Montana Chapter of The Wildlife Society

58th Annual Conference 2020

Private Lands Conservation: Where it has gone and where it is going

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Brett Dorak, President Elect 2019-20
Montana Chapter of The Wildlife Society

Introduction

Our theme for this year's conference takes a look at what is going on across the state on private lands and how landowners are working with different agencies, NGOs, developing grass root programs, and utilizing other avenues to improve and conserve the resources right here in our backyard. Approximately two thirds of Montana is privately owned, and without private lands conservation, many of the flora and fauna species that call this place home would not be as abundant as they are now. For the most part, wildlife does not understand anthropogenic lines drawn on a map, but the mosaic of landownership across the state requires everyone to do their part to conserve not only the wildlife, but also the way of life and traditions that have been associated with these lands for centuries.

Plenary Session Abstracts

Ranching, Conservation and Community; A Winning Team

Leo Barthelmess, The Rancher's Stewardship Alliance, Malta, MT

The Ranchers Stewardship Alliance (RSA) works in the northern great plains focusing on the high-lighted area of the state of Montana, Blaine Phillips and Valley counties. As our capacity to help other communities grow, we are reaching across the Missouri River to help other areas develop community-based conservation. The Rancher's Stewardship Alliance works with many different partners. Our partners from the conservation community include NGOs, wildlife agencies, state and federal conservation/management agencies, as well as contributions from livestock organiza-tions and livestock businesses.

What is the value of community-based conservation, who should participate and what components will lead to success of local efforts to preserve grasslands and local communities? There are many components that lead to successful communities and conservation, many of these components are overlooked or undervalued. I will discuss successful strategies for community-based conservation. This discussion will include identifying positive programs and or skill sets that create success as well as behaviors that detract from positive outcomes.

I will be using the evolution of RSA as an example of a community led organization that tries to preserve local culture and implement landscape scale conservation. As with any start up organiza-tion growth and change are difficult.

An Overview of FWP's Wildlife Habitat Program

Rick Northrup, Habitat Bureau Chief, Montana Fish, Wildlife and Parks, Helena

The state of Montana Fish and Game purchased the Judith River Game Range in 1940 in response to wintering elk conflicts on private ranchland. Additional acquisitions over subsequent decades set a direction for the agency to invest in habitat conservation as an alternative to artificially-feeding wild ungulates. Habitat acquisitions focused on big game winter range, river-bottom riparian, and wetland habitats. With the establishment of new programs in the late 1980s, Montana Fish, Wildlife and Parks (FWP) has integrated a palette of incentive-based habitat protection and enhancement options for private landowners. These options involve both perpetual and term agreements. Habitat conservation emphasis has also broadened and now includes key threatened habitats for game and species of concern and connectivity habitats for terrestrial wildlife. The strengths of FWP's habitat program are its supporting partners, the agency's extensive field-level interaction with private landowners, dedicated staff and funding, emphasis on working lands and public access, strategic implementation, and an extensive history of landscape-scale conservation successes.

The Nature Conservancy Work on the Northern Great Plains

Brian Martin, Montana Grasslands Conservation Director, The Nature Conservancy, Helena

The Nature Conservancy is working across the Northern Great Plains to retain functioning grasslands and other natural habitats that provide habitat for wildlife and economic and cultural values for human communities. Working with and respecting the needs and interest of local communities is one of the Conservancy's organizational values, and we have strived to implement strategies that benefit both people and nature. Using the best available science, we recognize that ranch operations are compatible with maintaining habitat. In Montana, we have permanently conserved over 100,000 acres of private land through purchase and ownership of land and use of conservation easements. The protection efforts have contributed toward maintaining the continuity of over 250,000 acres, when public lands are also considered. Easements have created opportunities for multi-generation ranches to grow their operations to allow family members to stay on the ranch or facilitate transfer between generations. Our Matador Ranch Grassbank has facilitated best management practices for wildlife and habitat on 295,000 acres, and we are also supporting planning and enhanced management through our Candidate Conservation Agreement with Assurances for sage-grouse and four species of grassland songbirds. The challenge in private lands conservation is to continue to work with people to create a virtuous cycle where conserving grasslands and wildlife is a recognized and widely adopted element of sustainable ranch operations and those efforts are supported by the public at-large

Ducks Unlimited Collaboration and Patnerships on Montana's Landscape

Bob Sanders, Manager Conservation Programs - Montana, Ducks Unlimited, Inc., Elliston.

Ducks Unlimited, in collaboration with its many federal, state, NGO and private partners has delivered over 328,000 acres of habitat conservation in Montana since 1984. As most of these acres (73%) have been on private lands, being able to work with private landowners is paramount. DU works state-wide with an emphasis on waterfowl breeding habitat along Montana's Hi-Line. Keeping ranchers on the landscape ensures that adequate grass and water will be available for livestock, waterfowl and other wildlife. Delivering private land conservation involves four basic components: 1) knowing the landscape and the needs of the wildlife species you are targeting, 2) having the technical skills to deliver projects that create, restore and protect those habitat values, 3) understanding and connecting with the human communities and the individuals that make up those landscapes and, 4) having the leadership, funding sources and inspired dedication to drive yourself and others to achieve mutually beneficial conservation goals.

Communities, Economics, and Conservation

Greg Neudecker, State Coordinator, Montana Partners for Fish and Wildlife Program, U.S. Fish and Wildlife Service, Ovando

Private lands conservation in Montana has progressed from a mindset of buying isolated parcels of private lands and micro managing each individual tract to one that focuses on high priority landscapes using conservation easements and stewardship practices. This change has also included adjustments for agencies and conservation groups to move a single individual or agency approach to one that is partnership centric focusing on both the natural and human components of conservation. As the science of private lands wildlife biology has evolved, the picture being painted is one of fish and wildlife species population's dependence on large intact landscapes. With over sixty percent of Montana in private ownership it is incumbent upon biologists to look beyond public lands and build relationships with private landowners. The biology requires us not just work with individual private landowners but linking multiple private landowners across a large landscape that often includes a mixture of public lands. As conservationists we would do well to embed ourselves in local rural communities and adopt a "neighboring up" mentality in high priority landscapes that focuses on the triple bottom line (communities, economics and conservation) if we are going to be successful.

American Prairie Reserve's Land Conservation Project

Damien Austin, VP and Reserve Superintendent of American Prairie Reserve, Malta, MT

What is the American Prairie Reserve and how they are building the largest land conservation project in the lower forty-eight states? Leveraging philanthropy and utilizing of private property rights to construct a 21st Century protected area, to preserve an ecosystem and expand public access.

Presentation Abstracts

Alphabetical By Presenter's Name

*** Denotes Presenter**

**** Indicates Student Presentation**

Montana Rangeland Resources Program

Stacey Barta*, Conservation and Resource Development Division, DNRC, Manhattan, MT

1977 legislation created the Rangeland Resources Program (RRP) MCA 76-14-102. The purpose is to establish a program of whereby; the importance of Montana's rangeland with respect to livestock, forage, wildlife habitat, high-quality water production, pollution control, erosion control, recreation, and the natural beauty of the state is recognized; cooperation and coordination of range management activities between persons and organizations charged with or having the management of rangeland, whether private or public, can be promoted and developed; and those who are doing exceptional work in range management can receive appropriate recognition. The program is guided by 6 ranchers from across Montana whom serve at the pleasure of the Governor. The Coordinator has specific roles outlined in 76-14-105, to serve as an advisor, counselor, and coordinator for and between persons and agencies involved in range management; strive to create understanding and compatibility between the many users of rangeland, including sportsmen, recreationists, ranchers, and others; promote and coordinate the adoption and implementation of sound range management plans to minimize conflicts between governmental agencies and private landowners; participate in zoning and planning studies to insure that native ranges are adequately represented at sessions for development of zoning and planning regulations; and coordinate range management research to help prevent duplication and overlap of effort in this area.

Rangeland Resources Program serves as a credible source of information, unbiased, and non-political. RRP fosters understanding and creates collaborative partnerships to sustain healthy rangelands by building relationships with diverse groups and creating positive relationships proactively working together.

Performance and Trend of Remotely Sensed Forage Phenology and Productivity Metrics Across the Western United States

Ethan Berman*, Northern Rocky Mountain Science Center, U.S. Geological Survey, West Glacier, MT

Tabitha Graves, Northern Rocky Mountain Science Center, U.S. Geological Survey, West Glacier, MT

Nate Mikle, Northern Rocky Mountain Science Center, U.S. Geological Survey, West Glacier, MT

Jerod Merkle, Department of Zoology and Physiology, University of Wyoming , Cheyenne

Aaron Johnston, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT

Geneva Chong, Northern Rocky Mountain Science Center, Jackson Hole, WY

Forage drives many important wildlife habitat, movement, and demographic processes, yet few studies assess the best remote sensing datasets for use in wildlife research and management. We compare phenology and productivity metrics from 10 leading remote sensing datasets against a network of PhenoCam near-surface cameras throughout the Western

United States from 2002-2014 to guide users in dataset selection. Overall correlations and mean bias varied substantially by dataset, metric, and land cover. The best performing phenology metrics calculated a date rather than a duration (length of season, duration of spring greenup) with R2 ranging from 0.04â€“0.69. Datasets performed best in shrubland, grassland, and deciduous/broadleaf forest land cover types, and weakest in evergreen forests. Productivity metrics performed worse overall than phenology metrics, though some datasets showed strong results in deciduous/broadleaf forests. Using the two best performing datasets with a long historical record, we analyzed changes to growing seasons from 1982-2016 and compared results of the competing datasets. The direction of trend generally agreed but the strength of the trends differed. This study provides the first comprehensive comparison of remote sensing datasets across many important phenology and productivity metrics. We discuss considerations for users to make informed decisions about their data choices.

Do American Black Bears Track Resource Waves in Yellowstone National Park? **

Nathaniel R. Bowersock*, Department of Ecology , Montana State University, Bozeman

Andrea R. Litt, Department of Ecology , Montana State University, Bozeman

Kerry A. Gunther, Yellowstone Bear Management Office, National Park Service, Yellowstone National Park, WY

Jerod A. Merkle, Wyoming Coop Unit, University of Wyoming, Laramie

Frank T. van Manen, Interagency Grizzly Bear Study Team , United States Geological Survey, Bozeman, MT

American black bears (*Ursus americanus*) are opportunistic omnivores that consume diverse foods, allowing them to maintain a macronutrient diet and optimize body mass gains. During the spring in the Northern Range of Yellowstone National Park, black bears may synchronize their daily movements to resource waves, including when green vegetation reaches peak foraging quality (green wave) and a pulse of neonate elk (*Cervus canadensis*, calving wave). To understand how resource waves might influence black bear movements in spring, we instrumented 8 black bears with GPS collars in 2017 and 2018 and estimated fine-scale resource selection based on used and available locations with integrated step-selection functions. Our findings indicate that black bears selected areas with high forage quality, suggesting they followed the green wave during spring. Although the calving wave was an important covariate associated with black bear resource selection, bears avoided elk calving areas, suggesting that they instead consumed elk calves opportunistically. Due to their smaller body size and lower metabolic needs, black bears might be able to capitalize on the green wave, potentially providing an advantage if grizzly bears (*Ursus arctos*) are better competitors for neonate elk. Given that the distribution of foods may change due to variation in climatic patterns, understanding how black bears use resource waves may be vital, especially if nutrient-rich foods become limited, which could impact the growth and expansion of bear populations in the region.

