinction risk. This work provides a spatially and temporally explicit framework for considering how investments in land set-aside programs is anticipated to impact wildlife populations.

** Identifying a Hidden Social Structure in a Solitary Carnivore

Carly Brooks, Colorado Parks and Wildlife, Fort Collins, CO
Sergio Morales, MPG Ranch, Florence, MT
Malakhi Spint*, MPG Ranch, University of Montana, Missoula, MT
Phillip Ramsey, MPG Ranch, Florence, MT
Melissa Reynolds-Hogland, Wildlife Research and Education Foundation, Frenchtown, MT
Alan Ramsey, MPG Ranch, Florence, MT

The American black bear (*Ursus americanus*) is traditionally considered a solitary species, yet accumulating evidence suggests complex social behavior. We integrate land-tenure, resource dispersion, and kinship theories to generate predictions about carnivore social structure. We tested predictions about spatial overlap, association, and resource sharing using GPS, genetic, and video data from 50 bears across a 2,400 km² region encompassing the northern Bitterroot Valley and the adjacent northern Sapphire Mountains in western Montana, USA, between 2010 to 2024. Home ranges overlapped extensively (mean overlap = 38.5%), and tracking behavior—defined as directional movement following for a sustained period—accounted for 39.5% of all recorded interactions, occurring more than an order of magnitude more frequently than avoidance. Genetic analyses assigned 11 sires for 45 cubs with multiple paternity detected in 4 of 11 litters (36%); neither age nor body mass predicted male annual reproductive success. We also documented sustained synchronous movements among dyads, including unrelated individuals outside the mating season, as well as evidence of stable, spatially dispersed, pack-like social groups. Together, these results demonstrate that black bear social structure extends beyond mating and kinship, supporting classification of the species as facultatively social along the solitary–social carnivore spectrum.

** Effects of Stream Geomorphology on Beaver Colony Success in Southwestern Montana

Denali Stetson*, Montana State University, Bozeman
Daniel Atwater, Montana State University, Bozeman
Daniel Tyers, USDA Forest Service and Montana State University, Bozeman
Tim Covino, Montana State University, Bozeman

Beaver (*Castor canadensis*) are ecologically vital for maintaining riparian ecosystems. They were broadly dispersed throughout North America prior to the 1900s but their numbers greatly declined with Euro-American settlement due to habitat loss and trapping. Reintroduction efforts have been used to restore beaver populations and improve degraded riparian areas. This occurred in the southern Absaroka Beartooth Wilderness, a designated Wilderness on the northern tier of the Greater Yellowstone Ecosystem where beavers were extirpated by about the 1970s. Between 1986 and 1999 forty-six beavers were reintroduced into this area. To assess the results of this program, researchers recorded active lodges, caches, and dams throughout 4 drainages and thirteen meadows since 1986. These surveys have documented widespread beaver activity and a stable population. My project involves pairing almost forty years of beaver colony inventory data with Rosgen stream classification surveys I completed in the ABW and northern Yellowstone National Park to assess the relationship between beaver activity and stream morphology. Our objective is to predict the probability of beaver occupancy based on relevant environmental and geomorphic parameters. Model outputs will be applied to stream systems in adjacent geographic areas where Rosgen surveys have also been conducted to predict potential beaver occupancy across a broader landscape. Our findings will be used to inform future beaver reintroduction efforts across the Greater Yellowstone Ecosystem.

Mule Deer and Weather - 45 Years' Gatherings

Shawn Stewart*, MT Fish, Wildlife & Parks, Red Lodge
Justin Paugh, MT Fish, Wildlife & Parks, Big Timber

Mule deer recruitment counts have been conducted on the Magpie Census Area (MCA) along the north face of the Beartooth Mountains for 45 years. The first 25 years saw broadly stable counts averaging 1200 deer. Since the early 2000s there has been a steady decline in deer numbers reaching just 253 in 2025. Here we examine the role weather may be contributing to this decline. Mystic Lake Power Plant, located less than a dozen miles from the MCA, has been collecting snowfall and precipitation data since 1925. We calculated the annual percent change in total mule deer count between years and related that to summer precipitation and winter snow. For years that mule deer numbers were affected by drought, severe winter or both, the average percent change in total population was -8.2% (n=22 years). During periods when lush summers were followed by mild winters the average annual percent change in the population was +10.8% (n=9). During years when summer precipitation and winter snowfall were both within the normal range, mule deer populations were nearly stable. The average percent change in the population was -0.2% (n=13). The average percent change in spring population size following severe winter and/or drought was significantly different than the percent change during average years ($p \leq 0.05$) or the percent change following lush summers ($p \leq 0.005$). Since 2003 there have only been seven years where extreme weather, either drought or deep snow or both, has not occurred. Little respite from severe weather appears to have triggered long-term population declines.

