Plenary Session Abstracts

Alphabetical By Presenter's Name

Transfer of Federal Lands to the State

Jennifer Fielder, Montana State Senate - District 7, Thompson Falls

The federal government owns over half of all land in western America. This is not only unfair, it is not working. Some of this land can and should be transferred to the states so it can be tended with greater care and accountability. Restoring the balance and strengthening the local voice in public land management will lead to better outcomes in environmental quality, economic productivity, recreational opportunity and social harmony. A variety of historic, legal, economic, political and environmental factors support the viability of transferring certain federally controlled public lands to the States.

Sportsmen's Engagement in Conservation in Montana

Jeff Herbert, Retired MT FWP wildlife biologist, Helena

Montana represents a very successful and effective model of conservation relative to its fish, wildlife and habitat resources. It is nationally recognized as such. Foundational to this model of conservation is the public trust doctrine and the premise that these resources are to be managed in perpetuity for the benefit of all. It includes an underpinning of rigorous science to guide management decisions and actions and a democratic opportunity for the citizens of this state and our guests to participate in a variety of regulated recreational opportunities. Montana provides a blend of public and private lands including the presence of two significant national parks, several major wilderness areas and working landscapes that contribute to the physical and economic well being of this state. Most importantly, the people of Montana have been committed to the support of this model, uniquely so when it comes to local and statewide engagement. Montana hunters, anglers and conservationists have a history of participation in decisions relative to population management, habitat conservation and access issues.

Transforming Land, Transforming People

Jeff Laszlo, Granger Ranches, Madison Valley, MT

Norman Mclean wrote, "Eventually all things merge into one, and a river runs through it."Restoration is about reconnecting water to land, living things to their former habitats and people to each other. The O'Dell Creek Headwaters Restoration project is a collaborative multi partner effort to restore wetlands and degraded stream channels from O'Dell's headwaters to its confluence with the Madison River 12 miles downstream. The project began in 2005 on The Granger Ranches with funding provided by PPL Montana (now Northwestern Energy). The results were immediately apparent and the work accomplished in the Phase 1 project quickly gained support from Montana Fish Wildlife and Parks, Ducks Unlimited, Trout Unlimited and the US Fish and Wildlife Service. The potential for this project as well as its public benefits have led to an extensive and growing public private partnership that continues to evolve. Nonprofits such as The Trust for Public Land, The Montana Land Reliance and The Madison River Foundation along with neighboring ranches and The Patagonia Company have also become highly engaged partners. Regular visits from

student groups, agency personnel, the ranching community and wounded veterans fishing organizations have been an integral aspect of reconnecting people to the land and have provided important educational benefits from both the project's outcomes and its partnerships. A decade since the project's inception all the major drainage canals have been closed and the restored wetlands now host over 200 plant species including 6 listed by the state of Montana as "Species of Concern". Monitoring by the University of Montana's Avian Science Center has documented an increase from 10 bird species to approximately 130. Water temperatures in the restored stream channels have been substantially reduced and stabilized. Efforts to re-introduce threatened Trumpeter Swans and Arctic Grayling are ongoing. One thousand Greater Sandhill Cranes have been observed staging along O'Dell prior to fall migration. Simultaneously, the Granger Ranches has grown ints livestock operations, demonstrating that healthy and diverse habitat can coexist along with sustainable ranching. The O'Dell Project has succeeded beyond anyone's expectations.

Transferring Federal Lands to States: Unanswered Questions and Implications for Wildlife

Martin Nie, Director, Bolle Center for People and Forests; Professor, Natural Resources Policy; W.A. Franke College of Forestry and Conservation; University of Montana, Missoula

The Wildlife Society should oppose the transfer of federal lands to the states or their sale to private interests. Federal public land and the wildlife it supports is in the national interest and is essential to the conservation of biological diversity. Those interests advocating the transfer of federal lands to the states have still yet to explain how transferred lands would be managed. These unanswered questions have significant implications for wildlife conservation and the management of habitat. Managing federal public land in a democracy comes with its challenges. The solution is not to transfer federal lands to the states or sell them to private interests or to backslide on foundational federal land and environmental laws. The more constructive approach is to seriously investigate ways in which these laws can be more effectively and efficiently implemented.

Sagebrush Stories

Bok Sowell, Department of Animal and Range Sciences, Montana State University, Bozeman
Mike Frisina, Department of Animal and Range Sciences, Montana State University, Bozeman
Carl Wambolt, Department of Animal and Range Sciences, Montana State University, Bozeman

Wildlife habitat management approaches are often based on success stories we like. The justification for using fire to control juniper encroachment of sagebrush in western Oregon is well founded. Application of this approach in western Montana can have long term negative consequences because the recovery time of our plant species are much slower. Improving sage-brush habitats with fire appeals to our sense of stewardship, even though most sagebrush taxa do not have any evolutionary adaptations to fire. Management suggestions taken from other areas for residual grass heights do not match the vegetation of sage-grouse core areas in Montana because of differences in climate and plant species. Some managers suggest we need to reduce sagebrush cover to promote forb production even though this relationship has not been demonstrated in many places in Montana. We are drawn to stories that are simple and that share our view of the world. Improved management begins when we test these stories.

Presentation Abstracts

In Order of Presenting Author
*** Denotes Presenter**
****indicates student presentation**

Surveillance Strategy for Detecting Pseudogymnoascus Destructans (PD) and White-Nose Syndrome in Montana 2016-2017

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Dan Bachen, Montana Natural Heritage Program, Helena
Lauri Hanauska-Brown, Montana Fish Wildlife and Parks, Helena

The devastating bat disease, White-Nose Syndrome (WNS), caused by the fungus *Pseudogymnoascus destructans* (*Pd*), was detected in western Washington state in March of 2016. This detection was 1,300 miles from the previous westernmost detection and highlighted the urgency for surveillance in other western states like Montana. Early detection of the disease may provide valuable insights into the statewide status of WNS, research opportunities, mitigation options and cave management. The goals of Montana's surveillance plan include 1) surveying for WNS/Pd in new geographic areas outside the WNS-affected zone and/or biologically important sites and 2) surveying for WNS infection in bat species that are not currently known to be susceptible. In the absence of information or a risk assessment to help Montana focus on priority surveillance areas other than winter hibernacula, the 2017 strategy focuses on sampling at six hibernacula representing all regions where aggregations of bats overwinter. Both active and passive sampling of bats and hibernacula environments will be conducted. Active sampling can detect Pd from swabs of bats or in hibernacula soils. Passive sampling will be conducted into the early summer specifically targeting bats found dead outside of hibernacula, bats showing clear signs of WNS infection, and bats found dead as part of a large mortality event. Bats submitted for rabies testing may also be sampled when circumstances or characteristics of the carcass indicate WNS may be the cause of mortality. While surveillance efforts can be costly it may provide information with enough time to better inform decision making.

Modeling Management Strategies for the Control of Bighorn Sheep Respiratory Disease

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Kezia Manlove, Washington State University, Pullman
Frances Cassirer, Idaho Department of Fish and Game, Lewiston
Jennifer Ramsey, Montana Fish Wildlife and Parks, Bozeman
Keri Carson, Montana Fish Wildlife and Parks, Bozeman
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Infectious pneumonia has plagued bighorn sheep populations and stymied recovery efforts across the western United States for decades. Here we present a simple, non-spatial, stochastic, discrete-time model that captures basic bighorn sheep demographics and in which we simulate the dynamics of *Mycoplasma ovipneumoniae*, the suspected primary causative agent in bighorn sheep respiratory disease. We then use the model to explore the impacts of

management approaches, including augmentation, depopulation and reintroduction, density reduction, and test-and-cull, aimed at reducing or eliminating the pathogen, its transmission, or associated infection costs. Results suggest that test-and-cull (testing 95% of a herd and removing PCR-positive individuals) and depopulation and reintroduction (assuming ability to only depopulate 95% of the herd) offer the best probability of eliminating the pathogen, although neither are expected to be 100% successful. Augmentation (adding 30 adult ewes) does not increase the probability of pathogen extinction, and in some cases may prolong pathogen persistence and diminish herd recovery. Density reduction (randomly removing 25-50% of the herd) only modestly increases the probability of stochastic pathogen extinction and herd recovery. Stochastic pathogen extinction and herd recovery is predicted to occur on occasion without any management intervention. Ultimately, decisions to manage respiratory disease in wild sheep must weigh the predicted success of the management tool against financial, logistical, ethical, and value-based considerations. Here, we aim to supply mechanistic-based predictions of the relative efficacy of currently employed or proposed tools, as well as characterize the sensitivity of these predictions to our assumptions about how the disease process works.

Challenges with Sampling Sage Grouse Leks and Interpreting Population Trends in Central Montana

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Estimating population size and monitoring trends over time is a fundamental task for management biologists. For species of conservation concern like the Greater sage-grouse (*Centrocercus urophasianus*), using robust methods to monitor populations is imperative. Biologists usually monitor sage-grouse by surveying males at breeding leks each spring. Over 1700 sage-grouse leks exist in Montana, presenting a formidable logistical challenge to census given their accessibility, timing of activity, and other constraints. Thus, not all leks get surveyed each year. In 2005, Montana Fish, Wildlife, and Parks designated 88 Adaptive Harvest Management (AHM) leks to prioritize survey efforts and undergo a more rigorous, consistent sampling protocol; these counts are considered the best indicator of sage-grouse population trends in Montana. However, AHM leks do not provide a random sample required for strong statistical inference, and may not be representative of the remaining leks in an area. I compared count data between AHM and non-AHM leks near Lewistown, Montana, finding mean males/lek is significantly higher on AHM leks than non-AHM leks. Additionally, these larger AHM leks appear to persist longer than smaller leks, which may indicate a minimum size (or potential Alee effect of sorts) at which a lek is more likely to fail. A Cox proportional hazards model indicates differences in survivability across lek size classes (i.e., the hazard of a lek failing is 11.48 times greater for the smaller leks than the larger leks). Given these observations, sampling only AHM leks may predispose us to incorrectly interpreting sage-grouse population status across the state.

Bat Use, Human Visitation, and Environmental Attributes of Cave Hibernacula in Montana

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Across the eastern United States, caves historically supported large aggregations of overwintering bats. In contrast, few large aggregations have been observed within caves in Montana. To collect comprehensive information on cave use by bats and inform White Nose Syndrome surveillance, we inventoried caves to estimate numbers of hibernating bats, assessed the microclimate within hibernacula, monitored activity of bats using acoustic detectors, and quantified visitation by people using trail cameras. In collaboration with recreational cavers, state, and federal biologists we conducted over 300 structured and incidental surveys at 99 caves. Only 6 caves had counts exceeding 100 individuals, and our largest hibernacula had approximately 1,700 bats. The mean annual temperature and humidity across 16 caves averaged 5.0°C and 100% RH. At the 6 largest hibernacula, we established year round baselines of bat acoustic activity and quantify visitation by people. We found that both the number of people entering caves and bat activity within caves peaked in summer. During the winter, visitation appears largely dependent on accessibility of the cave and all monitored caves had low levels of bat activity. Caves in Montana appear to support relatively few aggregations of overwintering bats. Although we have visited most known caves in the state, the number of hibernating individuals we observed is likely orders of magnitude less than the total number we presume overwinter in-state. Future projects should explore the use of cracks, crevices, talus, and badlands to identify other important hibernacula.

Rediscovery of the Northern Myotis in Montana

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The Northern Myotis aka: Northern Long-eared Bat (*Myotis septentrionalis*, NLEB) may be among the rarest mammal species within Montana. Prior to 2016 its presence in the state was known from a single male collected from an abandoned coal mine south of Culbertson, MT in the winter of 1978. In 2015 this species was listed as Threatened under the Endangered Species Act because of significant declines in eastern populations due to White-Nose Syndrome (WNS). To provide information about the presence and distribution of this species within the state, we conducted mist netting surveys in 2015 and 2016 across 9 counties designated by the US Fish and Wildlife Service as part of the NLEB's range. In 2015, forested uplands and deciduous forest were targeted over 11 nights. In 2016, we targeted deciduous forest along major river drainages for 23 nights. We captured 3 NLEBs at 2 sites in 2016 and 0 in 2015. All Myotis species were genetically confirmed. Individuals were captured at 2 sites along the Missouri river in proximity to the previous detection in Montana and historic records in North Dakota. Both females and the male were reproductive, indicating that this species may breed within the state. However, given the close proximity to the border of the female captures, we cannot definitively say whether these animals roost in North Dakota or Montana. In addition to captures of NLEBs we also established records for several WNS susceptible species, providing valuable pre-WNS baseline information on bats in this region.