Fisher Occupancy Twenty-Five Years after Translocation in the Rocky Mountains of Montana

Jessy Coltrane*, Montana Fish, Wildlife and Parks, Kalispell
Robert Inman, Montana Fish, Wildlife and Parks, Helena

The historical distribution of fisher (*Pekania pennanti*) throughout Montana and the northern Rocky Mountains of the United States is uncertain, and most fishers in Montana appear to be descendants from translocated animals originating from the midwestern United States and British Columbia; however, a genotype that is unique and native to the Northern Rockies of Idaho and Montana exists in west-central Montana. Predictions based on Idaho models depict potential suitable habitat for fishers throughout the Cabinet Mountains of northwest Montana, yet distribution, occupancy and population status is currently unknown for these fishers. We conducted the first comprehensive monitoring of fishers in the Cabinet Mountains of Montana using baited camera/DNA stations. We detected fishers at 7 out of 21 cells, which resulted in a 0.43 probability that fishers occupied a grid cell. Detection probability was low, but increased slightly throughout the sampling periods. Genetic analysis revealed a minimum population count of 4-6 individual fishers in the study area, but all individuals successfully identified were males and of midwestern genetic origin. The low number of fisher detections may indeed reflect low abundance of fisher, yet these results also raise questions about our study design and sampling regime. We recommend future monitoring to increase precision of the occupancy estimate and determine the reason for a lack of female detections. We also recommend maintaining a closed trapping season on fisher, until data exists to indicate a population large enough to sustain harvest.

A Home on the Prairie? Restoration Potential of Bighorn Sheep in Montana's Prairie Region

Jesse DeVoe*, Ecology Department, Montana State University, Bozeman
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Kelly Proffitt, Wildlife Division, Montana Fish, Wildlife & Parks, Bozeman
Robert Garrott, Ecology Department, Montana State University, Bozeman

Efforts to recover Montana's bighorn sheep (*Ovis canadensis*) have focused primarily in the mountainous western region; however, rugged areas in the eastern prairie region were historically occupied by bighorn sheep. Currently, only 4 populations exist in this region and are some of the state's most abundant and stable populations. We predicted that potential habitat and restoration opportunity likely exists in the prairie. We used GPS collar data collected during 2014-2018 from 2 bighorn sheep populations located along the Missouri River in Montana to estimate a resource selection model. We first extrapolated model predictions across Montana's prairie region to understand the spatial distribution of predicted habitat and restoration potential of bighorn sheep. Second, within an estimate of bighorn sheep historic range, we estimated the abundance of bighorn sheep that the predicted habitat could potentially support. Resource selection was most strongly associated with terrain slope and ruggedness, canopy cover, and an NDVI metric. Within currently unoccupied areas of the historic range, the model predicted 7,211 km^2 of habitat, with about half (55%) managed by public land agencies. We estimated that these unoccupied areas of habitat could support 1,327-3,457 bighorn sheep, an increase in the abundance of Montana's prairie bighorn sheep of 1.9-3.2 times. Our results demonstrate substantial potential for restoration opportunities of bighorn sheep in eastern Montana. Broad restoration of bighorn sheep across the prairie

region would likely require strong collaboration among and between public resource managers and private landowners given the heterogeneous landownership patterns.

Interspecific Competition and Seasonality Correlate with Determinants of Hantavirus Transmission in Deermice **

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Amy J Kuenzi, Biology, Montana Tech, Butte
Angela D Luis, Ecosystem and Conservation Sciences, University of Montana, Missoula

Infectious wildlife diseases are becoming more common, causing population declines and species extinctions. Ecological and environmental factors can influence disease spread in wildlife, through effects on parasite transmissibility (regulated by host immunity), and contact rates. These factors can induce chronic stress, which can depress host immunity, and thus influence disease spread. Glucocorticoids are hormones, which are called fecal corticosterone metabolites (FCMs) when excreted in feces, and are typically used to measure chronic stress. Sin Nombre virus (SNV) is carried by deermice (*Peromyscus maniculatus*), and in western Montana grasslands, deermice compete with voles (*Microtus* spp.) and shrews (*Sorex* spp.). Because voles are dominant over deermice, they could increase SNV prevalence in deermice via stress-induced immunosuppression and/or alteration in contact rates, while shrews may have a lesser effect. Seasonal changes in these same measures may explain higher SNV transmission typically observed in spring/summer. We live-trapped small mammals over 2 years in western Montana grasslands and evaluated deermice for scar numbers (proxy for contact rates), demography, and body condition scores (BCSs; another measure of chronic stress). Deermouse blood was evaluated for white blood cell (WBC) counts/differentials, and SNV antibodies, and feces for FCMs to measure stress (baseline and stress-induced). Using mixed effect regression trees, we found that higher vole density was correlated with lower BCSs and scar numbers. Higher shrew density was correlated with lower stress-induced FCMs, lower BCSs, and higher scar numbers. Neutrophil/lymphocyte (N/L) ratios (another measure of chronic stress) were highest in spring/summer and WBC counts (a measure of immunity) were lowest during the summer. Due to low SNV prevalence, we could not evaluate effects on infection. Interspecific competition may influence SNV spread via effects on chronic stress (i.e. lower stress-induced FCMs and BCSs), and scar numbers. Higher N/L ratios in spring/summer, suggestive of chronic stress, and lower WBC counts in summer, suggestive of immunosuppression, may provide an ideal time for SNV transmission. Our findings may extend to other directly-transmitted wildlife diseases.

Influence of Livestock on Grizzly Bear Habitat Selection **

Kari Eneas*, Wildlife Biology, University of Montana; Confederated Salish Kootenai Tribes Wildlife Management Program, Polson

When encounters between carnivores, livestock and humans result in conflict or livestock depredation, the safety of both wildlife and humans are at risk. Reducing livestock depredation by grizzly bears (*Ursus arctos*) is crucial to the continued recovery of the species. We used 5 years of grizzly bear location data in the Mission Valley, Montana, to analyze habitat selection. Bear use indicated preference to areas in closer proximity to streams and wetlands than to livestock sites. Bears also showed a positive association with the density of homes. Our results showed that livestock were not being selected as a resource by grizzly bears, but also highlighted the importance of protecting livestock near riparian habitats to prevent depredation. These mapping methods can be used to identify how and where electric fencing, bear resistant garbage bins and other conflict mitigation efforts should be focused.

Evaluating Bighorn Sheep Restoration Using Genomics **

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Jennifer Thomson, Animal and Range Sciences Department, Montana State University, Bozeman
Kelly Proffitt, Region 3, Montana Fish Wildlife and Parks, Bozeman
P.J. White, Yellowstone Center for Resources, Yellowstone National Park, Mammoth, WY
Thomas Stephenson, Sierra Nevada Bighorn Sheep Recovery Program, Bishop, CA
Robert Garrott, Ecology Department, Montana State University, Bozeman

Wildlife restoration often involves translocation efforts to reintroduce species and enhance genetic diversity of small, fragmented populations. We examined the genomic consequences of bighorn sheep (*Ovis canadensis*) translocations and population isolation, to enhance understanding of evolutionary processes that affect population genetics and inform future restoration strategies. We conducted a population genomic analysis of 511 bighorn sheep from 17 areas, including native and reintroduced populations with contrasting translocation histories. Using the High Density Ovine array, we generated datasets of 6,155 to 33,289 single nucleotide polymorphisms and completed clustering, phylogenetic, and kinship analyses. Our study design maximized insight by employing standardized sampling of bighorn sheep herds, a standardized set of genomic markers, and a suite of contemporary analytical tools. Our analyses determined that most examined populations were isolated from recent, unassisted gene flow, including two pairs of native herds that had past connectivity but were recently fragmented. To identify which augmentation and reintroduction efforts made a genetic contribution, we synthesized genomic evidence across analyses to evaluate 24 different translocation events. We detected five successful augmentations and eight successful reintroductions based on genetic similarity with the source populations. A single native population founded most of the reintroduced herds, suggesting that genetic diversity of founders may have been more important to successful reintroduction than matching environmental conditions. Our results provide insight on genomic distinctiveness of native and reintroduced herds, the relative success of reintroduction/augmentation efforts and their associated attributes, and guidance for genetic rescue augmentations and reintroductions to aid in bighorn sheep restoration.

Microhabitat Selection by Reproductive State in Greater Sage-Grouse **

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Greater sage-grouse (*Centrocercus urophasianus)*; hereafter "sage-grouse", are the focus of much research and conservation efforts owing to their obligate relationship with sagebrush (*Artemisia* spp.) and dramatic population declines over the last 50 years. Research suggests female survival and chick survival are two of the most important demographic parameters for sage-grouse. In addition, recent research has shown habitat partitioning occurs between broodless (i.e., females without a brood) and brood-rearing females and that broodless females have lower mortality risk than females with chicks. Thus, habitat used by both reproductive states must be considered in management plans. Our study was initiated in spring 2018 in Carbon County, Montana to identify seasonal habitat use and compare landscape and microhabitat characteristics between brood-rearing and broodless females. Identifying

differences in habitat use between reproductive states can inform better management to account for all life stages of sage-grouse. We monitored 39 and 43 females captured at 7 leks in 2018 and 2019, respectively, with the use of GPS transmitters. We monitored 17 broods in 2018 and 21 broods in 2019 until 5 weeks post-hatch. We examined 5-minute locations for females to focus vegetation surveys during different behaviors-day and night roosts and active day locations. We measured vegetation characteristics (e.g., shrub, grass, forb, and ground cover) at 66 early brood-rearing (0-2 weeks post-hatch), 72 late brood-rearing (3-5 weeks post-hatch), 75 broodless locations, and 123 random locations. Understanding female sage-grouse habitat use during both reproductive states will better inform wildlife practitioners to manage habitat for all sage-grouse life stages.

Western Bumble Bee Declines in Us and Sample Design for Filling Range-Wide Information Gaps

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Sarah Gaulke, Northern Rocky Mountain Science Center, U.S. Geological Survey, West Glacier, MT

Amy Nicholas, ES, U.S. Fish and Wildlife Service, Cheyenne, WY

Doug Keinath, ES, U.S. Fish and Wildlife Service, Cheyenne, WY

In recent decades many bumble bee species have declined due to changes in habitat, climate, and pressures from pathogens, pesticides, and introduced species. The western bumble bee (*Bombus occidentalis*), once common throughout western North America is a species of concern and will be considered for listing by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA). We attempt here to improve the alignment of data collection and research with USFWS needs to consider redundancy, resiliency, and representation in the upcoming species status assessment. We reviewed existing data and literature on B. occidentalis, highlighting priority topics for research. We used existing data to model changes in B. occidentalis occupancy from 1998 to 2018. The probability of local occupancy in the continental United States declined by 93% over 21 years from 0.81(95%CRI = 0.43, 0.98) in 1998 to 0.06 (95%CRI = 0.02, 0.16) in 2018. The decline in occupancy varied spatially by landcover and other environmental factors. However, we found considerable spatial gaps in recent sampling, with limited sampling in many regions, including most of Alaska, northwestern Canada, and the southwestern U.S. We therefore propose a sampling design to address these gaps to best inform the ESA species status assessment through improved assessment of the spatial drivers of occupancy changes. Finally, we request involvement via data sharing, participation in occupancy sampling with repeated visits to distributed survey sites, and complementary research to address priorities outlined in this paper.