** Using Adaptive Management to Understand Elk Population Dynamics in Northwest Montana

Kelly Proffitt, Montana Fish, Wildlife and Parks, Bozeman
Nicole Bealer, Montana Fish, Wildlife and Parks, Bozeman
Jesse DeVoe, Montana Fish, Wildlife and Parks, Bozeman
Zackary Farley, Montana Fish, Wildlife and Parks, Thompson Falls
Andi Stewart*, University of Montana, Missoula
Christopher Hansen, Montana Fish, Wildlife and Parks, Missoula
Joshua Millspaugh, University of Montana, Missoula

Uncertainties about population dynamics may hamper the ability of state agencies and commissions to make informed wildlife management decisions. In hunting district 121, Montana, bull elk harvest has declined since 2012. Minimum counts suggest populations have been stable; however, it's unknown if these counts reflect actual abundance and there are no vital rate data available for the region. Due to these uncertainties, Montana Fish, Wildlife & Parks developed an adaptive management project to address data gaps and uncertainties. From 2022-2025, we GPS collared 124 adult females, 18 adult males, and 185 neonate or 6-month-old calves. Across all years, the average adult pregnancy rate was 84% (n = 122). Based on initial elk survival estimates through 2024, adult female survival was 0.891 (95% CI = 0.832 – 0.954) and adult male survival was 0.571 (95% CI = 0.301 – 1.0) with leading causes of mortality for all adults including harvest (n = 5/15) and mountain lions (n = 3/15). Calf survival was 0.537 (95% CI = 0.377 - 0.764) with leading causes of mortality including mountain lions (n = 10/27) and black bears (n = 6/27). We combined these population estimates with information about carnivores, habitat, and harvest into an IPM and initial results indicate the population is stable but has high bull harvest. Ultimately, this IPM will provide the analytical tool needed to inform management decisions and select management prescriptions to achieve elk population size objectives in an adaptive management framework.

Thinking Beyond Migration- Using the Motus Wildlife Tracking System to Study Small-Scale Animal Movements

Katharine Stone*, MPG Ranch, Florence, MT
Mary Scofield, MPG Ranch, Florence, MT
Eric Rasmussen, MPG Ranc, Florence, MT

The Motus Wildlife Tracking System has revolutionized our collective ability to track small organisms near and far. Most studies are designed to connect animal movement across large landscapes, like the migratory paths between breeding and wintering grounds. However, we can also use Motus to study other aspects of animal life history, such as arrival and departure dates, rates of travel, and indices of activity. In this talk, we'll share how we can apply Motus technology to study small-scale movements of creatures too small for GPS transmitters, and how we infer activity from variation in signal strength. We'll also discuss the tag specifications and Motus station options that a researcher might consider if they are interested in this type of analysis. We'll share movement data from species like the Common Nighthawk, Common Poorwill, and several owls as examples of what researchers can "see" using Motus detection data. We believe using Motus to study small-scale movements will greatly advance our understanding of many of Montana's nocturnal creatures.

** Impacts of Multiple Covariates on the Immune Response of Deer Mice in Western Montana (Poster)

Rachel Throckmorton*, University of Montana, Missoula
Angela Luis, University of Montana, Missoula

Sin Nombre Virus (SNV) is an exceptional model system for studying wildlife disease because of how simple it is to capture, take samples, and obtain disease status from the primary host. Immune response is an important factor to consider when testing for SNV because it can affect susceptibility of the host as well as transmission of the virus. We investigated immune response of deer mice (Peromyscus maniculatus), to identify individual and environmental conditions that may influence SNV transmission in wild populations. We examined whether SNV infection status, reproductive status, sex, and season influenced immune response through examining white blood cell differentials and neutrophil to lymphocyte ratios (N:L ratios). Across a trapping period of three years, we caught deer mice from six different trapping grids across western Montana. There was a total of 1065 mice captured and 79 were SNV positive. Out of the total number caught, 236 blood smears from one trapping site were analyzed for this study. Our results will provide a coarse but easily obtainable immune assessment from a field study to offer insights into deer mice immune system and SNV interactions. This study is one of the largest studies of its kind for deer mice and SNV so the results will add substantially to the existing literature.