**Nutritional and Demographic Consequences of Varying Elk Migratory Behaviors

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Elk (*Cervus elaphus*) populations in the American West exhibit wide variation in migratory behavior. The traditional view of elk migration holds that migratory elk move from winter range in order to track growth of highly nutritious fresh vegetation into higher elevation areas. Non-migratory elk forego this seasonal movement, typically foraging in lower elevation winter range areas throughout the summer. Although the effect of summer nutrition on elk body condition and reproductive success is well known, the nutritional and demographic consequences of these differing migratory behaviors remain unclear. We developed a predictive model of summer forage quality to compare the nutrition available to migrants and non-migrants in a partially migratory population of elk in western Montana. Non-migratory elk had access to significantly higher forage quality than their migratory counterparts; the lower forage quality available to migrants is predicted to result in reduced reproductive success based on published studies linking nutrition with elk demographic rates. We therefore expect non-migrants to have higher fecundity rates and to comprise a higher proportion of the population relative to migrants. Harvest management actions that reduce survival rates of non-migrants or increase survival rates of migrants may be an effective tool for maintaining migratory behavior in partially migratory populations.

**Immigration as a Compensatory Mechanism to Offset Harvest Mortality in Harvested Wolf Populations

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In less than a decade the U.S. Northern Rocky Mountain gray wolf (*Canis lupus*) population has experienced large shifts in management practices, from federal protection under the Endangered Species Act to increasingly liberal hunting and trapping seasons in many portions of their range after delisting. As a result, there is interest in how current wolf management practices will affect this population over time. Recent research suggests wolf pup recruitment in central Idaho has declined since harvest was initiated, yet wolf densities appear stable in many regions of the state, suggesting other compensatory mechanisms are offsetting the effects of harvest mortality. Our objective was to evaluate immigration as a compensatory mechanism that may offset the effects of harvest mortality and facilitate population persistence in a heavily harvested wolf population. Using noninvasively sampled DNA we identified dispersers into two focal study areas in central Idaho prior to and after harvest was initiated. We measured genetic relatedness within and among wolf packs using three different metrics to assess how immigration has changed with changing management practices. Our results suggest that at current harvest rates immigration is not acting as a

compensatory mechanism to offset the effects of harvest mortality. Local dispersal may be unaffected by harvest pressure whereas harvest has negative effects on long-distance dispersal. Our research can help managers consider the effects of immigration on local wolf populations when making harvest management decisions.

Timing, Duration, and Pathways of Harlequin Duck Migration to Pacific Molting and Wintering Areas

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The core breeding range for Harlequin Ducks (*Histrionicus histrionicus*) in western North America extends from Alaska, and south through the Yukon, Northwest Territories, and British Columbia. Smaller breeding populations exist in southwestern Alberta, Washington, Oregon, Idaho, Wyoming, and Montana. Each state and province in these areas has identified the Harlequin Duck as a species of conservation priority, given its small and isolated populations, its specific nesting requirements, and changes in abundance or distribution. Conservation objectives for all areas have identified the importance of mapping migration routes that connect breeding sites to Pacific coast molting and wintering locations, as well as determining migration timing, duration, habitat use, and stopover sites. In spring 2016, we captured Harlequin Duck pairs on breeding streams and surgically implanted satellite transmitters in the males and attached geolocators to the leg bands of females. We marked 18 harlequin pairs (Alberta = 10 (minus one female), Montana = 5, Wyoming = 2, Washington = 1). Migration initiation dates varied by breeding areas and occurred from June 3 to July 10. Male migration lasted between 1-17 days and stopovers occurred approximately half-way to the coast and included rivers, mountain streams, and lakes. They arrived at their molting areas between June 5-July 24 and these areas ranged from southeast Alaska to northwestern Washington. The majority (71%) of harlequins departed molt locations to differing winter locations. Efforts will be made to retrieve the geolocators from females in spring 2017 to compare locations between males and females from different devices.

Restoration of Trumpeter Swans on the Flathead Indian Reservation and Adjacent Aboriginal Lands in Northwestern Montana

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In an effort to restore extirpated native wildlife to the Flathead Indian Reservation (FIR) and aboriginal lands in western Montana, the Confederated Salish and Kootenai Tribes (CSKT) commenced reintroduction and restoration efforts for Trumpeter Swans in 1996 with a trial reintroduction. Since then, 264 captive-propagated Trumpeter Swans were released on the FIR from 2002 through 2016. By 2004, breeding pairs had formed and the first production of wild cygnets in possibly 100 years or more fledged from local wetlands. During

the intervening years, at least 119 nesting pairs have produced at least 343 fledgling cygnets. Swans from this project have colonized into several wetland habitats throughout northwestern Montana and may soon do the same in southeastern British Columbia. The primary cause of mortality of released swans has been powerline collisions, and lines are regularly marked with flight diverter installations to minimize potential future collisions. Since annual surveys seemed to indicate a healthy, growing population of Trumpeter Swans in northwestern Montana, the CSKT contracted for a population viability analysis with the University of Idaho to assess overall success of the project and the prognosis for the population to continue to thrive. The results of that analysis indicated that, although the population was predicted to have a low likelihood of persistence, the short time span of data in which adults successfully fledged a brood was increasing (since 2012) was likely a factor in that result. Projecting this analysis into the future, thereby extending the time span of data, indicated that the likelihood of the population persisting was high (approximately 95-96%) over both the short-term (30 years) and the long-term (100 years). As additional population surveys are conducted over the years, the long-term data will better estimate the likelihood of reaching the objectives of long-term sustainability in the future.

**Use of Camera Collars to Reassess the Foraging Strategies of Bears in Yellowstone National Park

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Black bears and grizzly bears are opportunistic omnivores that consume a seasonally dynamic diet that varies over time and space. Changes in climate may influence the abundance and distribution of foods consumed by bears, which may place bears in closer proximity to humans and increase human-bear interactions. Therefore, reliable data on bear diets will remain important information for managers. Previous studies of bear foraging relied on visiting locations from GPS collars and documenting bear activity, but evidence of activity or foraging was observed at only 30–50% of locations. Emerging technologies, such as GPS camera collars, can provide new insights into the ecology of cryptic animals, including bears, and could be used to better understand the dynamic nature of their diets. During 2014–2016, we deployed GPS camera collars on 3 grizzly bears and 3 black bears in Yellowstone National Park as a pilot study to gain insights about the nutritional ecology of these species. Field crews observed sign of bear activity at ~52% of the GPS locations searched, which is comparable to other studies. However, when we compared the sign found by field crews to videos recorded by the collars at the same locations, the two methods matched only 18.6% of the time. This low congruence demonstrates a need to improve methods to understand foraging activities. Inference may be improved by matching rich datasets from GPS-tracking devices (i.e., location information and accelerometer data) with video documentation to predict bear foraging behaviors.

Predicted Suitable Habitat Modeling for Species of Concern in Montana

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Predicted suitable habitat models can be valuable and informative tools for species management and conservation, especially for rare or infrequently documented species. For nearly ten years, the Montana Natural Heritage Program (MTNHP) has produced predicted suitable habitat models for use by agency personnel, researchers, and the general public with the goal of predicting the distribution and relative suitability of habitat for those species. These models are produced using maximum entropy modeling (Maxent), a method of inductive modeling that is robust to small sample sizes. Recent advances in automation by MTNHP using Python and templated reports have decreased the time required for model production more than tenfold, allowing for the publication of models for all terrestrial vertebrate Species of Concern (SOC). Models for SOC can now be updated whenever valuable new data become available due to the costs and time saved by automation. Simplified results for most models have been incorporated into standard environmental summary products at MTNHP in the form of potential species lists for SOC within a grid of one square mile hexagons. Models for non-Species of Concern will be developed as staff time and funding allow, but should be very affordable (e.g., circa $250 per species).

Imperfect Tests, Pervasive Pathogens, and Variable Demographic Performance: Thoughts on Managing Bighorn Sheep Respiratory Disease

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Respiratory disease (pneumonia) has been a persistent challenge for bighorn sheep (*Ovis canadensis*) conservation and its cause has been attributed to numerous bacteria including Mycoplasma *ovipneumoniae* and several *Pasteurellaceae* family species. This study sought to investigate efficacy of diagnostic protocols in detecting *Pasteurellaceae* and Mycoplasma *ovipneumoniae*, generate sampling recommendations for different protocols, assess the distribution of these disease agents among 17 bighorn sheep populations in Montana and Wyoming, and evaluate what associations existed between detection of these agents and demographic performance of bighorn sheep populations. Analysis of replicate samples from individual bighorn sheep revealed that detection probability for regularly-used diagnostic protocols was generally low (<50%) for *Pasteurellaceae* and was high (>70%) for Mycoplasma *ovipneumoniae*, suggesting that routine pathogen sampling likely mischaracterizes respiratory pathogen communities. Power analyses found that most pathogen

species could be detected with 80% confidence at the population-level by conducting regularly-used protocols multiple times per animal. Each pathogen species was detected in over half of the study populations, but after accounting for detection probability there was low confidence in negative test results for populations where *Pasteurellaceae* species were not detected. Seventy-six percent of study populations hosted both Mycoplasma ovipneumoniae and *Pasteurellaceae* pathogens, yet a number of these populations were estimated to have positive population growth rates and recruitment rates greater than 30%. Overall, the results of this work suggest that bighorn sheep respiratory disease may be mitigated by manipulating population characteristics and respiratory disease epizootics could be caused by pathogens already resident in bighorn sheep population.

Protecting Spirit of Place: Reconstructing Highways, Maintaining Habitat Connectivity, and Respecting Tribal Culture

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The US Highway 93 North reconstruction project on the Flathead Reservation in represents one of the most extensive wildlife-sensitive highway design efforts to date in North America. The reconstruction of the 56 mile long road section included the installation of wildlife crossing structures and wildlife exclusion fences. The mitigation measures were aimed at improving safety for the traveling public through reducing wildlife-vehicle collisions, while simultaneously allowing wildlife to continue to move across the road. These measures were an integral part of the reconstruction of this highway because the Confederated Salish and Kootenai Tribes required the reconstructed highway to be respectful of the land, the people and their culture, and wildlife. This project provided an opportunity to evaluate the extent these mitigation measures helped improve human safety through a reduction in wildlife-vehicle collisions; and maintain habitat connectivity for wildlife. Wildlife-vehicle collision data were obtained from Montana Department of Transportation. Completed wildlife crossing structures were monitored for wildlife movements between 2010 and 2015 using wildlife cameras (Reconyx, PM35 and PC900 HyperFire). The reconstruction of US 93 North improved human safety in general along the entire transportation corridor between Evaro and Polson. The total number of reported crashes decreased by approximately 33%. However, the number of reported wildlife-vehicle collisions did not decrease over the entire length of the highway between Evaro and Polson. Total wildlife use of the 29 crossing structures that were monitored can be described as substantial with 95,274 successful crossings in total, and 22,648 successful crossings per year.

Hemorrhagic Disease in Montana's Wild Ruminants

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Epizootic hemorrhagic disease and bluetongue virus have been documented in Montana for decades. Montana has experienced localized and variable population declines in wild cervids when these outbreaks occur. Transmission is seasonal in North America, with infection occurring in the late summer and fall. In northern states, transmission ends once adult vectors cease activity with the onset of winter. Montana is in an epidemic zone where outbreaks appear periodically and mortality events can be significant. Montana Fish, Wildlife

and Parks wildlife health lab has tested samples from suspected outbreak events, research captures and opportunistically for detection of EHD and BTV. Environmental factors and virus-vector-host interactions are knowledge gaps that need to be addressed to improve our understanding of these orbivirus dynamics. Enhanced reporting, surveillance, and research efforts are potential tools that may improve our understanding of the role these viruses play in wild ruminant populations across the state.

Diet and Macronutrient Optimization in Wild Ursids: Grizzly Bears Versus Black Bears

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When fed ad libitum, ursids can maximize mass gain by selecting mixed diets wherein protein provides 17 ± 4% of digestible energy. In the wild, this ability is likely constrained. By visiting locations of 37 individuals during 274 bear-days, we documented foods consumed by grizzly (*Ursus arctos*) and black bears (*Ursus americanus*) in Grand Teton National Park during 2004–2006. Based on published data, we estimated foods and macronutrients as percentages of daily energy intake. Using principal components and cluster analyses, we identified 14 daily diet types. Only 4 diets, accounting for 21% of days, provided optimal protein levels. Nine diets (75% of days) led to over-consumption of protein, and 1 diet (3% of days) led to under-consumption. Highest protein levels were associated with animal matter (i.e., insects, vertebrates), which accounted for 46–47% of daily energy for both species. As predicted: 1) daily diets dominated by vertebrates were positively associated with grizzly bears and protein intake was positively associated with body mass; 2) diets dominated by fruits were positively associated with black bears; and 3) mean protein was highest during spring, when high-energy foods were scarce, however it was also higher than optimal during summer and fall. Although optimal gain of body mass was constrained, bears opted for the energetically superior trade-off of consuming high-energy, high-protein foods. Given protein digestion efficiency similar to obligate carnivores, this choice likely supported mass gain, consistent with studies showing monthly increases in percent body fat among bears in this region.