Bison Conservation and Management in Montana, What FWP's Decision on the Final Statewide EIS Means and What it Does Not

Lauri Hanauska-Brown, Wildlife Division, Montana Fish, wildlife and parks - Helena

In 2012, Montana Fish, Wildlife and Parks (FWP) began a process to evaluate opportunities for restoring bison (*Bison bison*) through development of a Programmatic Environmental Impact Statement (EIS). The purpose of this EIS was to determine if bison restoration is appropriate and if so, what opportunities are feasible and consistent within Montana's laws, policies, and regulations. A formal public scoping process identified concerns, opportunities, and stakeholders around the issue of bison as wildlife. Passionate support for and against bison was expressed during public hearings and the working group meetings were sideboards for any restoration of effort were developed. FWP finalized a draft EIS in 2015 and in January 2020 released a decision that supports the idea of bison restoration somewhere on the landscape. The decision does not choose any one of the action alternatives over another, rather it says bison restoration may be appropriate within well thought out project specific guidelines and with lots of stakeholder involvement. The decision does not select any particular site for a restoration effort, rather it provides FWP with great flexibility and leaves the framework for future discussions of specific project ideas at specific sites. Completion of the necessary steps to implement any restoration project as required by FWP process will take considerable time for even the smallest of test projects. The decision on the EIS has been misinterpreted, misrepresented, and misunderstood much like bison and their status in Montana overall. This talk hopes to clear up at least some of the confusion.

Effects of Wildfire and Logging on Forage Availability and Mule Deer Habitat Selection **

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Collin J. Peterson, Wildlife Biology Program, University of Montana, Missoula
Nicholas J. DeCesare, Wildlife Division, Montana Fish, Wildlife, and Parks, Missoula
Chad J. Bishop, Wildlife Biology Program, University of Montana, Missoula
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In many western forests, anthropogenic disturbance has increasingly replaced wildfire as the predominant source of landscape alteration. Recent declines in mule deer (*Odocoileus hemionus*) population estimates and hunter harvests have been linked to changes in the availability and distribution of nutritional resources in northwest Montana. However, the relationship between the spatial configuration of disturbances and resource selection is not fully understood, particularly for lesser-studied mule deer populations in Montana's northern forests. We conducted a 3-year study to quantify selection of mule deer for forest disturbances from wildfire and logging in the southern Rocky Mountain Front, Cabinet-Salish Mountains, and Whitefish Mountains. We predicted that forage availability would vary with disturbance age and configuration at individual and population scales. We evaluated movements of 131 GPS radio-collared adult female mule deer and documented forage composition and quantity in disturbed and undisturbed forests in all three study areas. Abundance and configuration of wildfire and harvest varied between study areas, and deer resource selection was influenced by the age and type of disturbance and associated forage response. Determining the factors driving mule deer use of disturbances can help managers identify potential strategies for land management and to identify treatment sizes and configurations that are accessible and beneficial for mule deer.

Modeling the Effects Of Habitat, Livestock Grazing and Climate on Greater Sage-Grouse Population Dynamics in Central Montana **

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Lorelle Berkeley, Wildlife Biology, Montana Fish, Wildlife and Parks, Helena
Victoria Dreitz, Wildlife Biology Program, University of Montana, Missoula

Access to quality habitat is a key driver of population dynamics for many wildlife species. To direct habitat conservation efforts and to determine if these efforts are successful, habitat models should be linked with population models at local scales. This project addresses this need by providing information about relationships among greater sage-grouse (*Centrocercus urophasianus*) habitat, livestock grazing, and demographic rates in central Montana. This work is based on a collaborative, decade-long effort among multiple resource agencies and private landowners in central Montana. It is led by Montana Fish, Wildlife & Parks and the University of Montana, and data collection is nearly complete. First, we will establish the habitat components that sage-grouse select at each life stage in a local population. We will include both livestock grazing and climate variables that affect greater sage-grouse habitat. Second, we will use a population model to relate habitat components to demographic rates that are known to influence greater sage-grouse population dynamics. We will examine these relationships during multiple life stages and across spatial scales. We will also examine the relationship between demographic rates and lek-based abundance estimates to evaluate lek counts as an indicator of population health. Our effort will identify components of the sagebrush steppe ecosystem in central Montana that are important to the persistence of sage-grouse in this region, and how livestock grazing affects these components. Our findings will be used to evaluate and update sage-grouse habitat conservation strategies and management plans in central Montana.

Characterizing Summer Roosts of Male Little Brown Myotis in Lodgepole Pine-Dominated Forests **

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Bryce Maxell, Program Management , Montana Natural Heritage Program, Helena
Robert Garrott, Ecology Department, Montana State University, Bozeman
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Lauri Hanauska-Brown, Montana Fish, Wildlife & Parks, Helena

Although bat roosts have been well-studied in the eastern United States, we know less about roosts in the west. Western bats may make use of trees and snags, as in the east. However, the topography of the Rocky Mountains provides more exposed rock, and western bat species likely use different roosting features compared to the eastern US. Some western bats use rock features as autumn and winter roosts, but we know little about use as summer roosts. Additionally, roost studies often focus on maternity colonies, and information on roosts used by male bats is limited. Given that roosting sites may be limiting, we aimed to quantify characteristics of male roosts in lodgepole pine-dominated forests during the summer. We mist-netted for bats during summer 2017 and 2018 and attached transmitters to 34 male little brown myotis (*Myotis lucifugus*). We located at least 1 roost for 20 individuals (average = 1.6 roosts/bat; range = 1 â€“ 5). Although snags were available, most bats roosted in rock features (15% in snags, 85% in rocks). Rock-roosting bats mainly used crevices (85%) instead of rock

cavities (15%) and were more likely to select roosts with less canopy cover that were closer to water. They were also more likely to select roosts with wider entrances that provide access to a skyward-facing crevice. These results suggest that rock features may provide important summer habitat for male little brown myotis roosting in lodgepole-dominated forests. Understanding roost selection in these forests will help inform management decisions for conserving western bats.

Drivers of Elk Aggregation on the National Elk Refuge, Wy

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Aaron Johnston, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT
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In North America, diseases in ungulates have elicited increased attention due to direct impact on populations and indirect effects on outdoor recreational industries. Chronic wasting disease (CWD) has been found in 21 US states and 2 Canadian provinces over the last 40 years and is rapidly spreading in Montana. Degree of sociality and aggregation can drive disease spread and transmission. In Wyoming, supplemental feeding of elk (*Cervus canadensis nelsoni*) during winter occurs on 22 feedgrounds, including the National Elk Refuge (NER), and concern that feeding increases elk aggregation and thus disease spread has been rising. However, the comparison of feeding to other factors, including abiotic drivers of aggregation, such as snow levels has been underexplored. The winter of 2017-2018 had relatively high forage and little snow, which led to a rare non-feeding year on the NER, providing a unique opportunity to evaluate the role of feeding in aggregation relative to other conditions. We examined data from 2016 to 2019 for 68 elk fitted with GPS collars resulting in 223,526 elk relocations. We used a proximity index to assess daily joint space use of elk and modeled proximity using beta regression as a function of 13 variables including abiotic weather-related effects, biotic effects such as supplemental feeding and hunting pressure, and aggregation from the prior day. This approach may be useful for assessing management implemented with the intent of reducing aggregation. Mean daily elk aggregation was 1.7 times larger during winters with feeding but was also strongly regulated by snow cover and hunting pressure.

Grizzly Bear Population Augmentation in the Cabinet Mountains of Northwest Montana

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The Cabinet Mountains grizzly bear(*Ursus arctos*) population was estimated at 15 or fewer individuals in 1988 and believed to be declining toward extinction. In response to this decline, a test of population augmentation techniques was conducted during 1990-1994

when four subadult female grizzly bears were transplanted to the area from southeast British Columbia. Two criteria were identified as measures of success: bears must remain in the target area for one year, and bears should ultimately breed with native male grizzly bears and reproduce. Reproductive success of any of the remaining individuals could not be established until 2005 when genetic analysis of hair snag samples collected from 2002-2005 indicated that one of the transplanted bears remained in the Cabinet Mountains and had reproduced. Success of the grizzly bear augmentation test prompted continuation of this effort. The Northern Continental Divide Ecosystem area of north central Montana has been the source of an additional 10 female and 8 male bears transplanted to the Cabinet Mountains during 2005-19. Genetic analysis has determined that two females and one male have produced at least 14 first generation offspring, 19 second generation offspring and 3 third generation offspring. Seven bears are known to have left the target area but two have returned. Six augmentation bears are known dead. Fates and movements of these bears are discussed. The augmentation effort appears to be the principal reason that grizzly bears remain in the Cabinet Mountains today.

Finding Fishers: Factors Affecting Fisher Distribution in the Northern Rocky Mountains

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The Northern Rocky Mountain (NRM) fisher (*Pekania pennanti*) population is of special concern to conservation and management professionals and has been petitioned for listing as threatened under the Endangered Species Act. In partnership with Montana Fish, Wildlife & Parks and the Idaho Department of Fish and Game, we assessed the current distribution of fishers across their Northern Rocky Mountain range through a large-scale, multi-state baited camera and hair snare study. In the winter of 2018/19 we deployed baited remote cameras and hair snare stations in randomly selected grid cells containing plausible fisher habitat throughout Washington, Idaho and Montana, spanning the purported geographic range of the NRM fisher population. We used single-species, single-season occupancy modelling while considering several covariates that might contribute to their distribution such as existing fisher habitat models, site-level habitat characteristics, distance from population centers, the influence of past translocation sites and the effect of harvest, to estimate occupancy and detection probabilities of fishers across their NRM range. By incorporating our understanding of fisher habitat with contemporary analytical techniques, we estimated the current distribution of fishers in the northern Rockies and addressed the primary uncertainties about drivers of fisher distribution. The results of our project will help Idaho and Montana effectively prioritize areas for future fisher conservation in the hopes of maintaining the distribution of fishers across suitable habitat in the Northern Rocky Mountains.

Grassland Ghosts Keeping an Eye on the Recovering Swift Fox 2018 International Census

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Swift Fox (*Vulpes velox*) were extirpated from Canada in 1938 and in Montana in 1969, largely due to federal eradication campaigns in the 1930s targeting coyote and wolves. Reintroduction efforts in Canada occurred from 1983 until 1997. By 2001, swift fox were thought to be established in Northern Montana. In Montana, survey efforts began in 2000/2001, then repeated in 2005/2006, 2014/2015, and most recently the summer of 2018. Surveys in the winter of 2014/2015 consisted of two methods, live trapping and camera trapping. The goal was to determine changes in demography and distribution, but also to assess the feasibility of switching exclusively to camera traps for future survey efforts. There was little difference in detection probability between the two methods suggesting camera trapping is an effective alternative to live trapping. This resulted in only camera trapping being used for the 2018 census. Analysis comparing occupancy between 14/15 and 2018 showed that swift fox populations in the sampling area remained stable and relatively unchanged despite the harsh winter of 2017/2018. Through a finer scope, the Montana populations seem to have experienced a slight increase. The swift fox population in Canada and northern Montana is interdependent and continued collaboration for monitoring across jurisdiction and boundaries is important. Management of swift fox in Montana will continue to follow the Swift Fox Conservation Strategy.