** To Flea or Not to Flea? Biotic And Abiotic Factors Driving Flea Parasitism in Deer Mouse Populations (Poster)

Parker Todd*, University of Montana, Missoula
Angela Luis, University of Montana, Missoula
Mike Kinsella, Helm West Labs, Missoula
Maddy Rowland, University of Montana, Missoula
Leah Rensel, University of Montana, Missoula

Deer mice (*Peromyscus maniculatus*) are an abundant North American rodent and the primary reservoir for Sin Nombre virus (SNV), a hantavirus with a 30-40% case fatality rate in humans. While ectoparasites, such as fleas, are not considered vectors of SNV, their bites may indirectly affect the transmission of SNV by impacting host condition or immune function. These impacts could potentially lead to an increase in host susceptibility and/or an increase in viral shedding, yet there is still little knowledge on what influences flea parasitism on deer mice in western Montana. This study looks to examine how mouse sex, mouse body mass, soil moisture, and soil temperature affect the presence and number of fleas in two populations of deer mice at MPG Ranch in Florence, Montana. For this study, I used preserved carcasses that were collected as a part of a longitudinal trapping effort at UM that took place from 2023-2025 with soil moisture/temperature being logged every 30 minutes at each site. Each mouse was individually examined for fleas. Preliminary results show that 154 of 546 (28%) mice were parasitized. We identified 264 total fleas to species and found 9 different species, 2 of which are species not commonly found in this area. We are analyzing the data using Generalized Linear Mixed Models to assess how biotic and abiotic factors are influencing the presence and abundance of fleas. These analyses will provide insight on the patterns of flea infestation on wild deer mice in Montana.

Tracking Montana's Bumble Bees: Insights from Two Years of Bumble Bee Atlas Data

Michelle Toshack*, Xerces Society for Invertebrate Conservation, Livingston
Rich Hatfield, Xerces Society for Invertebrate Conservation, Portland

Bumble bee populations are declining, but conservation efforts are constrained by the lack of systematic data on species distributions and trends. The Bumble Bee Atlas was established to address these data gaps using community science, emphasizing systematic and standardized data collection to produce a data set that informs evidence-based conservation decision-making. Across 21 states, the Atlas engages thousands of community scientists and land management agency staff to systematically survey bumble bees across diverse landscapes. The Montana Bumble Bee Atlas has completed two years of data collection documenting bumble bee species distributions, as well as associated floral and habitat data. To date, participants have submitted 5,805 observations from 628 surveys, documenting 22 species statewide. Notably, two target species, the western bumble bee (*Bombus occidentalis*) and the American bumble bee (*Bombus pensylvanicus*), have been detected during Atlas surveys. This presentation will summarize key outcomes from the first two field seasons. We will also highlight remaining data gaps and provide survey priorities for the 2026 field season to further advance bumble bee conservation in Montana.

** Optimizing Sharp-Tailed Grouse Restoration--Habitat Matching and Post-Release Nest Survival (Poster)

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Laura Dykstra, Montana State University, Bozeman
Lance McNew, Montana State Univeristy, Bozeman
Mikel Newberg, Montana Fish, Wildlife, & Pakrs, Helena
Ty Smucker, Montana Fish, Wildlife, & Parks, Helena
Beau Larkin, MPG Ranch, Missola
Kristina Gunderson, Montana Fish, Wildlife, & Parks, Missoula

Grouse reintroduction outcomes depend on the nest survival of translocated birds. Identifying whether nest site conditions or source-site adaptations have a stronger influence on nest survival is critical for informing reintroduction management. One strategy for reintroductions is selecting source populations exposed to similar habitats as the restoration site, so that translocated animals are better adapted to release site conditions. To guide reintroduction planning, we quantified how local habitat conditions, source-site environments, and similarity between source and release sites determine nest survival of translocated sharp-tailed grouse in western Montana. We expected that daily nest survival would be positively associated with 1) increased visual obstruction and concealment at nests, and 2) increased similarity between the nest habitat and source lek habitat. We translocated grouse from 43 leks in central and eastern Montana to three restoration sites in western Montana and monitored 126 nests from 106 females during 2023–2025. We recorded nest fate and assessed vegetation cover and height around nests. We quantified land cover, canopy height, distance to roads, and rangeland productivity within 2 km of nests and associated source leks, then calculated an index of habitat similarity. Areas surrounding source leks differed in whether grassland or shrubland was the dominant vegetation type, and in the proportion of anthropogenic and agricultural land use. Restoration sites also ranged from more developed to more rural and dominated by private cattle ranches. If source-site adaptations affect nest survival, then reintroductions should prioritize capturing birds at source leks most similar in habitat to the restoration sites.