The Northwest Section of the Wildlife Society and Montana: Past, Present, and Future

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At this 2017 meeting of the Northwest Section and the Montana Chapter of The Wildlife Society, this talk will present the past, present, and potential futures of the Northwest Section as it relates to Montana and to the Parent Society. Many members today will remember the Section's dedicated meetings and high level of professional involvement and wonder "where are we now?" For others, this talk may be their introduction to the Section and how to be involved. The Northwest Section has shared deep roots with our Montana wildlife heritage, with common leaders and common vision, since the inception of our profession. Originally composed of Montana, Alaska, Oregon, Washington, Idaho, British Columbia, and Alberta, the Section had powerful and well-attended annual meetings with themes including

foundational concepts in game bird and big game population and habitat management and policy. Professionals representing an array of agencies, entities, and universities gathered to share the latest scientific findings, mentor students, and address environmental challenges. A Parent Society reorganization in the early 2000's lead to formation of a Canadian Chapter and the Section lost connection with British Columbia and Alberta. Since that time, the Section has been through a period of reformation. With well-represented member states, an enthusiastic board, and increased dues, the Section's vision for the future is bright. Future directions will include focus on building student chapters and bringing student conclaves to the Northwest, supporting policy stances on issues that cross state lines, and increasing communication between our member states.

**Harvest and Non-harvest Mortality Relationships for Lesser Scaup Breeding in Southwestern Montana

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Since the mid-to-late 1990s, lesser scaup (*Aythya affinis*) populations have remained more than 20% below the population goal set forth in the North American Waterfowl Management Plan. Accordingly, considerable attention has been directed towards understanding what factors may be limiting their population, including the role of harvest. Red Rock Lakes National Wildlife Refuge (RRL) in southwestern Montana is the site of a long-term study of lesser scaup ecology and demography with data from which survival and harvest rates can be estimated using capture-mark-recapture statistical techniques. The role of harvest in regulating duck population dynamics, including lesser scaup, is clouded with uncertainty. Decades of research into the additive or compensatory nature of harvest mortality has yielded little consensus as to which of these hypotheses prevail in North American duck populations. The most limiting factor to assessing these relationships stems from lacking estimates of population size during waterfowl hunting seasons. We assessed the relationship between survival rates and harvest rates for lesser scaup females breeding at RRL for an 11 years, beginning in 2005. Consistent with predictions of density dependence regulation of natural mortality rates during the non-breeding season, we found evidence suggesting adult female survival rates fluctuate in response to harvest regulations, an index of population size, and the total number of lesser scaup harvested in the Pacific and Central Flyways.

Occupancy Modeling of Hunter Sightings for Monitoring Moose in Montana

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Moose (*Alces alces*) are widely distributed across >100,000 km2 of Montana yet occur at low densities and garner minimal funding. Traditional monitoring methods present challenges of low precision and high cost. During 2012–2015, we tested the efficacy of applying patch occupancy modeling to moose sightings made by hunters of other cervids for cost-effective statewide monitoring. We used phone surveys to collect sightings and allocated each

spatially to grid cells and temporally to 1-week sessions within a 5-week hunting season. For each cell we estimated covariates with hypothesized relevance to occupancy by moose or detectability by hunters, including characterization of vegetation, topography, accessibility by humans, hunter effort, and spatial correlation. We sampled ≥45,500 hunters per year at a cost of $12,000–$15,000. Of responding hunters, 14% reported ≥1 moose sighting which accumulated to 4,800–6,800 sightings annually. Statewide occupancy estimates were robust and consistent across years of sampling, averaging $\Psi = 0.30$ (SE=0.005, range=0.30–0.31). Forested vegetation types reduced the probability of detection but increased the probability of occupancy, while shrub and riparian vegetation types increased both detection and occupancy rates. The amount of sampling effort expended affected detection rates but did not affect occupancy estimates. We expect occupancy estimates to be less sensitive to population changes in areas with higher abundance, making this approach better suited for monitoring change at the range periphery. Alternate count-based analysis techniques such as n-mixture models may offer an alternative to make best use of hunter sightings for monitoring statewide moose populations.

Fire and Forage: Variability in Elk Forage on a Landscape of Wildfire and Changing Fire Management

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Forest management practices can modify ungulate nutritional resources through landscape-scale processes such as prescribed fire and wildfire. The resulting availability and distribution of nutritional resources can affect ungulate survival, reproduction, and distribution. Our primary goals were to evaluate how landscapes with varying post-fire successional stages influence elk summer nutritional resources and to quantify the variability of nutritional resources associated with varying fire histories and management practices during 1900–2015. Within 3 elk population ranges located in the Bitterroot Valley, Montana, we measured elk forage quality across a range of land cover types and fire histories and developed a landscape-scale forage quality model. Based on historical wildfire and prescribed fire data, we reconstructed decadal land cover models and used our forage models to predict fire-related variations in forage quality each decade within the elk summer ranges. Forage quality was predicted to decrease with successional stage. The area burned by wildfire increased 242–1,772% during 1990–2015 as compared to 1900–1990, resulting in fire-related variations of predicted nutritional resources. The area of highest forage quality varied, increasing 31.3–48.5% in 2 ranges and decreasing 2.4% in 1 range, from 1900–1990 to 1990–2015. These results highlight the important effect of wildfire on the distribution of ungulate nutritional resources and demonstrate that ungulate nutritional resources likely vary over time with variation in fire history and management practices.

Tracking New Species: An Update on Satellite Telemetry Data from Raptors Captured on the MPG Ranch

Robert Domenech*, Raptor View Research Institute

We have studied the fall migration of raptors at the MPG Ranch near Florence, Montana, since 2011. Our banding efforts during this period have yielded modest totals, but impressive species diversity, with a relatively high proportion of Red-tailed Hawks and large falcons. After several successful years outfitting Golden Eagles and Ospreys with satellite transmitters, we decided to expand these efforts to other species. To date, we have outfitted 8 Red-tailed Hawks, 4 Cooper's Hawks, 3 Peregrine Falcons and 1 Prairie Falcon with satellite transmitters captured on the MPG Ranch during fall migration. We will share what we've learned from these individuals and give a telemetry update on our Osprey study.

Climatic Data for Wildlife Research and Management

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There is generally a poor correlation between climatic variables at lower elevations and higher elevations. It is imperative that this relationship be understood when evaluating climatic effects on species that move from lower to higher elevation during different seasons. It is also important that valley climatic conditions are not used to define relationship of species that occupy higher elevations. Using data from NRCS SNOTEL (SNOw TELemetry) sites and NWS climatic stations can help define climatic conditions at locations occupied by concerned species. Daily data is generally more useful than monthly or seasonal averages. There are approximately 90 SNOTEL sites across Montana that typically report daily SWE (snow water equivalent), precipitation, maximum, minimum and average temperatures year-around and data is available in real-time. SWE can be related to travel, soil temperature, forage production and availability, migration and predator-prey relationships. Some SNOTEL sites also report snow depth. NWS stations typically report daily precipitation, maximum and minimum temperature but data for most stations is reported monthly. SWE can be estimated for NWS sites where daily air temperature, snow depth and precipitation are reported. Precipitation can be related to forage production, soil moisture and fall green-up. Maximum, minimum and average daily temperature can be related to forage production, phenology, the day plants break dormancy, fall green-up, critical temperatures for animals. Annual variability as well as elevational variability can be used to refine data to each area of interest. Some examples of the relationships described above will be presented.

Mule Deer Management in Southeastern Montana

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In 1982, Montana Fish, Wildlife and Parks Region 7 implemented a five week regionwide general license either-sex plus additional antlerless B license harvest structure for mule deer (*Odocoileus hemionus*). This harvest strategy implemented three important changes from previous years. First, the regionwide harvest structure eliminated the use of small hunting districts and allows the law of diminishing returns to operate: hunters tend to avoid areas with low deer numbers and focus on areas with higher densities. Second, general licenses were made either-sex, rather than antlered-only for mule deer. Third, following natural population

declines (e.g., due to severe natural stressors), biologists began increasing antlerless quotas soon after populations began to recover, rather than waiting until populations were at or above long-term averages. This management system has maximized opportunity and flexibility for hunters while simplifying regulations and enforcement. In the 30-plus years since implementation, Region 7 has seen a reduction in game damage complaints, and an increase in buck-to-doe ratios. Mule deer populations and harvest have been stable long-term, and population fluctuations have decreased in magnitude. This harvest strategy has produced similar results in both Region 7 as a whole (75% private lands) and on the Custer National Forest, a 436,000-ac block of public land.

Comparing Bird Population Trends in the Badlands and Prairies Using BBS and IMBCR Data

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We compared the direction and precision of trend estimates of bird species in the Badlands and Prairie Bird Conservation Region (BCR 17) from 2009-2015 using Breeding Bird Survey (BBS) and Integrated Monitoring in Bird Conservation Regions (IMBCR) data. We used Bayesian modeling estimates provided by the BBS and newly developed Bayesian estimates of IMBCR data. Trend estimates often differed between the two data sets and estimates of precision were generally smaller for IMBCR than for BBS data. In addition, because the BBS estimates do not correct for detection probability, the BBS estimates measure the trend on an index rather than the detection corrected abundance. If the relationship between the BBS index and true abundance is not linear and 1:1, the interpretation of the BBS trend is unclear. Finally, because BBS counts are conducted along roads, species that are attracted to or avoid roads may be over or under counted, respectively. BBS trends can be helpful for examining long-term trends (greater than 20 years) in bird abundance across large regions but only IMBCR trends provide sufficient precision to examine trends at shorter time intervals. IMBCR trends, therefore, are more useful for identifying current factors influencing bird population trends.

Northwest Climate Science Center–Linking Climate Science to Wildlife Management and Conservation

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In 2009, Secretarial Order 3289 (Interior) established eight regional Climate Science Centers (CSC) to "work with other federal, state, tribal, and local governments and private landowner partners to develop landscape level strategies for understanding and responding to climate change impacts." This Order acknowledged that climate-driven changes would likely affect ecosystem function, structure and composition, wildlife populations, and biodiversity in ways that no single management entity could effectively address alone. On-going and emerging ecological changes such as hydrologic regime shifts, invasive species, changes in fire regimes, and land use changes are occurring at spatial and temporal scales that demand a coordinated, inter-jurisdictional approach if we are to mitigate for and adapt to these stressors. The Northwest (NW) CSC has developed approaches to coordinate with regional partners, strategize to identify needed science and capacity, and identify resources to fund

applied research and implement coordinated application to management needs in Washington, Oregon, Idaho, and western Montana. In addition, the NW CSC has developed collaborative partnerships with Federal and state agencies, tribal and intertribal organizations, Landscape Conservation Cooperatives (LCCs), USDA Climate Hubs, and others to provide needed scientific information and tools. This presentation will outline the goals and operational framework of the NW CSC, present case studies of NW CSC climate research used to inform decision-making relevant to wildlife management and conservation across the region, and provide guidance to scientists and managers for identifying actionable science projects that the NW CSC could support for addressing climate-driven changes in ecological systems.

A Multispecies Monitoring Approach for Mesocarnivores in the US Northern Rockies

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Mesocarnivores are ecologically important species that are wide-ranging and often difficult to detect. Fisher (*Pekania pennanti*), lynx (*Lynx canadensis*), and wolverine (*Gulo gulo*) (hereafter mesocarnivores) are three mesocarnivores of conservation or management concern native to the US northern Rocky Mountain region (NRM). Federal and state managing agencies in NRM have multiple directives that guide management of these species and their habitats. Fulfilling these mandates is complicated by two overarching problems: 1) gaps in knowledge about the basic distribution, habitat requirements, and spatial and population trends of these mesocarnivores in the region; and 2) the lack of an appropriate, multi-scale framework to analyze the short-term and long-term trends of these species. In response, the USFS is developing a comprehensive mesocarnivore monitoring strategy to meet our mandates for the NRM. These ideas will ultimately be merged with those of our partners. We present the initial phase of this monitoring strategy, a sequential hierarchy that links the following questions to geographic locations: 1) is the species present? 2) are multiple individuals and females present? 3) how many are present? These questions were developed based on a series of structured interviews, as well as past local and regional survey and monitoring efforts for these mesocarnivores. Repeated investigations of these questions over time will allow understanding of changes in distribution and populations of these mesocarnivores in the NRM..