Estimating Abundance of Dusky Grouse for Population Monitoring **

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Dusky grouse (*Dendragapus obscurus*), are a forest grouse species found throughout mountainous regions of western Montana. Despite being a game species, population monitoring has been inconsistent in recent years. Our objective is to develop, test, and evaluate sampling and statistical methods for unbiased population monitoring to inform management. We developed a spatially explicit model of dusky grouse relative habitat suitability in Montana to identify suitable survey sites for population monitoring. Prior to sampling in the field, we conducted statistical simulations to evaluate efficacy of potential survey protocols. Results from the simulations suggested that a minimum of 100 independent sites surveyed three times within a period of closure had the potential to yield unbiased and reasonably precise estimates for regional population abundance. During a pilot study in 2019, we conducted surveys during two sampling periods, spring and summer, within Montana, Fish, Wildlife, and Parks administrative region 3. Field methods included point counts with and without the use of electronic playback and walking transect surveys. We used N-mixture models and distance sampling to estimate abundance, density, and detection for each of the survey methods in each sampling period. We observed significantly more grouse during spring surveys than summer surveys, which yielded more precise estimates of abundance and

density. The use of electronic playback calls increased detection probability during spring surveys but had no effect on summer detectability. Future work includes evaluating current and other potential survey protocols using simulations and estimates produced from the pilot study.

The Montana Big Game Migration and Seasonal Range Mapping and Research Initiative

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For the last 15 years, Montana Fish Wildlife and Parks and collaborators have been deploying GPS collars across the state to help address local and regional management and research objectives. The continuous capture and instrumentation efforts have resulted in large and ever-growing spatial data sets for elk, mule deer and pronghorn. For elk (*Cervus canadensis nelsoni*) in particular, the aggregated datasets now include over 850 individuals sampled from over 20 populations and nearly 10 million GPS locations. Montana Fish, Wildlife and Parks recently prioritized a broad effort to delineate migration routes and seasonal ranges of elk, mule deer and pronghorn using rigorous methodologies that account for varied terrain, habitat, and big game migration behaviors across the state. This effort has been bolstered by Sectorial Order 3362, which mandated that Department of Interior bureaus work with state wildlife agencies to enhance and improve habitat quality of big game winter range and migration corridors. The broad mapping effort and associated new research will help fulfill local information needs as well as contribute towards regional coordinated mapping efforts across the western US. Spatial files and maps from the mapping effort will be made available to Fish, Wildlife and Parks staff and the public. Our talk will provide an overview of the aggregated data sets to be used in the mapping effort, initial data summaries of migratory behaviors and land ownership use, and the planned methods to delineate migratory corridors and seasonal ranges.

Behavior-Specific Habitat Models as a Tool to Inform Ungulate Restoration

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GPS data is broadly used in wildlife research and management to construct habitat models and can help to inform translocation efforts. However, for species with both resident and migratory behaviors, a single population habitat model may not predict the varying selection patterns of residents and migrants as well as separate resident and migrant habitat models. Moreover, through developing behavior-specific habitat models managers can strategically target source populations with the behaviors that best match the landscape attributes of the areas being restored. Such targeted translocations may increase translocation success and help to build diverse migratory portfolios in restored populations. We used resource selection functions to develop an annual resident model as well as summer and winter migrant models using GPS locations from female bighorn sheep (*Ovis canadensis*) in eight

(resident = 2, migrant = 6) populations that were broadly distributed across western Montana. We extrapolated each model with the purpose of generating broad spatial predictions of bighorn sheep habitat and informing future translocations. Terrain and landscape covariates most strongly influenced resource selection for both behaviors in all seasons. The habitat predictions from the annual resident and winter migrant model strongly overlapped on rugged and steep slopes at low to mid elevations across western Montana. The habitat predictions from the summer migrant model were largely nonoverlapping with residents and broadly distributed across high elevations. Our behavior-specific habitat extrapolations across western Montana serve as a tool to inform future translocations into new areas or expand the distribution and migratory portfolio of existing populations.

Using Ecological Site Condition to Evaluate Habitat Selection by Sharp-Tailed Grouse Broods **

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Brood survival, an important vital rate affecting population viability of sharp-tailed grouse (*Tympanuchus phasianellus*), is largely determined by the selection of brood-rearing habitats by females. The abundance and quality of brood-rearing habitat is often influenced by land management decisions. Thus, improper rangeland management may lead to habitat degradation and impair sharp-tailed grouse populations. Many rangeland management decisions affecting brood habitats (e.g., livestock grazing, prescribed burning) are based on the type and condition of ecological sites in rangelands. However, associations between brood habitat use and ecological site condition have not been evaluated. We examined habitat selection of brood-rearing females in eastern Montana using radio-marked hens. We stratified our field sampling based on pre-existing ecological site maps prepared by the USDA-NRCS. We assessed the condition of each ecological site polygon by comparing the current plant community composition to the historic climax plant community composition (i.e., similarity index) across our study area. We then evaluated selection ratios of radio-marked brood hens in relation to ecological sites and their similarity index. We found that when selecting a home range, the interaction between ecological site type and similarity index was important. When selecting habitat within their home ranges, females selected for sites with a lower similarity index. We found little evidence that ecological site type was a driver of habitat selection once females had selected a home range. Our results provide useful information on brood habitat selection relative to habitat assessment frameworks used by rangeland managers and have implications for the management of sharp-tailed grouse brood habitats.

The Continental-Scale Implications of Point Source Lead Exposure in Golden Eagles

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Lead poisoning threatens many species of raptors, including golden eagles (*Aquila chrysaetos*). Much of this lead likely comes from bullet fragments that remain in carrion after

hunting. The likelihood of lead exposure in golden eagles may peak when migratory and nonmigratory birds congregate in the fall and winter. From 2011 to 2018 in western Montana, we captured 91 golden eagles in the winter, tested their blood lead levels (BLL), and outfitted a subset of birds (n = 30) with GPS transmitters to determine their migratory status. Nearly all golden eagles (94.5%) had elevated BLL (â‰¥ 10 Î¼g dL-1), and eight of them had BLL at or above concentrations expected to cause clinical lead poisoning. Blood lead levels decreased as the winter progressed because hatch-year and juvenile birds tended to have lower BLL later in the season. At least two-thirds of the golden eagles equipped with GPS transmitters migrated northward, spending the summer throughout Alaska and northwestern Canada. Blood lead levels did not differ between migratory and nonmigratory golden eagles. Overall, we show that elevated BLL are widespread among golden eagles overwintering in western Montana, regardless of sex, age, and whether they migrate.

Integrated Monitoring in Bird Conservation Regions (IMBCR) - Avian Monitoring for Management & Conservation

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The 2019 field season marks the 10th consecutive year of statewide implementation of the Integrated Monitoring in Bird Conservation Regions program (IMBCR) in the state of Montana. Today, the IMBCR program represents the second largest breeding landbird monitoring program in the US. IMBCR is made possible via a broad partnership of government and non-government agencies from the Great Plains to the Intermountain West. The randomized, hierarchical sampling design allows for sampling on private and public lands and within all vegetation types. The sampling framework allows for inference about avian populations at multiple scales, from a National Forest or Bureau of Land Management field office, up to the regional level. Using a spatially-balanced, hierarchical study design, the IMBCR program provides density and occupancy estimates for bird species at various spatial extents across the western U.S. Managers can use these baseline estimates and habitat-specific information for project-level planning and environmental assessments. The IMBCR program also provides context for targeted monitoring in project areas to evaluate impacts of land-use change or conservation actions. We highlight several case studies where short-term monitoring efforts leverage the long-term IMBCR data to evaluate avian response to land management practices.

Seasonality of Bobcat Resource Selection

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Home range size of bobcats (*Lynx rufus*) varies by sex, season, and latitude, with bobcats reducing home range size in winter. Additionally, bobcats may shift habitats seasonally, but may also reduce movements to conserve energy in winter. We found that bobcats on the Flathead National Forest, Montana seasonal home ranges did not change size significantly for all bobcats pooled; thus, bobcats did not reduce winter home range size as compared to other seasons. For all bobcats combined, winter home ranges (N = 3) were 65.3 ± 37.5 km^2, spring home ranges (N = 5) were 74.2 ± 16.7 km^2, summer home range (N = 4) were 81.4 ± 13.9

km2, and fall home ranges (N = 4) were 72.0 ± 10.9 km^2. Bobcats significantly reduced daily movement distances dependent on season, specifically reducing movement distances in winter and increasing movements summer. Habitat selection differed significantly for both 2nd order (home range to study area) and for 3rd order habitat selection (GPS locations to home range), but did not differ across seasons, or for the interaction of 2nd and 3rd order selection*season. Specifically, habitat selection differed with burned and wetland habitats being avoided, and lodgepole and dry site mixed species coniferous stands being preferred. Bobcats on the Flathead exhibited seasonal movements comparable to Canada lynx. If bobcats were typical of the broader population, bobcats in northwest Montana may demonstrate a mixture of behaviors characteristic of both bobcats and lynx that allow them to be successful in deep winter snows of this region.

Grizzly Bear and Human Use at Moth Aggregation Sites, Wyoming **

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The objective of our study was to quantify human-bear interactions associated with moth aggregation sites in the greater Yellowstone ecosystem. Our field work was conducted during the summers of 2017 and 2018, and focused on two of the most human-accessible sites within the Shoshone National Forest, Wyoming. Occupancy surveys of grizzly bears (*Ursus arctos horribilis*) were conducted and evaluated using a resource selection function to quantify bear use patterns. Human use was quantified through trailhead monitoring, peak log entries, and opportunistic documentation. Interactions were documented through written or verbal surveys at peaks and trailheads. GPS tracking units were distributed at trailheads to quantify human use patterns. Bear and human use patterns were analyzed in ArcMap to identify areas of overlap. We documented 84 and 182 bears and 37 and 39 human use groups in 2017 and 2018, respectively. Bear use was most strongly associated with landcover and temperature, and to a lesser degree terrain ruggedness and curvature, slope, and moisture. Human use was largely concentrated on published routes from internet resources that overlapped predicted high-use bear areas. We documented 18 bear-human interactions, 12 of which were within predicted high-use bear areas. All interactions resulted in bear displacement with no aggressive behavior toward humans. Human use and bear-human interactions appear to be relatively low but will continue to increase with human use, particularly in high-use bear areas. In the future, managers may consider measures to educate visitors or manage human access to promote human safety and minimize disturbance of grizzly bears.

Bird Community Responses to Habitat Manipulations **

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Habitat treatments such as prescribed burning and mechanical thinning are commonly conducted across the United States for many reasons including reducing fuel loads, increasing habitat quality for wildlife, and modifying forest structural diversity. The Rocky Mountain Elk Foundation has implemented numerous habitat treatments in the Western US to increase

habitat quality for elk (*Cervus canadensis nelsoni*) and other species. Understanding how habitat treatments impact bird communities is important in conserving their habitat and preserving ecosystem services and recreational opportunities that they provide. The objectives of this study are to 1) determine how prescribed burning and mechanical thinning impact occupancy and species richness of birds and 2) determine how these impacts change over time since treatment and in different landscape contexts. To determine these impacts, we sampled the bird community at paired treated-control sites across eastern Oregon, northern Idaho, and western Montana. We sampled sites 1-30 years post treatment. We visited sites three times between May and August, 2018-2019. We conducted point counts and sampled forest and vegetation characteristics along randomly located points within all site pairs. We measured treatment effects on bird communities using changes in occupancy of our focal species (Western Bluebird (*Sialia mexicana*), Dark-eyed Junco (*Junco hyemalis*), Mountain Chickadee (*Poecile gambeli*), and Woodpeckers), and species richness. Our results indicate that there is no significant treatment effect on species richness or occupancy of our focal species.