The Effects of Timber Harvest on Grizzly Bear Habitat Use, Behavior, and Diet

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As grizzly bears expand outside of protected areas into multi-use landscapes it is critical to understand the effects of forest management. We conducted a study on the effects of clearcut timber harvest on the habitat use, behavior, and diet of grizzly bears in the Caribou-Targhee National Forest just west of Yellowstone National Park (YNP). There was extensive timber harvest in the study area from 1980-1990 with smaller amounts of harvest in later years so most timber harvest was 20-40 years old at the time of the study. A total of 40 grizzly bears were captured and fitted with GPS collars from 2000-2014 and over 900 bear locations were visited to classify bear behavior and collect scats for diet analysis from 2013-2014. We developed seasonal resource selection functions to determine if bears selected or avoided timber harvest compared to forested habitat and evaluated the effects of timber harvest on bear behavior and diet. We found that grizzly bears used timber harvest as available during the spring and fall and avoided timber harvest in the summer. Grizzly bears strongly avoided areas with higher densities of open roads in all seasons. Grizzly bears in the study area were more likely to feed in timber harvest and consumed more ants and ungulates than bears in YNP. Our results show that timber harvest can be compatible with grizzly bear management if roads associated with timber harvest are closed.

** Heavy Metal Exposure in Songbird Nestlings Across the Anaconda Smelter Superfund Site (Poster)

Mary Venegas*, University of Montana, Missoula, MT
Megan Fylling, University of Montana Bird Ecology Lab (UMBEL), Missoula, MT
Creagh Breuner, University of Montana, Missoula, MT
Erim Gómez, University of Montana, Missoula, MT

Legacy mining and smelting operations have left extensive heavy-metal contamination across western Montana, yet the ecological impacts of these persistent pollutants on terrestrial wildlife remain poorly understood. The Mount Haggin Injured Area (MHIA), located downwind of the historic Anaconda copper smelter, experienced heavy metal deposition throughout nearly a century of smelter activity, permanently altering the landscape and the organisms that rely on it. Because songbirds accumulate metals through their diet, they serve as sensitive and effective indicators of ecosystem health in contaminated environments such as MHIA. This research investigates how soil metal concentrations and diet composition influence blood metal loads in nestlings of several focal insectivorous songbirds, including Dusky Flycatcher, Warbling Vireo, and Yellow Warbler. Across 4 field sites spanning the contamination gradient, we collected soil samples, nestling blood samples, and nestling fecal material to quantify prey origins (aquatic vs. terrestrial). We will pair these exposure metrics with intensive nest monitoring data to evaluate whether elevated blood metal concentrations predict reduced reproductive success. By integrating soil contamination, trophic pathways, and reproductive outcomes, this work identifies areas where songbirds face the highest exposure risk. These findings will improve understanding of contaminant transfer in mixed aquatic–terrestrial food webs and inform management strategies for wildlife within the Mt Haggin Injured Area owned and operated by Montana Fish, Wildlife, and Parks.

** Forest Disturbance from Fire Influences Seasonal Female Grizzly Bear Space Use in the Northern Continental Divide Ecosystem

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Cecily M. Costello, Montana Fish, Wildlife and Parks
Lori L. Roberts, Montana Fish, Wildlife and Parks
Sarah N. Sells, U.S. Geological Survey, Montana Cooperative Wildlife Research Unit, Wildlife Biology Program, Ecology and Evolution Program, University of Montana