Conflicting Priorities, Competing Interests and Unintended Consequences – Three Decades of Lessons Learned Managing Wildlife Habitat

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Management of food, cover and water at the Ninepipe Wildlife Management Area (WMA), an intermountain prairie pothole complex in the Mission Valley of western Montana involves many facets beyond decisions to benefit waterfowl and pheasants populations and hunters for which the WMA was established. Interests of WMA users have expanded beyond game species, the mission of Fish, Wildlife & Parks has evolved, and management goals of the WMA program have broadened. This paper describes management approaches and

lessons learned in response to often conflicting priorities and competing interests as the local environment and human values have changed. Pheasants and some waterfowl species have overlapping habitat requirements that serve different life history needs. Habitat features that are good for reproduction and survival are not necessarily the best for hunting. Members of the general public who lobby for their particular interests are not aware of what it takes to get the habitat they think is best. Using farming practices to grow food and nesting cover while conserving and protecting soil, water, and vegetation is the driving goal. Using flood irrigation to manipulate water levels in wetland basins ensures abundant, diverse, and productive habitat. Weed management activities are conducted to improve habitat, whereas habitat improvements are conducted in a manner to minimize the spread of weeds. Trees planted for pheasant winter cover have resulted in grizzly bear/human conflicts – lesson learned! Other lessons include that management practices must be based first on the needs of the natural resources, habitat conditions are fluid and dynamic, great habitat does not necessarily result in high wildlife populations or high hunter satisfaction, and keeping a broad perspective is the best strategy, regardless of short term conditions and pressures. Hopefully the lessons that were learned will be instructive to others managing similar habitats.

Recovering America's Wildlife Act of 2016: What Passage of the Act May Mean to You

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The Association of Fish and Wildlife Agencies organized a panel of 26 national business and conservation leaders in 2015 to examine the current system of conservation funding and recommend a new mechanism to conserve all fish and wildlife. Known as the Blue Ribbon Panel on Sustaining America's Diverse Fish and Wildlife Resources, the group recommended Congress dedicate up to $1.3 billion annually in existing revenue from the development of energy and mineral resources to the Wildlife Conservation and Restoration Program. These funds would be awarded to state wildlife management agencies for wildlife related conservation, recreation and education projects. In Montana, the funds would be used to more fully implement State Wildlife Action Plan priorities including on the ground conservation for a broad diversity of species and habitats. Federal House Bill 5650 "Recovering America's Wildlife" act was introduced during the fall of 2016 but needs to be reintroduced in 2017. If passed and fully funded, the federal act could bring $22 million dollars annually to Montana but $7 million dollars in non-federal match will be needed each year. Proactive and partner based projects will be critical to ensure the best use of these funds but prior to that a broad based effort to pass the act is needed. Wildlife enthusiasts, business owners, developers, researchers and others will be needed to argue it is in everyone's best interest to keep species from becoming federally listed and to keep wildlife and habitat healthy.

Drone Technology for Monitoring and Mapping in the Grasslands of Eastern Montana

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The Nature Conservancy in Montana has been working to protect wildlife habitat and enhance conservation in the Northern Great Plains for several decades. The foundation of our work has been the Matador Grassbank in south Phillips County. Through the grassbank, ranchers implement conservation practices on their home ranches in exchange for discounted

grazing on the Conservancy's Matador Ranch. One of the conservation practices is the retention of black-tailed prairie dog towns. The southern portion of Phillips County supports among the most acres and largest prairie dog towns in the state. The prairie dog towns in this region of Montana support species of high conservation concern, including two black-footed ferret reintroduction sites, the largest population of mountain plovers, and large numbers of burrowing owls. Discounts for retaining prairie dog towns on grassbank ranches is tiered, based on the size of the town and potential for supporting species of concern. However, precisely mapping towns is challenging when using handheld GPS units and ATV's to traverse the perimeters. Currently, The Nature Conservancy is using drone technology to create more precise and detailed maps. Drones yield detailed imagery which can be incorporated into a GIS, allowing precise mapping of town boundaries. Using drones will enable ranchers and the Conservancy to better understand the expansion or contraction of towns over time. The Matador ranch successfully implemented drone technology as a tool for more efficient and accurate monitoring, and plans to continue incorporating its use in all aspects of conservation and management.

**The Effects of Beetle-Induced Tree Death on Forest Bird Diversity in Western Montana

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In forest ecosystems, climate change can hinder management success by increasing the frequency and intensity of fire and insect outbreaks that cause massive tree die-offs and abrupt habitat change. Resource managers often use ecological indicators to gain insight into the health and status of ecosystems due to the challenge of monitoring all aspects of any ecosystem. Birds are increasingly identified as appropriate taxa for predicting changes in biodiversity and ecological integrity around the globe. We assessed the effects of bark beetle induced forest die-off on patterns of avian diversity in western Montana. We used songbirds, which are ubiquitous and possess attributes capturing the complexity of forests as ecological indicators. In addition to assessing the effects of bark beetle forest die-off on bird diversity we also sought to examine the relative importance of the "conspecific neighborhood" in influencing species-level occurrence rates at a given survey location. This approach is motivated by the idea that individuals of a species aggregate around resources. It follows, that a species is more likely to occur in a patch surrounded by other occupied patches (the conspecific neighborhood). Incorporating measures of spatial autocorrelation in ecological studies is not new. However, this topic is only just beginning to be applied in the context of more recent analytical advances such as Bayesian multi-species hierarchal models used to estimate species abundance and occurrence rates.

**Effects of Electric Fence Permeability on Grizzly and Black Bears in the Blackfoot Valley

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Electric fencing is an effective tool for deterring bears from calving areas and bee yards, however scientific evaluations of the impacts of large-scale electric fencing on bear movements and habitat use are lacking. In 2015 and 2016, we conducted a study in the Blackfoot Valley to evaluate A) the efficacy of rapid-deployment electric fencing designs in deterring bears from agricultural lands, and B) landscape level space use and permeability of agricultural lands relative to electric fences. Baited enclosures of 2 fencing configurations

were established in the valley. Each enclosure was systematically energized and unenergized for 3-day periods; passage into the enclosure was monitored with trail cameras to provide information on effectiveness and permeability. In addition, we established 60 randomly selected camera trap stations throughout the valley to evaluate landscape-level use relative to electric fences. Daily locations provided by 4 grizzly bears fitted with GPS collars in 2016 will provide individual-level information on seasonal movements and habitat selection relative to electric fences. The proportion of black bears that were deterred from both configurations of fence when turned on or off over both years was 61% and the proportion that successfully penetrated the enclosures was 38%. The proportion of grizzly bears that were deterred from both configurations of fence over both years was 69% and the proportion that were successful was 30%. The camera traps did not detect enough individuals to conduct a hierarchical occupancy analysis. We will collect the GPS collars in 2017 and conduct an RUF analysis on space use.

How Historical and Current Management Practices have Affected Milk River Riparian Habitat in Northcentral Montana

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Riparian and wetland communities support the greatest concentration of plants and animals, yet only constitute 4 percent of Montana's land cover. Because they are more productive than surrounding uplands, they are attractive to livestock and wildlife as they provide important forms of cover and forage. For private and public land managers interested in maintaining long-term integrity and functionality of riparian and wetland communities on their lands, management strategies that accommodate on-site resource needs must be implemented. Determining habitat types and their associated community types on these sites can help identify historical impacts that have affected community type succession, and how current management strategies could be affecting the trend towards one seral stage or another. Both natural and artificial disturbances can affect community type succession, yet succession from one type to another can take several years and even decades. Thus, changes from year to year can be very subtle, and as land managers implement current management practices, they may overlook the visual cues indicating these trends, simply because these processes can be very slow. This presentation summarizes an evaluation of a riparian area located in the Milk River Valley in Northcentral Montana. An illustration of how historical impacts have affected community type succession, and how this site has been affected by a significant change in management practices that occurred over 20 years ago, is provided. Depending on what goals are desired for this site will determine if a change in current management practices is warranted.

Grizzly Bear Restoration in the North Cascades of Washington

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The North Cascades of Washington was one of 6 recovery areas where grizzly bears were known or believed to exist at the time of listing under the Endangered Species Act (ESA) in

1975. The North Cascades recovery plan identified the need for a National Environmental Policy Act process to evaluate a range of alternatives to restore this grizzly bear population. In January of 2017 the Draft Grizzly Bear Restoration Plan for the North Cascades Ecosystem was released for public comment by the National Park Service and the U.S. Fish and Wildlife Service. This plan evaluated four alternatives for population restoration. Alternative A was "No Action" with continued existing management practices focused on improved sanitation, poaching control, motorized access, education, and monitoring to evaluate natural restoration. Alternative B was "Ecosystem Evaluation Restoration" which would transplant up to 10 grizzly bears to the North Cascades and monitor those individuals for 2 years before deciding whether to proceed with additional releases. Alternative C was "Incremental Restoration" in which 5-7 grizzly bears per year would be transplanted to the North Cascades to achieve an initial population of 25 individuals. Monitoring would determine success of the program and the need for additional releases of bears. Alternative D was "Expedited Restoration" in which 5-7 grizzly bears/year would be transplanted to the North Cascades until a population of approximately 200 individuals was achieved. All action alternatives possess an experimental (ESA 10j) population option. The draft document is available for review and comment through March 14, 2017 at: https://parkplanning.nps.gov/projectHome.cfm?projectId=44144

Grizzly Bear Population Trend Estimated Using Genetic Detection

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We use genetic detection data from natural bear rub sites to estimate annual rate of change for a threatened grizzly bear (*Ursus arctos*) population in the 33,300 km2 Northern Continental Divide Ecosystem (NCDE) in northwestern Montana, USA). Bear rubs were surveyed twice annually in 2004, 2009-2012 (3,580 – 4,805 rubs). We detected approximately 1/3 of the grizzly bear population annually. Using spatially explicit capture-recapture (SCR) models in a maximum likelihood framework, we estimate growth rate from the slope of a linear regression fit to the log of density estimates. To evaluate the usefulness of our estimates, we compare them to estimates of λ made using independent data from known-fate telemetry monitoring for our population. Total annual population rate of change was 1.056 (95% CI = 1.033-1.079). The large sample sizes generated by genetic detection provided information on variation in density and trend within the NCDE useful for designing monitoring and management strategies tailored to area-specific needs and priorities. Local rates of change within the NCDE were higher in areas of lower density and population expansion than in Glacier NP, the area with highest density. As density increased, the amount of space used by bears estimated by the SCR models, σ, decreased. Hair collection from natural bear rub sites was an efficient sampling approach able to generate precise estimates of annual growth rate from 2 years of data.

Population Monitoring and Modeling to Enable an Adaptive Management Strategy for Mountain Lions in Montana

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Historically, managing harvested mountain lion populations was confounded by the lack of a method to affordably, accurately, and repeatedly estimate a population's size, make rigorous predictions about the effect of future harvest prescriptions, and monitor population trends over time. Managers were unable to fully implement an adaptive mountain lion harvest management program because they lacked the necessary objective monitoring and modeling information. Disagreement about the past, and potential, effects of management decisions led to conflict among stakeholders and with FWP. Montana has now developed a draft mountain lion Management Strategy that will allow FWP to actively monitor statewide mountain lion populations using new genetic spatial capture-recapture field techniques and to routinely extrapolate those local estimates across discrete mountain lion ecoregions using a statistical resource selection function. Managers will then be able to input these population estimates, along with lion demographic parameters (described by regional field research), into a web-based mountain lion integrated population model in order to predict the likely effect of future harvest prescriptions on managed lions across the State. These new monitoring and modeling methods will enable FWP to fully implement an adaptive harvest management program through which population objectives are set, management alternatives are objectively evaluated, a preferred harvest prescription is applied, the effect of that harvest is directly monitored over time, and management is adjusted based on new information and changing objectives. FWP believes that this strategy will help reduce contention among stakeholders, optimize harvest and pursuit opportunity, reduce conflicts, and ensure that robust lion populations are conserved across their Montana habitats.