Microbiome Analysis Enables Future Non-Invasive Microbiome Analysis Enables Future Non-Invasive Wildlife Monitoring of Rocky Mountain Elk Populations **

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Rocky Mountain Elk (*Cervus canadensis nelsoni*) seasonal migration, body-condition and sex ratios are important parameters for characterizing populations at high risk of disease or population decline but, so far, have been outside the scope of currently available non-invasive methods. Fecal microbiomes can be surveyed non-invasively and model systems indicate that microbiome compositional differences are associated with changes in diet, stress, disease and physical condition of the host. With this in mind, we set out to examine the host-microbiome connection in scat samples from 4 populations of elk in western Montana. The elk sampled, varied geographically (i.e. by population/herd), by body condition and by sex. We built a supervised-machine learning classifier on bacterial taxa with cross validation (CV) to predict each fecal microbiome's affiliation to known host categories. The microbiome classifier predicted host population, sex, and body-condition measurements with promising CV results for each classifier. The fecal microbiome classifier developed here may be useful for detecting the sex and relative body condition of elk from other populations or tracking variations within the sampled populations across years. Monitoring wildlife fecal microbiomes would represent a breakthrough for non-invasive conservation biology, and we provide proof of concept for obtaining low cost, fine scale, management-relevant information from scat samples that can be expanded to non-invasive applications and other animal species in the future. Future efforts may also explore training new classifiers to detect wildlife diseases such as Brucella, Anthrax, Tuberculosis or Chronic Wasting Disease that may also be associated with microbiome composition.

Polygyny, Parturition and Calf Survival in a Translocated Eastern Elk Population **

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Aaron Hildreth, Research Science, Missouri Department of Conservation, Columbia
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Translocated populations may undergo exceptional changes in physiology, behavior, genetics, and demography following release into their new environment. Understanding implications of translocation on population processes remains increasingly relevant as number and type of conservation translocation activities increase worldwide. We reintroduced a population of elk (*Cervus canadensis nelsoni*) to the Missouri Ozarks over the years 2011-2013 by translocating 106 individuals from Kentucky. Following translocation efforts we investigated changes in sire structure and consequences on male reproductive success and calf survival. All translocated individuals were fitted with GPS-radiocollars and tissue-sampled for DNA analysis. Subsequently, we captured and processed Missouri-born calves, took calf tissue samples for paternity analysis, and monitored calf survival. Results indicated increasing levels of polygeny in the face of advancing sire age structure across years following translocation. We found a positive effect of sire age on male reproductive success, but observed a significant year interaction signifying a decreasing effect of age across years following translocation as the population both aged and expanded. While we found increased calf mortality associated with later birth dates, we found limited evidence for increased calf mortality hazard associated with younger aged sires. Change in breeding structure is a little considered aspect of wildlife translocation that holds potential population genetic and demographic ramifications. Understanding how wildlife populations respond to translocation events across varied ecological metrics is crucial for increasing project success, improving subsequent management, and, ultimately, ensuring persistence of translocation populations.

Predator Avoidance by Partially Migratory Mule Deer **

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Within partially migratory ungulate populations, selection of forage and security may vary greatly between migrants versus residents, and with spatial scale. Predation risk and forage limitation may be limiting the growth of mule deer (*Odocoileus hemionus*) populations in northwest Montana, which appear to be in decline. We asked how avoidance of mountain lions (*Puma concolor*) and wolves (*Canis lupus*) varies between migrant versus resident deer in 3 partially migratory populations throughout western Montana. We used GPS collar locations of 113 mule deer collared from summers 2017-2019 and developed resource selection functions (RSFs) to assess the effect of predation risk (estimated using mountain lion and wolf RSFs) on home range (2nd order) and within-home range (3rd order) selection by mule deer. Across study areas and migratory strategies, mule deer avoided wolves more

strongly at the 3rd order than at the 2nd order. Migrants were indifferent to wolves at the 2nd order, whereas 2nd order selection by residents was more variable. Mule deer in each study area and strategy avoided lion risk at at least one scale, though lion avoidance strategies were highly variable. We hypothesize that mule deer's indifference to predation risk at a given scales was a result of prioritization of forage at that scale. Our findings highlight the ability of partially migratory ungulates to adjust scale-specific predator avoidance strategies based on local conditions. By incorporating forage quality estimates, we may be able to understand how scale-specific forage/risk tradeoffs vary between migrant and resident mule deer in different ecotypes.

CRP and FWP: the Past, Present and Future of FWP Collaboration with the Conservation Reserve Program

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The Conservation Reserve Program (CRP) is the largest private farmland conservation program in the US, with over 22 million acres currently enrolled nationwide and about $1.8 billion spent in annual rental payments. Since the program's inception in 1985 the positive impacts of CRP on many wildlife species have been documented in Montana and across the country. Montana Fish, Wildlife and Parks has partnered with CRP since 1990 by providing additional cost-share and lease programs specifically for private landowners enrolled in CRP, with the goal of increasing landowner participation and the resulting wildlife benefits of the program. However, over the last 30 years changing rules and implementation of both CRP and FWP programs have led to varying landowner enrollment and fewer benefits to wildlife over time. Discussion of the challenges and successes of both CRP and FWP programs in Montana may provide insight into improving future FWP programs to help keep CRP providing strong positive impacts on Montana's wildlife and private landowners.

To Beaver or not to Beaver, Strategies for Beaver Management on Private Lands

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The activity of beavers (*Castor canadensis*) on streams in the western United States can lead to landscape-scale benefits for natural water storage and fish and wildlife habitat. There is increasing interest in using beavers and beaver mimicry as stream and riparian habitat restoration tools, and to mitigate the impacts of drought and rapidly changing annual water regimes on rangelands. Private landowners may benefit from beaver activity through increased water availability and greater production of green vegetation in floodplains during dry portions of the year. However, beavers can also cause rapid and significant damage to human infrastructure and desired streamside vegetation when they settle down in an inappropriate area. The purpose of this presentation is to outline strategies for evaluating situations where landowners want beavers to colonize their property, as well as situations where landowners want to thwart or preclude beaver-related property damage. Strategies for encouraging colonization include GIS and field-based habitat evaluations, habitat modification to encourage settlement, evaluating the local beaver population for dispersal potential, and communicating realistic expectations of colonization potential and expected benefits based on stream conditions. Strategies for discouraging beavers include tree fencing and painting, culvert fencing, pond levelers, dam destruction, translocation, and lethal trapping. Beaver management on private lands will be a key issue in the coming decades as private landowners

are faced with challenges related to long-term environmental changes, and biologists, land managers, and other entities are uniquely situated to help private landowners navigate the complexities of beaver colonization and associated impacts.

Assessment of Sympatric Turtle Populations and Movements in Relation to an Irrigation Barrier on Pryor Creek **

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Habitat loss and fragmentation due to dams is one of the most significant threats to turtles worldwide. Barriers can isolate populations and reduce gene flow, increasing vulnerability to extinction-level events. Pryor Creek (Huntley, Montana) features a sympatric population of spiny softshell turtles (*Apalone spinifera*) and snapping turtles (*Chelydra serpentina*), and a 3-meter tall irrigation barrier. Populations of both species live on either side of the barrier, but connectivity between these populations is unknown. We hypothesized that movements of both species would be restricted by the barrier. We also expected possible differences in population demographic structures of each species above and below the barrier due to habitat differences and population isolation. Mark-recapture and radio-telemetry techniques were used to gather movement data on 150 individual turtles over four years. To date no snapping turtles have been documented bypassing the barrier, but four spiny softshell turtles have passed the barrier. Demographics of both species were found to be significantly different above and below the barrier. No female snapping turtles were caught below the barrier, and no juvenile spiny softshell turtles were caught above the barrier. Mean weight of spiny softshell turtles above and below the dam were significantly different. These differences may indicate differences in survival, reproduction, and possibly food availability. This is the first study looking at the ability of turtles to navigate around an aquatic barrier, which has significant long-term implications for population health and management efforts.

Seeking Snow and Breathing Hard: Behavioral Tactics in Mountain Goats to Combat Warming Temperatures

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Mark Biel, Natural Resources, Glacier National Park, West Glacier, MT

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The world glaciers and persistent summer snowpack are being lost due to warming temperatures. For cold-adapted species, habitat features may offer opportunities for cooling during summer heat yet the loss of snow and ice may compromise derived thermoregulatory benefits. Herein we offer insights about habitat selection for snow and the extent to which other behavioral adjustments reduce thermal debt among high elevation mammals. Specifically, we concentrate on mountain goats (*Oreamnos americanus*), a species whose native distribution is tied areas where large patches of persistent summer snow are declining, and which became extinct during geologically warmer epochs. To examine sensitivity to possible thermal stressors and use of summer snow cover, we tracked marked and unmarked mountain goats in Glacier National Park, Montana, USA, to test hypotheses about selection for cold microclimates including shade and snow during periods of relatively high temperature. To understand functional responses of habitat choices, we measured microhabitat temperatures and a component of goat physiology "breaths per minute" as an index for metabolic expenditure. Individuals 1) selected areas closer to snow on warmer summer days, and 2) on snow had a 15% mean reduction in respiration when accounting for other factors, which suggests remnant snow plays an important role in mediating effects of air temperature.

The use of shade was not as an important variable in models explaining respiration. Despite the loss of 85% of glaciers in in Glacier National Park, summer's remnant snow patches are an important reservoir by which animals reduce heat stress and potential hyperthermia.

Mount Dean Stone: Planning for Growth and Balancing Use at the Edge of the City

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Pelah Hoyt, Lands Director, Five Valleys Land Trust, Missoula, MT

Missoula's Mount Dean Stone community open space project is a 4,200 acre proposed complex located on the wildland-urban interface of the city's fast growing south side. The Mount Dean Stone Committee, comprised of community partners including organizations, agencies, businesses and individuals, have worked together since the inception of the overall proposed complex in 2016 to help understand how to best meet the recreation needs of a growing Missoula area and to leverage these recreational opportunities into broad and engaged community support for conservation of community open space and wildlife habitat. This session aims to share about the role of a community land trust in private lands conservation to meet the conservation values of publicly accessible community open space and protection of wildlife habitat along the wildland-urban interface.