The spatiotemporal distribution of food availability has been suggested as one of the main factors influencing female grizzly bear space use. Forest disturbance can reinstate early successional vegetation, often providing abundant grizzly bear foods. However, uncertainty remains in the extent to which post disturbance patches can satisfy female grizzly bear energetic requirements. We used collar data from 77 female grizzly bears between 1999 and 2024 to evaluate how timber harvest and fire influenced bear space use in the Northern Continental Divide Ecosystem. We predicted that female grizzly bear space use would be inversely related to the availability of early successional vegetation after forest disturbance because it can provide high quality foods, accounting for variation due to seasonal diets, population density, and reproductive status. We quantified seasonal bear space use by estimating the 50th percentile isopleth of a kernel utilization distribution, representing a bear's seasonal core range. We found that core range areas decreased with increasing population density across seasons and proportion in older burns (~11-40 years) in summer and fall. Core range areas were smaller for females with cubs of the year in spring and summer. We found no relationship between proportion of timber harvest availability and space use. Our findings support the hypothesis that older burns provide concentrations of high-quality foods for female grizzly bears, allowing individuals to satisfy energetic requirements across less space. Together, these results indicate that fire is a primary driver of landscape-scale resource quality for bears in this ecosystem, with potential implications for population dynamics.

Shock, Seed & Dam - A Large-Scale Grassland Restoration in Working Lands

Neil Vruno*, Coordinating Wildlife Biologist for Pheasants Forever, Inc., Miles City, MT

Maintaining and restoring native grassland habitat in a multi-use landscape is critical for the future of our sagebrush prairie ecosystems and the critters that depend on them. By partnering with a rancher located in the Northern Shortgrass Prairie of eastern Montana, we are using cost-shared management practices to protect and restore native prairie habitat across both private and public land. In spring of 2024, virtual fencing technology was implemented on the ranch to improve grazing management on nearly 16,000 acres. In spring of 2026, we will reseed nearly 1,000 acres of agriculture fields back to native grasses and install Beaver Dam Analogs (BDAs) to improve water retention along a 10-mile stretch of an intermittent stream. Virtual fencing will increase the effectiveness of the native grass seeding and BDAs with its fine scale grazing management, allowing for necessary rest and recovery of restored upland and riparian areas. These practices can improve habitat for a wide variety of upland birds (pheasants, sharp-tailed grouse, turkeys), big game species (pronghorn, deer), grassland songbird species and multiple species of concern (greater sage-grouse, Baird's sparrow, chestnut-collard longspur and thick-billed longspur). These practices will also improve the rancher's ability to manage grazing for sustainable livestock production, keeping grass right-side up in a multi-use, working landscape for years to come.

** Using Remotely Sensed Data to Understand the Influence of Beaver Dams on Surface Water in Prairie Streams of Eastern Montana

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Water fuels mesic productivity in semi-arid and arid regions. Beaver-based restoration is increasingly being implemented to conserve and restore streams and riparian areas and promote ecosystem resilience to drought. However, the influence of beaver dams on surface water has not been examined in small prairie streams. Watersheds in eastern Montana are characterized by erosive soils and sparse woody vegetation, often resulting in deeply incised channels with confined stream flow. This region is also known for variable and unpredictable summertime flows across intermittent and permanent streams. Although data from satellite imagery has dramatically increased our ability to monitor beaver dams and surface water change across landscapes, assessing the effects of beaver in prairie watersheds has been hindered by factors such as small stream size, intermittence, and deeply incised stream banks. To quantify the effects of beaver in prairie streams in eastern Montana, we created a land cover classifier that uses fine scale, freely available satellite imagery to identify surface water across the landscape. We then coupled this surface water data with topographic, geographic, and hydrologic data to quantify the relative influence of beaver dams on surface water in prairie streams. Results from this research show that 1) our surface water classifier performs well, 2) the relationship between dams and surface water is strongly constrained by channel confinement and stream discharge.

** Exploring Applications of Modern Technologies for Locating Wolverine Reproductive Dens

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Monitoring wildlife populations is essential for conservation, yet it is difficult to monitor many threatened species. Wolverines (*Gulo gulo*) occur at low densities across vast, remote habitats in Montana, exemplifying this challenge. In 2023, the U.S. listed wolverines as Threatened under the Endangered Species Act due to their low reproduction rates and high susceptibility to disturbance. Safeguarding wolverine reproductive den sites from human intrusion, especially during the breeding season, is therefore an effective conservation intervention. We use the wolverine in Montana as a case study to demonstrate how technological advances can be leveraged for monitoring threatened species. We aim to locate reproductive dens in southwestern Montana based on bait station detections of lactating females by camera traps followed by aerial track surveys using drones. The findings of this study help develop a protocol for integrating modern technologies to validate existing wolverine den suitability models, inform management, and add to a baseline data set of wolverine den locations in the continental U.S., where the species is extremely understudied.