Simulations Inform Design of Regional Occupancy-Based Monitoring for a Sparsely Distributed, Territorial Species

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Sparsely distributed species attract management concern. Insufficient information on population trends, however, challenges conservation and funding prioritization. Occupancy-based methods are cost effective and therefore attractive for broad-scale trend monitoring, but appropriate sampling design and inference depend on particulars of the study system. We employed spatially explicit simulations to inform regional occupancy-based monitoring of white-headed woodpeckers (*Picoides albolvartus*), a sparsely distributed, territorial species threatened by habitat decline and degradation. We incorporated basic knowledge of species ecology into population simulations to compare statistical power and trend estimation error under alternative scenarios. Sampling effort needed to achieve adequate power to observe a long-term population trend (≥ 80% chance to observe a 2% yearly decline over 20 years) consisted of annually monitoring ≥ 120 transects using the single-survey approach or ≥ 90 transects using a repeat-survey approach. The single-survey approach, which employs occupancy as an index of abundance and requires auxiliary information to account for

detectability, provided more power for a given level of sampling effort than repeat-survey approaches. Alternate allocation schemes improved statistical power and trend estimates over the baseline (surveying 10 points within all transects annually), including surveying a subset (33%) of transects each year (i.e., a panel design) and surveying fewer points per transect in exchange for a larger spatial sample. Considering this case study, single-survey methods (with separate evaluation of detectability), panel designs, and aligning sampling resolution with home range size could likely benefit broad-scale occupancy-based monitoring of other sparsely distributed and mobile species.

Illuminating the Nocturnal Soundscape in the Bitterroot Valley, Montana

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Kate Stone*, MPG Ranch, Florence, MT
Craig Kuchel*, MPG Ranch, Florence, MT
Carrie Voss, MPG Ranch, Florence, MT

Darkness hides species on the landscape, but vocalizations illuminate their presence. In a nocturnal soundscape, owls hoot, nighthawks boom, bats echolocate, and insects buzz. Birds that migrate at night emit calls we can record and use for species identification. In 2012, we began to record nocturnal flight calls of migratory birds at three monitoring sites, and by 2016 expanded to eight sites. We have collected and processed over five terabytes of recordings from spring and fall migration. To help us analyze the audio, we customized the open-source software called Vesper. Our archive now includes thousands of detections of species like Wilson's Warbler. In the Bitterroot Valley, this species occurs in low numbers during the breeding season, and are rarely detected during migration by passive observation on the ground. In this presentation, we will share this finding and others from our analysis. We will also discuss efforts to share this acoustic monitoring technique and the Vesper software with local students. Lastly, we will explore some of the ways we can use the recordings to study other acoustic phenomena. A longer-term goal of this project is to develop a network of acoustic monitoring stations across Montana, building a collaboration between interested individuals, non-profits, and managing agencies. We will provide information on how you can participate in this project and attend a training workshop taking place this summer.

Assessing Impacts From One Year of Monitoring at a Wind Farm in Central Montana

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Kristina Smucker, Montana Fish Wildlife and Parks, Great Falls
Sam Milodragovich, NorthWestern Energy, Butte, MT

In 2015, NorthWestern Energy, owner of Spion Kop Wind Farm, contracted Montana Fish, Wildlife and Parks to assess impacts on birds and bats and formed a Technical Advisory Committee to guide research and monitoring. An explicit objective was to ensure all methods and results are publicly available. We searched turbines weekly May-September, 2016 for mortalities, assessed eagle use via point counts year-round and the Montana Natural Heritage Program deployed acoustic bat detectors to record echolocation sequences for activity. Estimates of fatality were determined by adjusting raw carcass counts for bias using the Huso (2011) Fatality Estimator software. Bat activity and species presence were quantified through analysis of call sequences. We observed three Golden Eagles, *Aquila chrysaetos*, on counts

for a total of 3 eagle use minutes. We found carcasses of two Western Meadowlarks, *Sturnella neglecta*, 15 Hoary Bats, *Lasiurus cinereus*, and five Silver-haired Bats, *Lasionycteris noctivigans*. The mean bird fatality estimate was 14 (95% CI: 9-20) and for bats 221 (95% CI: 120-397). An estimate of raptor fatality is of interest, but since no raptor fatalities were encountered we used the Huso (2014) Evidence of Absence (EOA) software to assess likelihood of a raptor collision. We can assert with 95% credibility that no more than 3 raptors were killed at the site. Impacts to birds are low relative to other wind farms in the west. The observed bat fatality rate (5.5 bats/MW) is below the average but above the median fatality rate observed at 49 wind farms in the mid-west.

**Assessing Maternal Energetic Allocation During Lactation for the Weddell Seal Using Photogrammetric Techniques

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Life history theory predicts that allocation of resources to reproduction varies across an individual's life as one's reproductive value changes with age. As individuals reach late life and residual reproductive value declines, they should increase the proportion of energy allocated to reproduction at a cost to future survival or reproduction, this is referred to as terminal investment. Characteristics of Weddell seal life history make this marine-mammal a model organism for investigating terminal investment. Previous research from this population has indicated that pups of older females exhibit a higher growth rate from birth to weaning compared to pups from mothers of prime and young ages. We offer three competing hypotheses that may explain observed increased growth rates of pups born to older mothers and hypothesize that this finding may be a result of terminal allocation. Maternal volume measurements obtained with photogrammetric techniques will be used to explore variation in maternal energetic allocation during lactation. A simple linear regression of maternal volume against maternal measured mass was used to obtain the prediction regression equation. We found a very strong relationship between measured masses and those estimated from our predictive equation (Adjusted R2:0.8958, n=31). Estimated mass loss of mothers and apparent mass conversion efficiency from mother to pup over the course of lactation will be used to assess support for competing hypotheses. Results from this study may improve our understanding of life history theory and highlight sources of variation in population vital rates.

Using GPS/Iridium Radio Collars with Geofence Technology to Monitor Management Grizzly Bears in Northwest Montana

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Grizzly bears that come into conflict with humans may be captured, fitted with a radio transmitter, and released. The Interagency Grizzly Bear Guidelines require these management bears be radio-collared and monitored monthly. Radio collars typically used are VHF and bears can only be located by ground or aerial tracking. Locating these translocated bears is challenging, unproductive, expensive, and results in few locations. Global Positioning System (GPS) technology has greatly improved the ability to monitor bears. Advancements in

technology have resulted in radio collars such as the GPS/Iridium with Geofence technology and auxiliary schedules. In 2016, we captured and radio-collared eleven grizzly bears. Ten were fitted with Telonics TGW-4577-4 Iridium collars with a CR-5 release mechanism. These collars provided 13,864 GPS locations. One bear was fitted with a Telonics VHF collar which only provided two locations. The Iridium collars had geofencing, which was a polygon created in Google Earth that included all the private land. The collar was programmed so when a bear was outside the geofence, a GPS location was acquired every six hours. When a bear was in the geofence, a GPS location was acquired every 30 minutes. This provided more locations when a bear was on private land and near residences. The Iridium platform also provided two-way communication with the collar which allowed changing GPS acquisition rates, downloading all of the data every other day, detecting mortality, monitoring battery level, and triggering the collar to release. The advantages of this new technology to monitor grizzly bears are presented.

Baseline Indices for Calling Amphibians and Western Toads across Montana

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Amphibian populations are undergoing global decline, and nearly one-third of the world's amphibian species are threatened. Structured surveys can use a variety of invasive and non-invasive techniques to assess the status of a species while repeatable surveys allow for long-term monitoring to identify population trends. To establish baselines for species occupancy and indices for abundance we conducted two projects to inventory amphibians during May and June of 2016. We conducted roadside calling surveys for species that advertise breeding through calls and lentic surveys at known breeding locations of the Western Toad (*Anaxyrus boreas*). Roadside surveys were broken into west and east regions based on species distributions. We detected two species at seven of the eight western transects, Pacific Tree Frog (*Pseudacris regilla*) and American Bullfrog (*Lithobates catesbeianus*). The Pacific Tree Frog was identified at 19% of the stations sampled, but at low densities. In the east, we detected five species of amphibians at 18 of the 19 transects, Boreal Chorus Frog (*P. maculate*), Northern Leopard Frog (L. pipiens), Great Plains Toad (*A. cognatus*), Woodhouse's Toad (*A. woodhousii*), and Plains Spadefoot Toad (*Spea bombifrons*). The Boreal Chorus Frogs were most commonly detected (39%) followed by Woodhouse's Toad (13%) and Plains Spadefoot (12%). Of the 76 sites we surveyed for Western Toad, 63% had evidence of breeding. These surveys can be used as primary indices for future surveys to determine trends in abundance and occupancy through time and inform state status ranks.

Better Bullets: How to Shoot Varmints Without Poisoning Scavengers

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Recreational shooters kill millions of varmints each year. The carcasses can contain fragments of lead that scavengers can ingest. Less toxic bullets may alleviate the problem but their performance needs to be determined. In this study, ground squirrels were shot with

.17 HMR, .22 LR, and .223 Rem rifles with expanding and non-expanding lead and non-lead bullets. We monitored whether the bullets instantly incapacitated ground squirrels and then estimated lead concentrations in each carcass using radiographs. We found lead in the majority of ground squirrel carcasses that were shot with five out of six lead bullets tested. Expanding ammunition in the .17 HMR and the .223 Rem calibers left the highest estimated concentrations of lead in ground squirrels, which had, on average, 23.6 and 91.2 mg/carcass, respectively. Within a caliber, expanding bullets did not contaminate ground squirrels more than non-expanding bullets. Non-lead bullets incapacitated ground squirrels as well as lead bullets. Recreational shooters and land managers may reduce the amount of lead available to scavengers by using non-lead bullets when shooting ground squirrels and other varmints.

Montana's IMBCR Program: Utility of Seven Years of Statewide Landbird Monitoring Data

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The 2016 field season marks the 7th consecutive year of statewide implementation of the Integrated Monitoring in Bird Conservation Regions program (IMBCR) for monitoring bird populations in the state of Montana. Using a spatially-balanced, hierarchical study design, the IMBCR program provides density and occupancy estimates for bird species at various geographic extents (strata) across the western U.S. Based largely on agency investment, primary sampling occurs in all USFS R1 National Forests and extensive grassland/sagebrush habitats on Montana BLM lands statewide. Significant sampling also occurs in various habitats on private lands. Using these data, as well as tools available on the Rocky Mountain Avian Data Center web console, agencies and NGO partners can evaluate avian distribution and population dynamics statewide. As an effective monitoring program, the IMBCR program informs research questions, landscape-level management and conservation action. The design and current applications of the IMBCR program are summarized.

Elk Near Fossil Butte National Monument in Southwest Wyoming Migrate Early to Escape Human Disturbance

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Migration allows individuals to strike a balance between risk and reward, and use resources in the places and at times that maximize fitness. Large ungulates commonly migrate to increase access to quality forage in spring and decrease risks associated with winter weather in the fall in an effort to maintain the body condition necessary for winter survival and successful reproduction. However, foraging exists within a realm of strategies employed to maximize fitness, and so animals must take factors like safety into account when choosing to migrate. Here, we use 5 years of data from 73 female elk (*Cervus canadensis*), most of which are part of a subgroup of elk that utilize a protected area during hunting season, to identify the driving factors behind the initiation of migration from their late summer range. The onset of archery season, remotely sensed vegetation degradation, and having access to lands where hunting was prohibited (Fossil Butte National Monument) initiated autumn migration, with bad weather having a smaller effect. 67% of elk using the Monument initiated migration prior to the onset of archery hunting season (1 September), preemptively avoiding risk, while no elk from the subgroup not using the Monument left prior to archery season,

despite spending summer at higher elevations. Departure from productive summer range nearly two months before vegetation senescence afforded protection on the Monument during hunting season, but decreased access to late summer-fall forage (integrated NDVI) by 21%. Our results illustrate the complexity of managing a wide-ranging ungulate across jurisdictions with multiple missions.

**Effects of Grazing Management on Sharp-Tailed Grouse Nest Survival in Mixed Grass Prairies

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Grazing is the predominant land use across western North America and directly affects the structure, composition, and productivity of native grasslands. Thus, grazing management has a significant impact on the quality and extent of wildlife habitat. Sharp-tailed grouse (*Tympanuchus phasianellus*) have large home ranges and utilize a wide range of habitat types, allowing them to serve as an ideal indicator species for grassland habitats. To better understand the relationship between rangeland management, habitat conditions, and nesting ecology, we monitored 50 radio-collared sharp-tailed grouse in eastern Montana to assess the effects of grazing management, local habitat, and female attributes on nest survival. In the first year of a three-year study, we monitored 73 nests, 27 of which successfully hatched at least one chick. Probability of daily nest survival was 0.96 ± 0.006 and overall nest survival during the nesting period was 0.24 ± 0.05. Variables at the home-range scale, including grazing system and grassland shape complexity, were better predictors of nest survival than variables at the nest-scale. Nest survival declined with female age, and was higher for nests located in pastures managed with season-long grazing than for pastures managed with rotation and rest-rotation grazing. However, confidence intervals of effects overlapped 0 and a null model was considered parsimonious, suggesting little to no direct effect of grazing system on nest survival during our first year of study. By evaluating the influence of different rangeland management practices on demographic rates, this project will develop specific management recommendations for the conservation of sharp-tailed grouse.