Mechanisms Influencing Pack Size in Gray Wolves

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Estimates of the abundance of gray wolves (*Canis lupus*) are important to the Montana Fish, Wildlife and Parks (MFWP) Wolf Program. MFWP uses a Patch Occupancy Model (POM) to estimate area occupied, from which they estimate abundance based on average territory and pack size. Accordingly, abundance estimates depend on intensive field monitoring to estimate pack sizes. Pack size is driven by births, deaths, and the social decisions of group members, including if and when to disperse. Like many cooperatively breeding canids, gray wolves exhibit flexible and diverse dispersal behaviors. We aimed to better understand mechanisms influencing pack size and dispersal, and to develop a predictive tool for estimating pack size for wolves in Montana, absent data directly related to births and dispersals because these data will be unavailable to wildlife managers. We hypothesized that group sizes of cooperatively-breeding canids would be influenced by conditions related to prey, competition, and mortality risk. We found that wolf pack sizes in Montana were positively related to local densities of prey and packs, and negatively related to terrain ruggedness, local mortalities, and intensity of harvest management. A predictive model for pack sizes reliably estimated the mean annual pack sizes observed from 2005-2018 (adjusted R-squared = 0.58, $P < 0.002$) and illuminated possible underlying mechanisms influencing variation in pack sizes over space and time. Alongside a mechanistic territory model we developed for POM, our pack size model will help keep abundance estimates from POM calibrated into the future, absent intensive monitoring effort.

Gray Wolves Select Territories Economically

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Estimating wolf (*Canis lupus*) abundance is a key component of wolf management in Montana. Montana Fish, Wildlife and Parks uses a Patch Occupancy Model (POM) to estimate area occupied, from which they estimate abundance based on average territory and pack size. Abundance estimates thus depend on assumptions that territory size is fixed and consistent statewide. In reality, territories vary spatiotemporally, which will affect precision and accuracy of abundance estimates. We developed a mechanistic model of territory selection to better understand territorial behavior and improve abundance estimates from POM. We hypothesized that wolves select territories economically based on the benefits of food resources and costs of competition, travel, and predation risk. Using only simple behavioral rules and limited, readily-available data for food resources, terrain ruggedness, and human density, the model predicted wolf distribution in Montana and the territory sizes and locations for specific packs. It accomplished this without using empirical data for wolves. The model provided evidence for the mechanisms driving empirically-observed patterns in space use by wolves. It demonstrated, for example, how economical behavior will cause territory size to decrease and overlap to increase with greater densities of prey and competitors. Results are consistent with the hypothesis that wolves select territories economically based on the benefits and costs of territory ownership. The mechanistic nature of the model makes it reliable for predicting territorial behavior under a full range of conditions wolves might encounter. This information will help keep abundance estimates from POM calibrated, absent intensive monitoring effort.

By Thinking Outside the Box, Mitigation Conserves Working Private Lands Intermingled With Public Lands in Key Sagebrush-Grassland Areas

Carolyn Sime*, Montana Sage Grouse Habitat Conservation Program, DNRC, Helena

John Carlson, BLM, Montana/Dakota State Office, Billings

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Therese Hartman, Montana Sage Grouse Habitat Conservation Program, DNRC, Helena

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Graham Neale, USDA Forest Service, Bozeman, MT

Login Cain, Montana Sage Grouse Habitat Conservation Program, DNRC, Helena, MT

Erin Reather, Montana Sage Grouse Habitat Conservation Program, DNRC, Helena, MT

Ella Lunny, Montana Sage Grouse Habitat Conservation Program, DNRC, Helena, MT

Montana's efforts to conserve Greater Sage-grouse (GRSG) and GRSG habitats have been long-standing and significant. Most of Montana's highest priority GRSG habitats are found on working private lands managed for livestock. BLM lands comprise 30% of the total, but addressing all threats across a checkerboard ownership in ecologically meaningful ways and at a landscape scale requires outside-the-box tools. Alongside voluntary private land stewardship, developers must mitigate direct and indirect impacts on state, federal, and private

lands in designated GRSG habitats for which state or federal permits are required. Mitigation motivates developers to avoid, minimize, reclaim, and compensate for impacts by siting and implementing projects in ways that are least impactful and keep mitigation obligations/costs low. Mitigation motivates private landowners to continue stewarding their lands through the overt acknowledgment and explicit rewards reaped by providing ecosystem services that sustain a host of wildlife species. Developers can satisfy obligations through permittee-responsible projects implemented on state, federal, or private land or by contributing to Montana's Stewardship Account. The Account funds grants to implement projects offsetting development, similar to an in-lieu fee approach. The state will have spent almost $6.8 million to conserve 77,233 acres through perpetual easements and term leases targeted at private lands from 2016-2020. These projects are strategically located adjacent to and intermingled with BLM lands. State funds were matched with at least $6.86 million in NRCS and private funds. Developers themselves placed a perpetual easement on private land, permanently plugged and abandoned an oil and gas field on BLM land, and removed and buried overhead electrical distribution lines crossing private and BLM lands. Montana's approach to implementing mitigation across all lands is a novel way to conserve remaining habitats using market forces.

Sage-Grouse: Fine-Scale Specialist or Shrub-Steppe Generalist?

Joseph Smith*, Wildlife Biology, University of Montana, Missoula

Sage-grouse (*Centrocercus spp.*) are driving rapidly-evolving land management policy in the western United States. Management objectives for fine-scale vegetation characteristics have been widely adopted by land management agencies based on resource selection or relationships with fitness proxies reported among numerous habitat studies. However, some managers have questioned the appropriateness of these objectives. Moreover, it remains untested whether habitat-fitness relationships documented at fine scales (i.e., among individual nests within a study area) also apply at scales of management units (e.g., pastures or grazing allotments), which are many orders of magnitude larger. We employ meta-analyses to help resolve the role of fine-scale vegetation structure in nest site selection and nest success across the geographic range of greater sage-grouse (*C. urophasianus*) and evaluate the validity of established habitat management objectives. Importantly, our approach tests habitat relationships at a range-wide extent and a grain size closely matching scales at which agencies make management decisions. We found moderate, but context-dependent, effects of shrub characteristics and weak effects of herbaceous vegetation on nest site selection. None of the tested vegetation characteristics were related to variation in nest success, suggesting nesting habitat-fitness relationships have been inappropriately extrapolated in developing range-wide habitat management objectives. Our findings reveal surprising flexibility in fine-scale habitat use for a species often depicted as having very particular fine-scale habitat requirements, and cast doubt on the practice of adopting precise management objectives for vegetation structure based on findings of individual small-scale field studies.

An Interactive Web Tool for Deciding Between Possible Occupancy Study Designs for Rare and Cryptic Species

Hannah Specht*, Montana Cooperative Wildlife Research Unit AND UM Boone & Crockett Wildlife Conservation Program, University of Montana, Missoula

Occupancy-based monitoring has become a valuable tool for studying rare and cryptic wildlife species. The growth of popularity of occupancy studies has been accompanied by

the development of many adaptations to the original standard occupancy design, aiming to improve efficiency and to address cases where model assumptions cannot be met. For example, removal & conditional designs were developed for efficient distribution of effort between initial site visits versus repeat surveys based on how common a species is. The robust design is another adaptation that accounts for cases where the focal species may leave the study site between survey occasions. Given many options, it is not always clear which survey design will be most effective for the multiple constraints of a specific case. Yet, choosing an effective study design is critical, particularly when seeking to obtain information for rare and cryptic species, for which standard approaches are often less effective. We used case studies of Montana non-game "Species of Greatest Inventory Need" to guide development of an interactive, web-based tool that provides recommendations on occupancy study design based on study objectives and focal species characteristics. These recommendations are based on a synthesis of existing research into occupancy study design and accompanying power analyses. Simple power analyses provide users a visual sense of the effort required to obtain information related to covariates or detect trends when using an occupancy study approach under different circumstances. We will demonstrate the app using Montana Species of Greatest Inventory Need as an example.

Straight from the Horse's Mouth

Kate Stone*, Ecology, MPG Ranch, Florence, MT
Eric Rasmussen, Ecology, MPG Ranch, Florence, MT

What prompts a private landowner to decide that "opening the gate" for scientists or wildlife managers is a good idea? In this presentation, we will hear from several private landowners in the Bitterroot Valley who've embraced research and inventory projects. Why do they participate? What have they learned? How do they see these types of collaborations supporting conservation efforts in the Bitterroot Valley and elsewhere? Please join us in celebrating a few people brave enough to venture to Butte to visit with you. We'll allow ample time for discussion.

Bring Me a Carcass! The Gift of Reciprocal Giving on Private Lands in the Bitterroot Valley

Kate Stone*, Ecology, MPG Ranch, Florence, MT
Eric Rasmussen, Ecology, MPG Ranch, Florence, MT
Debbie Leick, Ecology, MPG Ranch, Florence, MT
William Blake, Ecology, MPG Ranch, Florence, MT

The Bitterroot Valley contains diverse stakeholders. We've experienced rapid growth in recent years, but agricultural activities and private parcels with minimal development still dominate much of the landscape. Conservation groups work on voluntary efforts to protect wildlife, working lands, and water in our community. However, like agricultural communities in many areas, our working lands and their stewards are often under-appreciated for the habitat services they provide to all community members. Our neighbors and friends host some of the best habitats for non-game wildlife, from Long-billed Curlews to Lewis's Woodpeckers. The decision to let scientists come on your land and collect data or record observations could instigate fear, skepticism, or hesitancy. Over the past ten years, the bird scientists at MPG Ranch have alleviated some of these reactions, expanding their research area to include thousands of acres of private land, blanketing the landscape with hundreds of thousands of observation points. What kind of data have we collected? How do we apply it? From moth

nights to carcass-camera traps to the peeps of millions of passerine migrants, we've expanded our knowledge of ecosystems, engaged the general public, and leveraged information for positive conservation outcomes. Come hear some tales from the field.

Scavengers Of Southwest Montana And Their Potential Impact On Brucellosis Transmission

Kimberly Szcodronski*, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT

Paul Cross, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT

Brucellosis, a bacterial disease caused by *Brucella abortus*, is a major concern in the Greater Yellowstone Ecosystem due to potential transmission from elk (*Cervus elaphus*) to livestock. B. abortus can lead to abortion in infected animals and is primarily transmitted between elk and livestock when individuals contact infected abortion materials. Therefore, the risk of transmission is likely a function of how long abortion materials remain on the landscape. To investigate removal rates of abortion materials by scavengers in southwest Montana, we placed bovine fetuses and placentas at 266 sites within suitable elk habitat during the brucellosis transmission risk period from February-June, 2017 and 2018. We used remote cameras to quantify the removal rate and conducted parametric survival analysis to test for covariate effects. Abortion materials were removed by scavengers at an average rate of 84 hours (± 8.5 SE) across all study sites. The top model suggested time to removal decreased in grassland habitats in comparison to sagebrush steppe and forest. Additionally, preliminary analyses suggest that mammalian predator removal practices on private ranches are correlated with time to removal. Abortion materials were consumed by a variety of avian and terrestrial scavengers with golden and bald eagles, coyotes, foxes, and turkey vultures being responsible for scavenging most of the abortion materials. Our results suggest scavengers play a vital role in reducing the persistence of B. abortus on the landscape, and that the rate of fetus removal varies across habitat and management types.