Scientific Integrity: Producing, Incorporating, and Advocating for Science in the Age of Alternative Facts

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Technical information – along with politics, economics, public opinion, societal values, and legal considerations – is one input into wildlife management decisions. As information consumers, decision-makers require objectivity of those who produce such information, and

should have an understanding of the inference scope and strength (and uncertainty) associated with technical information. Information producers must earn, demonstrate, and protect that reputation of objectivity. Both producers and consumers must both foster and guard a culture of integrity, such that the processes of producing and applying information are transparent and can withstand intense scrutiny. Today, rather suddenly, there is national discourse on these subjects of transparency, professional integrity, and rigorous questioning and defense of scientific information. The discussion of the role of science and scientists in informing public policy has assumed a prominent position in traditional and social media. This panel, consisting of representatives from federal, state, tribal, and non-governmental organizations will engage in this discussion with the audience.

Mule Deer Research and Management in the Bitterroot Valley, Western Montana

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Mule deer in the Sapphire Mountains on the east side of the Bitterroot Valley exist across a variety of habitats, densities, and management strategies, including the most popular trophy buck management area in the state of Montana (Hunting District 270 in the south end of the Sapphires). As in many other western states, mule deer populations have declined over recent decades, despite relatively good fawn recruitment. Beginning in winter 2015-2016, we used ground-based darting to deploy GPS collars on 30 adult female deer in HD270 and HD204 (north end of the Sapphires) to evaluate seasonal movements and causes of mortality. These areas were chosen not only because they represent a spectrum of environmental and management conditions, but because extensive data on habitat and forage quality in this area was collected as part of preceding elk habitat research. To date, we have observed a wide variety of movement strategies, from resident deer maintaining a small home range year-round in areas of high private land ownership to migratory deer moving from summer to winter range. Causes of mortality consisted of coyote predation (n=2), human hunting (n=1), and unknown mortality (n=1) in HD204, and natural mortality (n=1) and mountain lion predation (n=2) in HD270. This is an ongoing study by which we hope to evaluate factors limiting deer populations to help inform future management.

Montana Fish, Wildlife and Parks – A Wildlife Habitat Conservation Heritage

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The course of wildlife habitat conservation in Montana was set in 1940, with the initial purchase of 1,000 acres, the "Judith River Game Range". This was the start of extensive investment in wildlife habitat conservation across the state. Hunting license, Pittman-Robertson Federal Aide, USDA Forest Legacy, and funds from many partners have helped to conserve and manage nearly 890,000 acres of high priority wildlife habitats across Montana. I used historical records, program database queries, interviews, and popular articles from the Montana Outdoors publication to summarize conservation highlights from over the past 80 years. Two programs have been instrumental in accomplishing perpetual conservation in recent history. Since 1987, Habitat Montana has invested over $75 million and leveraged $66 million in partner funds. Since 2001, the Forest Legacy Program has invested nearly $65 million in Montana in addition to $60 million of partner funding, specifically for forest land conservation. In total, Montana Fish, Wildlife and Parks (FWP) and partners have

invested $290 million toward wildlife conservation easements and land purchase, including $42 million of donated value by landowners. FWP currently owns 385,000 acres, managed as wildlife management areas. Wildlife habitat conservation easements total 448,000 acres, making FWP the 10th largest holder of conservation easements in the nation. Conserved habitats span coniferous forest, intermountain grasslands, riparian bottomlands, wetlands, prairie, and shrub grasslands, benefitting many species. These lands substantially overlap with mapped priority habitats, involving hunted game and species of concern. Broad public support is essential to program survival. Such support appears to hinge on various project outcomes, including conservation benefits, compatible recreation, economic benefits, managing land as a good neighbor, and tapping local producers to assist with management.

Montana Fish, Wildlife and Parks Statewide Forest Management Plan

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Montana Fish, Wildlife & Parks (FWP) is responsible for managing approximately 150,000 acres of forested land across 36 Wildlife Management Areas (WMAs). Since 2009, Montana's legislature has passed several bills prescribing forest management on these lands and requiring FWP to adopt forest management plans. Work is progressing towards developing a statewide forest management plan. FWP is proposing a forest management plan that employs a "filter" approach with emphasis on conserving biodiversity. Our premise is that implementing this approach will provide sustainable habitat conditions for the variety of species endemic to these forests.

28 Years of Upland Game Bird Habitat Enhancement in Northeast Montana

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In 1989 Montana's Upland Game Bird Enhancement Program (UGBEP) was authorized to develop, enhance, and conserve upland game bird habitat in Montana using funding from upland game bird license sales. A combination of high public interest, robust game bird populations, and an extensively cultivated landscape in the northeastern corner of Montana made it a natural focus area for the new program. Habitat enhancements completed under the program included establishing nesting cover, shelterbelts for winter cover, and food plots as well as implementing rest-rotation grazing systems. Over the ensuing 28 years, 431 habitat projects were completed in a five county area. Most projects were completed in cooperation with private landowners and nearly all of the habitat enhancements occurred on private lands. Many projects resulted from partnering with Farm Bill conservation programs. Good working relationships between FWP staff, landowners, and partnering agencies played a key role in the success of the program. A discussion of achievements, challenges, and lessons learned from the UGBEP in northeast Montana may provide insight for wildlife managers dealing with habitat conservation issues across the state.

**Habitat Selection, Movements, and Survival of Dispersing Juvenile Beavers in Southwest Montana

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North American Beaver (*Castor canadensis*) colonies provide a variety of benefits to stream systems by capturing and storing water and sediment, expanding riparian habitats, and increasing habitat heterogeneity. Land and wildlife managers are increasingly interested in implementing beaver restoration projects with the goal of improving stream health and landscape water storage capacity. However, most research on habitat selection by beavers does not address habitat requirements when beavers form new colonies in novel areas, as is the objective of most beaver restoration efforts. We radio-marked juvenile beavers in the upper Gallatin and Madison River drainages to investigate dispersal, survival, and settlement site selection with the goal of improving the ability of managers to identify beaver restoration sites with the highest probability of success. Following the first year of data collection, we found the dispersal rate was low (0.16 ± 0.084) and the survival rate was high (0.82 ± 0.082) among our radio-marked beavers. Out of 50 active beaver colonies discovered in the study area in 2016, only 5 were new settlement sites. Newly-settled sites generally had a higher proportion of willow-dominated habitat types than unsettled sites while all other measured habitat variables were similar between settled and unsettled sites. Our observations indicate old beaver structures are frequently used by dispersing beavers when establishing a new colony. We assert that examination of local beaver densities and the spatial distribution of active colonies are essential components of a successful beaver restoration project, and should precede evaluations of habitat quality at potential restoration sites.

**Responses of Songbird Population to Cattle Grazing Regimes in Sagebrush-Steppe of Eastern Montana

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Sagebrush-steppe ecosystems in western US are characterized as a landscape mix of sagebrush shrubs and grass vegetation. A large portion of sagebrush-steppe across the west is used for grazing of domestic livestock, primarily cattle. We compared songbird communities over four breeding seasons in eastern Montana between two grazing systems: rest-rotation and traditional grazing. Rest-rotation involves grazing areas (or pastures) at different annual seasons across years allowing pastures to be rested between the same consecutive seasons. Traditional grazing is defined as grazing a pasture repeatedly at the same annual season each year. Recently, rest-rotation has been used as a conservation management tool by the Natural Resource Conservation Service's (NRCS) Sage Grouse Initiative (SGI) program. The goal is to improve habitat for greater sage grouse (*Centrocercus urophasianus*) through livestock grazing. We explore the effects of rest-rotation compared to traditional grazing on songbird population breeding demographics: adult abundance, nest densities and nest success. Abundance is a metric often used to assess conservation actions given the ease in collecting data to estimate this parameter. However, information on how the conservation actions influences the life histories, such as nest density and nest success, that determine abundance are lacking. Our goal is to understand the relationship between patterns in abundance, nest density, and nest success and how rest-rotation grazing influences those patterns. This knowledge will provide information on how to best manage for multiple songbird species in sagebrush-steppe by determining how conservation management tool affects individual songbird populations.

Resource Selection, Predation Risk, and Underestimates of Refuge Habitat for an Alpine Obligate

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Understanding relationships between animals and their habitat is a central goal in ecology with important implications for conservation. Misidentified habitat requirements, however, can have serious repercussions because land protections or reintroductions might occur in areas of less than optimal habitat. Studies of resource selection have greatly facilitated an understanding of relationships but suffer because rarely used, but vital habitat features may be insufficiently described. A critical element for many prey species is escape terrain or some form of refuge. Mountain goats (*Oreamnos americanus*) are a species well known for their use of cliffs to escape predation, but a survey of the literature reveals at least twelve different approximations of goat escape terrain. Here, we sought to 1) optimize mountain goat escape terrain estimates, and 2) highlight the assumption that the time an animal spends in an area is proportional to importance. We experimentally exposed mountain goats to grizzly bear (predation risk) and ungulate (control) imitations and recorded subsequent escape locations in Glacier National Park, Montana, USA. Through a used-unused resource selection function we tested 21 landscape variables for explaining goat escape terrain. We found that distance to slopes greater then 60o best explained where mountain goats fled. Additionally, we identified the need to incorporate behavior and predator interactions into resource selection studies. With 27 failed mountain goats reintroductions these results have consequences on habitat characterization and considerations for species restoration. Managers should consider the availability of escape habitat when protecting land or reintroducing prey species.

Patterns and Spatial Prediction of Livestock Predation by Grizzly Bears on the Blackfeet Reservation

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Human caused mortality is a primary limiting factor in carnivore conservation globally. A large proportion of predator persecution is the result of retaliation due to lost livestock. If carnivore conservation is to succeed then the economic burden on livestock producers needs to be ameliorated. Proactively preventing livestock depredation is perhaps the most effective method to solve conflicts compared to reactively relocating problem animals or reimbursing people for losses. Large carnivores, however, range across wide areas while management dollars are limited and thus where to implement conflict prevention measures is a matter of triage. To prioritize conflict prevention efforts we examined 23 years of data on livestock depredation by grizzly bears (*Ursus arctos*) across the Blackfeet Indian Reservation. Since 1993 livestock loss by grizzlies has increased an average of 6% per year and depredations were positively associated with warmer weather. Additionally, we forecasted spatial risk by estimating the relative probability of livestock loss across the reservation. Using logistic regression models we tested remotely sensed landscape variables to understand how habitat features influence the risk of depredation by bears. We found that locations closer to trees had the highest chance of livestock loss. Furthermore, places closer to perennial and seasonal water also had increased risk. Topography also influenced depredation probability with lower elevations and gentler slopes having increased risk. In all, our results will provide 1) managers a clear path in prioritizing areas to receive conflict prevention resources, and 2) livestock growers a knowledge of how to distribute animals to reduce risk.

Genetic Variation of Garter Snakes Across Western Montana

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This study addresses the variability in garter snakes across Western Montana. Some common garter snakes in the region exhibit characteristics of the valley garter (*sirtalis fitchi*), a subspecies typically found west of the continental divide. Other specimens exhibit characteristics of the red-sided garter snake (*sirtalis parietalis*), a subspecies found east of the continental divide. Wandering garter snakes (*elegans vagrans*) across Western Montana also exhibit a great deal of variability. Using tissue samples from 108 common garters, 185 wandering garters and 3 melanistic snakes across Western Montana, we explore the effect of distance, topography and land cover on the genetic similarity between members of both species. In addition, we examine whether genetic differences account for phenotypic differences amongst species and whether microsatellite sequences indicate geographic isolation, assortative mating or inbreeding among garter snakes.

Common Themes in Recent Human Fatalities Due to Grizzly Bear Attacks

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There have been 8 fatal grizzly bear attacks on humans in the lower 48 states since 2001. Of these, 6 occurred in the Yellowstone Ecosystem, and 2 occurred in the Northern Continental Divide Ecosystem. An additional encounter occurred in the Cabinet/Yaak ecosystem where a hunter shot and wounded a grizzly bear and then entered thick brush in pursuit of the wounded bear. The bear then attacked him and his hunting partner accidentally shot and killed him while trying to shoot the bear. Of the 8 fatal attacks, 4 occurred in National Forests, 3 in Yellowstone Park, and 1 on Montana state game range lands. Human behaviors at the time of the attacks involved hunting, camping at night, hiking, and mountain biking. Seven of the eight attacks occurred during daylight. Five of the fatalities involved lone individuals and 4 of these were lone hikers. Bear spray was not carried or used by any of the people killed in these attacks. Consistent messaging by management agencies about how to be safe in bear country has not been successful in convincing the public to adopt safety practices. Further efforts are necessary to educate users in grizzly habitat of the risks involved with certain behaviors and the cost of ignoring agency safety messages. The likelihood of fatal encounters could be significantly reduced by the adoption of common safety practices such as not hiking or hunting alone, not running when encountering a bear, the use of bear spray, and understanding the increased danger involved when surprising a bear due to fast travel in grizzly county by trail running or mountain biking.