The Flathead River to Lake Initiative - Diverse Partners Effectively Collaborating to Save a River Corridor

Kris Tempel*, Montana Fish, Wildlife and Parks, Kalispell

Twenty years ago, agencies, NGOs, tribes, and landowners came together to protect the natural heritage of Flathead River and Lake: excellent water quality, abundant fish and wildlife and their habitat, outstanding scenic and recreation values, and prime farmland. In the early 2000s, the Flathead Valley was experiencing rapid growth and development. Farms throughout the valley, but especially along the river and lake, were being sold and subdivided threatening this important natural heritage. Using the power of partnerships and leveraging multiple funding sources, the River to Lake Initiative has successfully knitted together a patchwork of relatively small private ownerships into an ecologically functional unit. Landscape-scale habitat protection is often the focus of conservation efforts, but small-scale, focused conservation can also play a critical role preventing wildlife conflicts and providing for movement corridors. This presentation highlights how long-term, collaborative partnerships can achieve meaningful conservation and are essential to weathering the ups and downs inherent in any conservation effort.

Stress Hormones Mediate Tradeoffs Between Survival and Growth for Amphibians Exposed to Increased Salinity **

Brian Tornabene*, Wildlife Biology, University of Montana, Missoula
Creagh Breuner, Organismal Biology, Ecology, and Evolution, University of Montana, Missoula
Blake Hossack, Northern Rocky Mountain Science Center, U.S. Geological Survey, Missoula, MT

Salinity has increased in many freshwater ecosystems in the last century. Despite this, limited information exists on its effects on freshwater vertebrates. Amphibians are sensitive to salinity because of their porous skin and primarily-aquatic lifecycle. Wildlife managers often seek biomarkers to gauge the influence of contaminants on population health; one marker may be changes in stress hormones (e.g., corticosterone; CORT). We investigated the influence of increased salinity on growth, CORT, and survival of larval leopard frogs (*Rana pipiens*) in a controlled experiment. We exposed larvae to one of three environmentally-relevant salt concentrations, and compared them against controls. For half of the larvae, we also blocked actions of CORT (using RU486) to determine if it mediates effects of salinity. We used novel, noninvasive techniques to collect waterborne CORT samples from larvae every 4 d for 24 d (baseline and stress-induced). Larval size, development, and survival decreased with exposure to increasing salinity. Survival decreased faster when CORT was also blocked. However, size and development did not decrease compared to controls when CORT was blocked. Baseline and stress-induced CORT were positively related to survival. Our results demonstrate that CORT may mediate life history tradeoffs of larvae exposed to increased salinity by diverting energy from growth and development towards survival. However, by blocking CORT, the opposite occurred. We detected some differences in CORT among treatments during the experiment, but CORT responses were not different after 3 weeks of exposure. Therefore, CORT may not be a suitable biomarker for monitoring influences of salinity on amphibians.

Looking Back at 19 Years of Mule Deer Adaptive Harvest Management in MFWP Region 6

Ryan M Williamson*, Montana Fish, Wildlife and Parks, Outlook

The FWP adapted the Mule Deer (*Odocoileus hemionus*) Adaptative Harvest Management plan in 2001 and since then, mule deer densities within FWP Administrative Region 6 have increased significantly over the last two decades, as estimated through 11 deer trend areas across the region. Due to increasing densities, increased hunting pressure, new disease threats and potential game damage concerns on private lands, the FWP has steadily increased harvest through available antlerless b-licenses. The majority of the region is either-sex, general hunting opportunity for both deer species with liberal b-licenses but available b-licenses have fluctuated in the last 19 years, as low as no b-licenses available for two years, to over 6,000 offered across the region in 2019. In recent years, the demand from both landowners and sportsman for increased harvest opportunity and the need to reduce higher concentrations of deer has also increased. Mule deer numbers have thrived under AHM since its inception and the FWP's objective to maintain deer densities at a more tolerable and closer to average level provides mostly liberal hunting seasons across the region while minimizing landowner conflicts with mule deer and maintaining a healthy population.

Learning From your Mistakes - A New Approach to Conservation Partnerships

Alan Wood*, Wildlife Division, Montana Fish, Wildlife & Parks, Kalispell, MT

Wildlife habitat conservation projects are often complicated, and they become increasingly so when working with a variety of funding partners. In addition, these projects can be politically charged when government agencies are involved. Montana Fish, Wildlife & Parks has a variety of funding sources that are dedicated to wildlife habitat conservation, including the funding for mitigating wildlife impacts caused by construction of Libby and Hungry Horse dams in northwest Montana. After years of struggling to complete conservation projects, we developed a new approach relying on partners to help us achieve our goals. This new focus on partnerships had unexpected and very positive results. This presentation will tell the story of how this partnership-based focus came to be and how $750,000 has leveraged more than $200 million dollars resulting in conservation of 260,000 acres of wildlife habitat in northwest Montana.

Quantifying Elk Aggregation From GPS, Satellite, and UAS Data on the National Elk Refuge

Michael Yarnall*, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT

The transmission and prevalence of CWD and other wildlife diseases likely depend on the density of animals on the landscape, which can have important implications for the frequency of animal contacts and the potential for environmental transmission. Amid increasing concern regarding the spread of CWD, new tools are needed to characterize the degree to which animals are aggregated on the landscape so that managers can assess the effectiveness of actions intended to reduce aggregation and disease transmission. Ideally, the type of data used to measure aggregation would a) provide precise and accurate information on how aggregation changes through time, b) yield additional information on the number and distribution of animals, and c) be inexpensive. We evaluated 7 aggregation metrics calculated using elk (*Cervus canadensis nelsoni*) locations on the National Elk Refuge derived from GPS collars, satellite, and UAS imagery. We assessed 1) the accuracy of these methods relative to traditional aerial and ground counts, 2) which approaches adequately identify changes in aggregation across time periods relevant for disease management action, and 3) whether aggregation metrics from different data sources can be compared directly to enable comparisons across multiple populations. We discuss potential pitfalls and benefits presented by new approaches to quantifying elk aggregations. We found that satellite and GPS data were most valuable for comparing elk aggregations across time and in relation to feeding activities. Inter-elk distance distributions and kernel density estimates represent easily interpretable metrics that are sensitive to changes in elk aggregation.

Poster Abstracts

Alphabetical By Presenter's Name
*** Denotes Presenter**
**** Indicates Student Presentation**

Montana Brat: an Online Tool For Assessing Beaver Dam Capacity and Suitability in Montana Streams (Poster)

Heidi Anderson*, Montana Natural Heritage Program, Spatial Analysis Lab, University of Montana, Missoula

Braden Burkholder, Montana Natural Heritage Program, University of Montana, Helena

Claudine Tobalske, Montana Natural Heritage Program, Spatial Analysis Lab, University of Montana, Missoula

Linda Vance, Montana Natural Heritage Program, University of Montana, Missoula

The Beaver (*Castor canadensis*) Restoration Assessment Tool, originally developed by the Wheaton Lab at Utah State University, is a planning tool designed to evaluate a stream's potential to support beaver dams, whether build by beavers or by humans in the form of beaver dam analogs (BDAs). It operates at a drainage network level to assess dam capacity and the potential risks that dams might pose to infrastructure (e.g., roads, bridges) or natural and human resources. The Montana Natural Heritage Program has adapted the USU BRAT model to run with Montana-specific data sets, and has turned it into an ArcGIS Onlone interactive tool for easy use by managers and planners. The poster presents the background and assumptions of BRAT, and demonstrates how it can be used to identify opportunities and risks associated with beaver conservation and restoration or BDA installation.

Experimental Mapping of Great Blue Heron Colonies in Important Bird Areas using Satellite Imagery (Poster)

Boaz Crees, Montana Audubon, 1515 6th Ave., Helena

Amy Seaman, Montana Audubon, P. O. Box 595, Helena

Bryce Maxell, Montana Natural Heritage Program, 1515 6th Ave., Helena

The great blue heron (*Ardea Herodias*) is a species of concern in Montana that has seen significant population decline of 2.2% per year between 1966 and 2010 and is vulnerable to human disturbance and habitat loss. They are an important indicator species as they rely on healthy productive riparian systems for foraging and nesting. Great blue herons are colonial nesters that typically nest in mature cottonwood galleries along major river and stream corridors. They prefer to nest in areas with little human disturbance and low road density, and often abandon colonies when disturbed during the egg laying and incubation stages. Colonies are also sometimes abandoned as a result of tree mortality. Since great blue herons establish nesting colonies in relatively remote areas, often dozens of miles apart, it can be logistically challenging and costly to survey them. We wanted to determine whether it is possible to effectively survey colonies in Montana using high-resolution satellite imagery. We used Google Earth to systematically survey for important burn areas and found that many colonies are clearly visible and relatively easy to detect using this method. To assess search efficacy, we conducted a "blind" search and then compared the findings to non-colony locations. In a short time, we were able to identify nearly all known colonies. Additionally, we documented

several unreported colonies using this simple, accessible method. This demonstrates that using imagery to survey remotely may be a viable or alternative to costly aerial surveys in a reliable way to monitor long-term population trends.

Evaluating Two Monitoring Methods During Autumn Songbird Migration (Poster)

Megan Fylling*, Bird Ecology Lab, University of Montana, Missoula
Margaret M. Blake, Bird Ecology Lab, University of Montana, Missoula
Debbie S. Leick, Avian Sciences Dept., MPG Ranch, Florence, MT
Tricia M. Rodriguez, Bird Ecology Lab, University of Montana, Missoula
Kate R. Stone, Avian Sciences Dept., MPG Ranch, Florence, MT

Migration is an important part of avian life cycles that is not well understood, particularly in the West. Understanding how factors like climate change and habitat condition are affecting migrating populations is limited by our ability to monitor them. We compared two widely used migration monitoring tools to see if they are comparable for detecting apparent abundance. This study evaluated how standard effort mist-netting detections compared to automated recording unit detections. For the 24 species that were detected by both methods, relative abundance was correlated ($r = 0.60$; SE 0.17). While there is some ability to estimate apparent abundance based on the correlative nature of one method, the target species or project goal may dictate which monitoring method should be applied. Ideally, combining these methods will provide a better and more complementary representation of trends in migrating songbirds.

Snapping Turtle Nesting Habitat On A Tributary Of The Yellowstone River** (Poster)

Miranda Gallagher*, Environmental Science, Rocky Mountian College, Billings, MT

Snapping turtles (*Chelydra serpentina*) are considered a "Species Of Concern" in Montana due to the lack of knowledge of their life history and distribution. Information on turtle home ranges, adult survival, and female nesting locations are critical for understanding the viability of snapping turtle populations. We used geospatial data about snapping turtle movement along Razor Creek (a tributary of the Yellowstone River) and environmental factors (slope, aspect, land use, proximity to water) to map linear home ranges and identify suitable nesting habitat. The study area is at the northwestern-most range edge of the species distribution, where no previous studies have occurred.Snapping turtle location data and attributes were collected with standardized trapping to document movements, and randomly selected turtles of both sexes were fitted with radio-telemetry tags to facilitate a more comprehensive analysis of habitat use and linear home range sizes. For nest habitat modeling we selected adult female locations during the nesting season (May - June). The resulting datasets were processed using ArcMap 10.5 GIS software. Geoprocessing workflows were then used to identify potential nesting areas based on the following factors known to influence nesting habitat: distance from water, land use, aspect, and slope.Average linear home ranges were longer for females (3,079 m) ($n = 6$) when compared to males (2,914 m) ($n = 6$) but not significantly different. Of the total accessible nesting habitat in our study area, 40% was deemed as "suitable nesting habitat". Of the total "suitable nesting habitat" area , 58% was located on private lands. This refined area will guide nest searches next spring and hopefully lead to the documentation of the first snapping turtle nests in Montana, a better understanding of nesting habitat, and improved efforts to conserve this species.