The Status of the Grizzly Bear in the Northern Rockies: Progress Toward Delisting?

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Grizzly bears in the Yellowstone Ecosystem have met recovery goals, are recovered, and should be delisted. Successful delisting under requirements of the Endangered Species Act requires meeting recovery goals and requires that adequate regulatory mechanisms be in place post-delisting so that the species will remain recovered. Acceptable mortality management

including some level of sport hunting could be possible if science-based mortality limits to stabilize the population are carefully applied within the core management area post-delisting. Unfortunately, some agency administrators have removed necessary regulatory details about mortality management and wish to limit to limit the time period for application of the regulatory mechanisms that would be used to demonstrate recovery. The same administrators have pushed for managed population decline inside core recovery area after delisting. Managed population decline in the core recovery area is scientifically indefensible for a species like the grizzly with such a low reproductive rate. State administrators also removed any reference in the post-delisting management plan to the important fact that grizzly bears are a conservation-reliant species (Scott et al. 2010; Goble et al. 2012) and will require careful management in perpetuity. Ideologically based erosion of science and necessary regulatory mechanisms puts successful delisting at risk. Such an approach does not serve: 1) the needs of the public who have been partners with the agencies in the achievement of recovery and who desire successful delisting to obtain increased management flexibility outside core areas; or 2) the conservation of grizzly bears who need public support to remain recovered.

Birds, Herps, and Small Mammals! Oh, My! Help FWP Find Rare and Elusive Species (Poster and Oral Presentation)

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In 2014, Montana Fish, Wildlife & Parks (MFWP) expanded their Nongame Program to include a Wildlife Biologist specializing in nongame species work in every region. Although each region has different priorities, the goals within the Nongame Program are universal: (1) Keep common species common, (2) Reverse population declines for species of concern, and (3) Foster awareness and enhance public knowledge and appreciation of nongame species. Our efforts are guided by the State Wildlife Action Plan (SWAP) which prioritizes work on habitats and species of greatest conservation need. These efforts include anything from developing habitat conservation projects to surveying single species. Within the SWAP there are a number of species considered Species of Greatest Inventory Need because they lack sufficient data to determine their status. Often these species are rare, elusive, or difficult to observe. Consequently, we seek the help of others to provide incidental observations in addition to our structured survey efforts. Some of our high priority species include: (1) black rosy-finch, a small high-alpine songbird, (2) greater short-horned lizard, a cryptic reptile dependent on sparse habitat, (3) black-tailed jack rabbit, a lesser-known lagomorph found in open country habitat, and (4) black swift, the largest of the swift species, nesting secretively in shallow caves and behind waterfalls. People interested in assisting with surveys should contact the appropriate FWP nongame lead. By working together, we can provide managers and regulatory agencies with vital information to make well-informed decisions about our valued resources in Montana.

**The Effect of Climate-Driven Phenological Shifts on Plant-Pollinator Interactions and Plant and Pollinator Reproductive Success

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Plants and pollinators are shifting their annual bloom periods and emergence dates (i.e., phenologies) in response to ongoing climate-warming. However, the magnitude of phenological shifts can be species-specific, causing concern that unequal responses will disrupted plant-pollinator interactions (i.e., phenological mismatches) and create novel community composition throughout the growing season. The effects of phenological mismatches on plants and pollinators remains unknown, preventing conservation strategies that pinpoint the most vulnerable species. The goal of this study was to investigate the effects of phenological shifts on plants and bees by manipulating plant-bee community composition within mesh-sided enclosures (mesocosms). Plant-bee communities were assembled following a factorial design based on phenologies (i.e., spring vs. summer blooming plants and spring vs. summer emerging bees), allowing a comparison of plant-bee interactions and reproductive success within 'phenologically matched' communities (e.g., spring blooming plants with spring emerging bees) and 'phenologically mismatched' communities (e.g., spring blooming plants with summer emerging bees). Preliminary results suggest that interaction frequency was similar between 'mismatched' and 'matched' communities, implying that plants and bees can compensate for interactions disrupted by phenological mismatches. Currently, I am processing the reproductive data from both plants (i.e., seed set) and bees (i.e, total offspring) to determine if interaction frequency is indicative of reproductive success.

Wind Energy Development in Montana: Guidance for Effective Agency Involvement to Minimize Wildlife Impacts

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Montana is one of the top five states for wind energy potential but ranks 19th for installed wind energy, with 691 megawatts of capacity built. Nationwide, wind energy development is on track to provide 20% of the country's electricity by 2030 and wind turbine technician is the fastest growing job in the nation. Wildlife managers in Montana will see more wind development projects come across their desks but may have limited experience with review. We present an overview of existing and potential wind farms in Montana and the typical process for project permitting and development. Wind has great potential as a source for green energy but improperly sited wind projects pose threats to wildlife including potential risk of bird and bat collisions; displacement of nesting raptors, songbirds, and prairie grouse at leks; and habitat fragmentation. In 2015, Montana Fish, Wildlife and Parks began wildlife monitoring at a wind farm near Geyser, giving the department direct experience designing and implementing fatality monitoring. The key to wildlife friendly wind development is early consultation with state and federal agencies and open discussion of survey results. To assist developers, USFWS has produced the Wind Energy Guidelines (WEG) and Eagle Conservation Plan Guidance (ECP). These are voluntary guidelines, but both aim to walk developers through the process of identifying, avoiding, and minimizing impacts to wildlife and key habitats. To assist biologists, we will summarize impacts to wildlife, give a short-course on the WEG and ECP, identify opportunities for agency involvement at each stage of development and offer a framework for effective consultations.

Future Upland Gamebird Extension Programs in Montana: Assessing the Needs of County Agents

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In cooperation with Pheasants Forever and Montana State University, I surveyed all 48 county extension agents in Montana who have roles in addressing wildlife and natural resource issues. Twenty-five replies were received, which was a response rate of 52%. Agents expressed considerable interest by landowners and producers in various aspects of upland gamebird management. Sixty-eight percent of agents perceived that the current interest in gamebirds by ranchers, agricultural producers, and other landowners is either medium or high, and that interest will remain stable through 2021. Information on food plots was expressed as being the greatest need, with recommendations for plantings to improve game bird habitat being foremost. Nearly all agents (88%) indicated that producers have considerable interest in cover crops in small grain, including the implications for upland gamebirds. Based on responses received, I recommend that demonstration days and field tours will be the most useful tools to incorporate in future extension program development. Agents also expressed a need for making wildlife expertise available via email. Seventy-nine percent of agents placed substantial priority on in-service training for themselves in gamebird ecology and management, so this is also a valuable future program. I believe that county extension agents can have a significant effect on providing guidance to the future of upland gamebird management by agricultural producers. In so doing, gamebird habitat and numbers might be positively affected across a large portion of Montana.

The Eagle has Landed: Winter Eagle Research Takes Flight in the Bitterroot Valley

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We began capturing Golden Eagles on the MPG Ranch in the Bitterroot Valley in 2011. Though we began with the intent of using satellite transmitters to learn about the habitat use and migration paths of adult, overwintering Golden Eagles, our research has evolved to encompass placing auxiliary markers on Golden and Bald Eagles of all ages. We also test eagles for environmental contaminants. So far we have captured and marked more than 75 Golden and 20 Bald Eagles. Due to these markers, we've amassed an impressive archive of eagle re-sightings in the Bitterroot Valley and other locations, including Washington and British Columbia. We've also learned that the majority of eagles captured show signs of lead exposure, likely from the ingestion of lead ammunition fragments. This year, we expanded efforts to study wintering eagles throughout the Bitterroot Valley. We've joined forces with Bitterroot Audubon and private landowners to set out carcass and camera stations on private lands throughout the valley. These efforts should increase the likelihood of re-encountering our marked eagles, demonstrate the value of private lands to eagles and other scavengers, and engage people from a variety of backgrounds with our research. We will share preliminary results from this collaboration, including impressive camera “captures” of Bald Eagles, Golden Eagles, and other scavengers. We will also share information about the public platform we are using to crowd-source image identification; this platform is available for other camera-trapping projects in Montana.

Montana Peregrine Falcon Population Survey: 2016

Jay S. Sumner*, Montana Peregrine Institute, Arlee

The release of 617 captive-bred young during the 1980's and 1990's sparked the recovery of the Peregrine Falcon (*Falco peregrinus*) in Montana. By 1994, a mix of state, federal, and private biologists (Montana Peregrine Falcon Working Group) documented 13 known active Peregrine Falcon territories. For the following four years, the number of known territories averaged about 16, but then intensive survey efforts in 1999 documented a total of 28 territories. The number of active Peregrine Falcon territories discovered in Montana has increased yearly. Montana had a record number of 108 active Peregrine Falcon territories recorded during the 2012 field season. By the end of the 2016 field season, we have recorded 207 active Peregrine Falcon territories. Annual survey objectives include the establishment of a citizens group (Project Peregrine Watch) to monitor individual Peregrine territories throughout the state, determine status and trends of Montana's Peregrine Falcon population, study all known historic Peregrine Falcon eyries, record occupancy and productivity at all active territories, locate new Peregrine Falcon territories, seek confirm and consolidate information from all public and private sources, record activity and locations of neighboring cliff-nesting raptors (Prairie Falcon (*Falco mexicanus*), Golden Eagle (*Aquila chrysaetos*), and the Red-tailed Hawk (*Buteo jamaicensis*), and develop a long-term and cost-effective monitoring program for determining annual status and population trends of the State's Peregrine Falcon population.

**Response of Amphibian and Invertebrate Communities to Wetland Mitigation in the Greater Yellowstone Ecosystem

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In the United States, a "no net loss" of wetlands policy mandates that when wetland impacts cannot be avoided, they must be mitigated by creating or restoring wetlands of equal or greater area. A primary goal of these projects is often habitat replacement, but success is generally evaluated only through presence of wetland-associated vegetation and physical characteristics, which may not be good surrogates for wetland function. Because amphibians and aquatic macroinvertebrates integrate processes at multiple levels and are sensitive to conditions in both the aquatic and surrounding terrestrial environment, evaluating their response to wetland mitigation may be more meaningful. The Wyoming Department of Transportation recently (2008-2013) constructed and restored 38 wetlands in Teton County, WY to mitigate for loss of wetland area caused by a road reconstruction project. Our objectives were to assess differences in species richness and community composition of amphibian and aquatic macroinvertebrate communities among ten constructed, seven impacted and ten reference wetlands. Preliminary results suggest that amphibians and invertebrates have quickly colonized created wetlands, leading to similar species richness among wetland types, but that community composition remains distinct even several years after wetland construction. These results suggest that wetland creation may be an important tool, but that the life histories of target species should be accounted for in the design phase to maximize the probability of native amphibian and invertebrate colonization and persistence.

Growing the Relevance of Wildlife Management in Uncertain Times

Michael J. Thompson*, Montana Fish Wildlife and Parks, Missoula

Political unrest in the United States requires wildlife managers in Montana to consider the shifting context within which citizens engage wildlife and wildlife agencies. The state and national elections of 2016 gave voice to concerns about losses of trust, safety and security. The public seeks or is bracing for change, arguably and in part for the sake of change, with consequences that have yet to unfold. Historically, the wildlife profession has been seen by some as an obstacle to change. In today's social environment, the wildlife profession risks censure, with political consequences, if seen as a distraction from overarching public concerns. Conversely, the opportunity exists to redirect its focus on leadership toward a desired future. To lead, the wildlife profession in Montana must connect with the issues of trust, safety and security that seem elemental on the minds of Montanans today. Thus, the wildlife profession would do well to help reinforce the societal underpinnings upon which amenity values can be conserved. For example, now is the time for the wildlife profession in Montana to lead openly in addressing climate change and the advance of invasive species. It could be seen prescribing the innovative use of renewable resources to meet social and economic, as well as environmental needs. The wildlife profession in Montana could set a more obvious and intentional example for workforce diversity and human respect. Montana's model of habitat conservation could more visibly include a vision toward a future when wildlife and people are better integrated on the landscape.