Estimating Population Size of Grand Canyon Bighorn Sheep With SCR (Poster)

Sarah M. Gaulke*, Northern Rocky Mountain Science Center, U.S. Geological Survey, West Glacier, MT

Tabitha A. Graves, Northern Rocky Mountain Science Center, U.S. Geological Survey, West Glacier, MT

Brandon Holton, Grand Canyon National Park, National Park Service, Grand Canyon, AZ

Clinton Epps, Department of Fisheries and Wildlife, Oregon State University , Corvallis, OR

Rachel Crowhurst, Department of Fisheries and Wildlife, Corvallis, OR

Ryan Monello, Pacific Island Network, National Park Service Inventory and Monitoring Network, Hawaii Volcanoes National Park, HI

Desert bighorn sheep (*Ovis canadensis nelsoni*) are a species of conservation concern and management importance for their symbolism, role as the only ungulate in the desert nutrient cycle, and as a prey and carrion source. The bighorn population in the Grand Canyon (GRCA) represents the largest population managed by the National Park Service on the largest protected habitat on the Colorado Plateau. Bighorn sheep are highly susceptible to pneumonia from contacts with domestic sheep and the first documented occurrence of pneumonia in the GRCA caused a significant decline in survey counts between 2011 and 2014. The disease outbreak occurred during a large-scale, multi-year study of bighorn sheep movement and connectivity by sampling fecal pellets. This created an opportunity to conduct the first estimate of bighorn abundance and disease impacts for the entire GRCA. Thirteen hundred samples from five years were genotyped and analyzed with spatial capture-recapture models to estimate abundance while modeling detection and incorporating environmental constraints. We will discuss top models for detection and density, and describe our approaches for accounting for a linear sample design in this population, reducing the size of confidence intervals with auxiliary data, and estimating movement through the system.

Nest Attentiveness in North America's Largest Grouse** (Poster)

Erin Gelling*, Department of Ecosystem Science and Management, University of Wyoming, Laramie

Aaron Pratt, Department of Ecosystem Science and Management, University of Wyoming, Laramie

Jeffrey Beck, Department of Ecosystem Science and Management, University of Wyoming, Laramie

Understanding nest attentiveness (i.e., amount of time spent incubating) of North America's largest grouse, greater sage-grouse (*Centrocercus urophasianus*), hereafter "sage-grouse"), can be important for conserving populations, as reproductive costs can reduce survival of parents and nest attentiveness can influence nest success. When nesting, parents must allocate their time between incubating and maintenance activities, such as foraging to meet their nutritional demands. Previous research has shown female sage-grouse sustain long stretches of incubation interrupted by relatively short recesses from their nests, but incubation patterns likely differ among females. We initiated our study in 2018 with two objectives: 1) to evaluate what factors influence nest attentiveness, and 2) how nest attentiveness influences nest success by examining duration, number, and timing of recesses, and time spent incubating for successful and unsuccessful nests. We monitored female sage-grouse with GPS transmitters collecting locations every 5 minutes from 0300-2300 MST in Carbon

County, Montana in 2018 and 2019 and in Carbon County, Wyoming in 2019. In Montana, we monitored 40 sage-grouse nests (17 hatched, 23 failed) in 2018, and 46 nests (21 hatched, 25 failed) in 2019. In Wyoming, we monitored 50 nests (12 hatched, 38 failed) in 2019. We measured microhabitat vegetation at 81 nests in Montana and 50 nests in Wyoming to determine habitat influences on nest attentiveness. Understanding factors that influence nest attentiveness throughout the incubation period and therefore nest success will add important and novel information to basic sage-grouse nesting ecology.

Mammal Community Response to Cattle Grazing** (Poster)

Christopher Hansen*, Department of Ecosystems and Conservation Science, University of Montana, Missoula

Joshua Millspaugh, Department of Ecosystems and Conservation Science, University of Montana, Missoula

Roland Kays, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh

The impacts of cattle (*Bos taurus*) grazing on the environment are complex. Chronic overgrazing may inhibit primary productivity and alter vegetation structure and composition, while moderate grazing may increase the quality of vegetation by stimulating new growth and net primary productivity. Numerous studies have estimated the effects of grazing on wildlife demography and behavior, but few have evaluated the effects of grazing on multitrophic communities. Our objective is to identify how squirrel-sized and larger mammals interact with cattle at varying grazing intensities and how cattle affect the structure of the mammal community. Specifically, we aim to determine whether species richness, occurrence, and behavior of mammal species is influenced by the number of cattle, and whether these potential influences cause changes in interspecific interactions among sympatric mammal species. To answer these questions, we set trail cameras 40-50 cm high, unbaited, at random sites within cattle ranches in western Montana representative of the variation in grazing management practices. Throughout spring, summer, and fall, we set trail cameras for at least 21 days at 75 sites per ranch. We will estimate co-occurrence of all potentially interacting mammal species, using a multispecies occupancy model that accounts for imperfect detection, and evaluate how the presence of cattle affects these interactions. We will also monitor species changes in temporal activity patterns in the presence of cattle. Results will identify how mammal communities respond to cattle grazing, which may offer insight into sustainable coexistence among wild and domestic species.

Help Wanted: Volunteer Observers Needed for Mountain Grouse** Population Study (Poster)

Elizabeth Leipold*, Department of Animal and Range Sciences, Montana State University, Bozeman

Claire Gower, Montana Department of Fish, Wildlife, and Parks, Montana Department of Fish, Wildlife, and Parks, Bozeman

Lance McNew, Department of Animal and Range Sciences, Montana State University, Bozeman

Montana State University in conjunction with Montana, Fish, Wildlife, and Parks is developing a population monitoring program for mountain grouse. Species of interest include dusky and ruffed grouse, which are found in montane conifer forests throughout western Montana. Males of both species engage in courtship displays during spring that increase the probability of detecting an individual. Dusky grouse produce a hooting noise that can be heard within 50-100 meters and ruffed grouse produce a drumming noise that is audible up to 200 meters. We are looking for volunteers interested in assisting with surveys during the sampling

period. Surveys will occur between 25 April-25 May during early morning hours. Survey methods may include point counts and walking transect routes that occur along forest service roads or trails. Point counts will consist of going to multiple locations (5) along a survey route and recording all grouse detections within a 4 minute time period. If interested in spending a few mornings this spring hiking and looking or listening for mountain grouse, please let us know!

The Bitterroot Valley Winter Eagle Project (Poster)

Mary Scofield*, Avian Science, MPG Ranch, Missoula, MT
Kate Stone, Avian Science, MPG Ranch, Missoula, MT

Golden (*Aquila chrysaetos*) and bald (*Haliaeetus leucocephalus*) Eagles commonly scavenge on carrion while overwintering in Montana. This behavior may expose them to conflict with other scavengers, including other eagles. The availability of carrion is generally ephemeral, suggesting overwintering eagles must possess behavioral adaptations to successfully find food and potentially compete with other scavengers. We documented the occurrence and behavior of marked eagles at camera traps set on roadkill deer on private lands in the Bitterroot Valley of western Montana. Our re-sightings included over 25 eagles individually identifiable by wing tag, colored and numbered leg band, or satellite transmitter. We also had re-sightings of at least 10 eagles with metal USGS leg bands, allowing us to look at visitation length and behavior without individual identification. With few exceptions, most eagles visited a carcass just one day and over half of these eagles fed on the carcass once that day. The length of time a bald eagle feeds at the carcass increases with the number of other bald eagles present and reduces when golden eagles are present. Golden eagles have more consistent feeding lengths regardless of the other eagles present. We also compared eagle re-sightings to movement data from eagles with transmitters to investigate whether or not persistent food availability influences the movements or behavior of bald or golden eagles. Our results suggest that even with a consistent food resource, eagles generally feed then move on. This behavior may result from an adaptation to ephemeral winter food resources.

Evaluating Habitat Suitability for Lesser Prairie-Chicken** Reintroduction (Poster)

Morgan Solomon*, Animal and Range Sciences, Montana State University, Bozeman
Lance B. McNew, Animal and Range Sciences, Montana State University, Bozeman

Large-scale patterns of land-use and habitat fragmentation have significantly reduced the range and numbers of lesser prairie-chickens in the southern Great Plains. Because lesser prairie-chickens are generally a residential species with limited dispersal abilities, increasing the size and connectivity of sub-populations and restoring habitat in areas previously occupied is essential for species' recovery. To guide future management practices for lesser prairie-chicken recovery, we will use locations of stable leks collected from lek survey data from 2010 -2019 to develop resource selection models for the species' current distribution in the mixed-grass prairie ecoregion. We will extrapolate our best resource selection model to the historic range of lesser prairie-chickens to identify and quantify potential habitat patches for reintroduction, as well as to evaluate the relative connectivity of potential habitat patches to existing lesser prairie-chicken populations using a least-cost path analysis. We will then use our resource selection model with habitat-based ratio estimators to estimate population sizes at potential habitat patches. Habitat patches will be prioritized for lesser prairie-chicken reintroduction based on habitat patch size, total available lesser prairie-chicken habitat, and relative connectivity of potential habitat patches to existing populations. Finally, we will use

our resource selection model to quantify the relative improvement in available lesser prairie-chicken habitat for areas that recently participated in restorative management actions by comparing current habitat conditions to habitat conditions prior to management actions. Our resource selection models will assist future reintroduction and habitat restoration plans by identifying habitat conditions that predict the presence of stable lesser prairie-chicken leks, and the highest quality, most connected habitat patches in the mixed-grass prairie ecoregion.

Sticking Their Noses in it…. Ungulates Investigating Carrion in a CWD World (Poster)

Katharine Stone*, Bird Ecology , MPG Ranch, Florence, MT
Eric Rasmussen, Bird Ecology , MPG Ranch, Florence, MT
Mike McTee, Environmental Science, MPG Ranch, Florence, MT
Erik Samsoe, Technology Transfer, MPG Ranch, Florence, MT

The recent arrival and spread of chronic wasting disease (CWD) in Montana permeates the thoughts of the hunting public and wildlife managers. Both communities share a concern for how hunters might play a role in either facilitating or limiting disease spread; live ungulates may contact infected carrion, either in the field post harvest or after transport and disposal by a hunter. We operate two camera-trap projects involving dead ungulates to study scavenger ecology. From winter of 2015 to present we have placed cameras on over 400 road kill deer on private lands in the Bitterroot Valley to document marked eagles and other scavengers. We've also worked with hunters for two years placing cameras on gut piles in the field in many parts of Montana as well as Colorado and Wyoming. In addition to scavengers, we incidentally noticed a surprising number of ungulates investigating the carrion involved in both projects. This poster will share camera footage and documentation of how often this behavior occurs. We'll discuss our results in the context of potential CWD transmission and spread and managing hunter behavior in disposal of gut piles, carcasses, and butchering scraps.

Footnote:

- *The annual meeting of The Montana Chapter of The Wildlife Society was held before the spread of the Covid-19 virus was declared a pandemic.*
- *No abstracts were submitted in 2020 by the Montana Academy of Sciences, since their 2020 annual conference was canceled due to the Covid-19 pandemic.*
- *The Montana Chapter of The American Fisheries Society opted out of submitting their annual meeting abstracts to IJS beginning in 2011 with Volume 17.*