Contact Patterns Among Bighorn Sheep In and Around Glacier National Park

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Identifying patterns of direct contacts among individual animals is important to understanding infectious disease transmission. Social behavior can be influenced by both intrinsic and extrinsic variables and can be explored at 3 levels: social network structure, dyad structure, and contact structure. We investigated drivers of contact structure using GPS locations of 87 male and female bighorn sheep (*Ovis canadensis*) in and around Glacier National Park in Montana, USA. Focusing on contacts between sheep moving separately, we examined relationships between contact locations and movement variables, land cover, distances to various resources, and variables known to influence survival using a resource selection function. Used and available points were defined as simultaneous locations within 25 m (the contact-used) and 13 km (largest step length- available) of another collared bighorn sheep, thus results of this analysis describe the strengths of these variables relative to habitat use. Data were analyzed separately according to dyad type (male-male, female-female, male-female). Most contacts occurred in March for male-male and female-female dyads and in November, December, and January for male-female dyads. For male-male dyads, contacts occurred more than expected given habitat use in conifer land cover and locations farther from perennial water sources, high NDVI, little canopy cover, and low and high solar radiation index. For female-female dyads, contacts occurred less than expected given habitat use in

grass and barren land cover and locations with intermediate terrain ruggedness, high NDVI, and low and high snow water equivalent. For male-female dyads, contacts occurred most during the night, least during the day, and at locations with intermediate elevation and farther from escape terrain. Together, these results suggest that more specific conditions apply to contact locations than general locations and that we can predict locations where contacts are most likely to occur, which may be useful for disease management.

Monitoring Hoary Marmots: Matching Objectives to Available Effort

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Monitoring provides information necessary for managers to make informed decisions related to the status of populations. However, collecting sufficient data to reliably detect trends in abundance over a large area is costly in time and resources. Instead, detecting changes in distribution may be a more feasible goal, while still providing useful information. Hoary marmots are alpine obligates, patchily distributed throughout the mountains of western North America. This species requires deep winter snowpack to survive during winter and populations at the edges of their distribution are most likely to be vulnerable to changes in climate. We sought to design a monitoring plan that could identify changes in distribution of hoary marmot populations. We used occupancy methods to create a predictive habitat map for hoary marmots in western Montana. We evaluated designs that could be implemented by existing staff or with 2 dedicated technicians and assessed tradeoffs in the number of sites and surveys needed to detect a change in distribution. We also evaluated the effort needed to sample throughout Montana or within selected mountain ranges. Based on our analyses, managers will need to complete surveys at ≥65 sites at least twice a season and without dedicated technicians, the area sampled will be limited. Hoary marmots likely will be negatively impacted by climate change, especially in isolated mountain ranges at the southern extent of their distribution. Assessing the magnitude of these changes will be impossible without sufficient data, highlighting the importance of identifying monitoring objectives before data collection begins.

Western States Wolverine Conservation Project Baseline Survey

Alex Welander*, representing the Western States Wolverine Working Group which consists of numerous individuals within Montana Fish Wildlife and Parks, Wyoming Game and Fish, Idaho Fish and Game, Washington Fish and Wildlife, Colorado Parks and Wildlife, United States Fish and Wildlife Service, United States Forest Service, National Park Service, Confederated Salish and Kootenai Tribes; University of Montana, Montana State University, Colorado State University, and Woodland Park Zoo

The wolverine is a naturally uncommon species whose conservation and management requires collaboration across a large geography. Conservation priorities for wolverines in the western U.S. have been identified as 1) Connectivity, 2) Restorations, and 3) Monitoring. The Western States Wolverine Working Group is a collaborative effort among state, federal, tribal, university, and private organizations that are actively working on these priorities. One element of the conservation program is baseline survey for wolverine occupancy across the 4-states where the species currently occurs – Montana, Wyoming, Idaho, and Washington. The survey uses a grid of 15 x 15 km cells. All cells >50% modelled wolverine habitat were

considered for sampling, and a GRTS sample of 180 cells was selected to be surveyed using a standard protocol across the 4-state area during winter 2016-17. A single camera/DNA station was established during November 2016 in each cell and will be run through April 2017. To date, stations in all states are successfully detecting wolverines and other species. This effort will provide the first estimate of wolverine distribution across the species range in the lower 48 and an estimate of occupancy. It will also allow investigations into a variety of genetic-based questions at the population scale, including identification of current and future areas of importance for connectivity. The survey is designed so that it can be repeated as a monitoring program and can determine changes in wolverine status (stable, increasing, or decreasing distribution via occupancy), and genetic composition over time. Results will also be used to identify potential population restoration areas if there are large areas with suitable habitat that have not yet been recolonized after historical lows.

**Livestock Depredation by Grizzly Bears on Forest Service Grazing Allotments in the Greater Yellowstone Ecosystem

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Grizzly bear population growth and range expansion over the last several decades in the Greater Yellowstone Ecosystem (GYE) has led to increased human-bear conflicts, including livestock depredation. In 2015, we began a study to evaluate spatio-temporal relationships between livestock grazing, grizzly bear habitat characteristics, and livestock depredations by grizzly bears on public lands in the GYE during 1992–2014. In collaboration with the U.S. Forest Service (USFS), Interagency Grizzly Bear Study Team, and National Park Service, we have obtained 23 years of grazing allotment attributes for 316 USFS and Grand Teton National Park grazing allotments including: livestock stocking information, grizzly bear habitat characteristics, grizzly bear density and distribution, and livestock depredation counts. Overall counts of livestock depredation events, total livestock killed, and the number of allotments experiencing depredations increased from 1992 to 2014, concurrent with range expansion and increasing grizzly bear densities. Annual depredation events per allotment differed by livestock class, where allotments stocked with cow-calf pairs and sheep experienced the majority of depredations. Livestock depredation counts will be modeled with livestock stocking data and grizzly bear habitat variables to better understand which attributes of grazing allotments had the greatest association with the number of depredations over the study period. We will evaluate habitat attributes at two spatial scales, representing daily and annual grizzly bear activity areas. Our results will enhance adaptive approaches to conserve grizzly bears, while also maintaining the economic viability of livestock operations.

**Effects of Supplementation Strategy and Dormant Season Grazing on Cattle Use of Mixed-Grass Prairie Habitats

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Dormant season grazing reduces reliance on harvested feeds, but typically requires protein supplementation to be successful. However, information relating supplementation strategies to individual resource utilization on dormant forage is lacking. Thus, the intent of this research is to examine cattle resource utilization, residual cover of vegetation and utilization on rangelands grazed during the dormant season under two supplementation strategies. Thirty transects were randomly located within each pasture for measuring vegetation composition, production, canopy cover and visual obstruction readings (VOR) pre and post grazing. Grazing locations were monitored for seven individuals within each treatment with Lotek GPS collars containing head position sensors that record daily space use. Resource utilization effect size was variable by treatment and time period. Vegetation response to treatment was similar for both cake and protein treatments across time periods (44.2 ± 4.8% vs 41.7 ± 4.5%, 36.7 ± 4.8% vs 30.7 ± 4.3%, 10.4 ± 3.1% vs 16.5 ± 3.5%). VOR was affected by supplementation treatment during time period 1, such that protein treatment significantly decreased VOR in comparison to the Cake treatment (36.6 ± 5.6% vs 15.7 ± 3.6%). Herbaceous and ground cover effects were similar across both supplementation treatments during time periods 1 and 3, while time period 2, cake supplementation had greater percent decrease of litter cover than the protein treatment (28.2 ± 4.4% vs 10.4 ± 2.9%). This research addresses comprehensive agro-ecosystem responses of dormant season grazing while providing multidimensional insight to stakeholders concerning grazing behavior and the ecological impacts on Montana rangelands.

**Survival and Reproduction of Wild Turkeys in the Northern Black Hills of South Dakota

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Chad P. Lehman, South Dakota Department of Game, Fish, and Parks, Custer

In South Dakota, wild turkeys are a high-interest species for both consumptive and non-consumptive uses. Harvest records indicate that the population segment residing in the northern Black Hills may be declining. Although data on hen survival, nesting survival, and early poult survival were collected for the southern Black Hills in the early 2000s, there is currently a paucity of demographic data for the northern Black Hills. We seek to inform wild turkey management by characterizing demography specifically for the northern Black Hills. We radio-tracked 80 turkey hens (40 adults/40 juveniles) in 2016 to estimate rates of hen survival, nesting, nesting success, and early poult survival; this two-year study will continue in 2017. Based on preliminary data, rates of nesting by adult hens are lower in the northern Black Hills than the southern Black Hills (77.5% vs. 98%), as are rates of renesting by adult hens (33% vs. 75%). We are in the process of estimating hen survival, but preliminary results indicate that annual survival is approximately 50%. Poult survival to 4 weeks is comparable in the northern and southern Black Hills, but lower than in other portions of the range of Merriam's wild turkey. Although the northern and southern Black Hills are in close

proximity, the substantial climatic differences likely explain the reduced productivity of the turkey population in the northern Black Hills. Limiting fall harvest of wild turkey hens in the northern Black Hills may be required to sustainably manage this important game species.

Wolverine Reproductive Den Habitat in Glacier National Park, Montana

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Wolverine reproductive dens occur in habitat not easily accessible to humans during the denning period (Feb – May) and can be challenging to find. As such, few den sites have been precisely described. From 2003 – 2007 we located and documented 14 natal and maternal dens of 3 reproductive female wolverine in Glacier National Park. Two females were known to have produced young in multiple years, using different den sites each year. Reproductive dens occurred at an average elevation of 1890m (range: 1805-1999m), on 9° slopes (range: 5-22°), within a variable range of aspects ($\bar{X}$=263°), and with an average snow depth of 2.6m (range: 2.4-3.4m). Den structures included downed trees, large boulders, and rock caves associated with alpine cirques, ridges, and cliff bands at, or below, existing tree line. Distance to occupied human development averaged 6.4km, and distance between denning areas of the same female in different years averaged 5.8 km. Various climate change models predict less persistent snowpack in many areas of the conterminous United States, with a resultant potential for increased isolation of island populations of wolverines.

Poster Abstracts

**Analysis of Spiny Softshell Turtle Distribution and Abundance in Four Rivers Systems in Eastern Montana (Poster)

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The spiny softshell turtle (*Apalone spinifera*) is designated as a species of concern in the state of Montana due to a lack of knowledge regarding their conservation status, loss of habitat connectivity and anthropogenic changes in hydrology. Information on population abundance, and basic population structure for these turtle species is necessary to better understand how climatic changes, human responses to these changes, and other disturbances influence this neglected faunal component of freshwater ecosystems. To examine differences in subpopulations exposed to different environmental factors, spiny softshell turtles were studied in four river systems in south eastern Montana. Over two years a total of 328 spiny softshell turtles (283 females, 41 males and four juveniles) were captured and tagged in the Bighorn, Clarks Fork, Musselshell and Yellowstone Rivers. The proportion of males to females across all four rivers was 86.28% females and 12.5% males. Based on a method adapted from the von Bertalanffy growth model by Plummer and Mills (2015), the length of the female spiny softshell turtles were correlated to known ages from other studies and broken into four age cohorts (juvenile, subadult, reproductive adult, mature adult). Numbers of turtles in each cohort were found to be significantly different between the four rivers p <

0.00001. The Musselshell and Yellowstone Rivers had a more even distribution of age classes with the Musselshell having notably less mature adult turtles. Differences in hydrology, such as temperature, and the timing and magnitude of spring pulse flows on these four rivers may explain the observed spiny softshell turtle demographic structures.

Acoustic Assessment of Year-round Bat Activity and Distribution in Montana and Surrounding Areas (Poster)

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Alexis McEwan, Montana Natural Heritage Program, Helena
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Montana's bat species face an array of conservation issues including wind energy development and disease. A collaborative project between state and federal agencies was initiated in 2011 to collect baseline data prior to the arrival of White-nose Syndrome and help inform surveillance and future mitigation strategies. In the last 6 years, we deployed a network of Song Meter ultrasonic acoustic detector/recorder stations at 76 sites across the region for an average of 1.8 years per station. Each detector recorded nightly bat passes across all seasons. To date 9.5 million sound files have been recorded. Using automated scrubbing and identification software we identified call sequences and generated initial species identifications, then hand confirmed species presence by month at each site. Over 54,000 bat passes have been reviewed by hand and used to track activity of all species at each site. To date we have 2,770 new records of monthly species presence, regular winter activity of 3 resident species, and year-round presence of 1 species previously considered migratory. Through integrating National Oceanographic and Atmospheric Association weather station with our call data, we have found positive correlations in activity with temperature and barometric pressure, and negative correlations with wind speed. Our experiences with these data highlight the importance of: (1) maintaining common settings across recording devices and consistent processing standards; (2) maintaining publicly available call libraries that can be reanalyzed using the latest software and made available to software developers; and (3) making standards used for species determinations available for peer review.

Historic Distribution and Abundance of Bison in the Rocky Mountains of the United States (Poster)

James A. Bailey*, Belgrade, MT

Scant public awareness of the early distribution and abundance of bison (Bison bison) in the Rocky Mountains of the United States inhibits discussion of possible restoration of wild bison. A review of written evidence, largely from 1805-1845, indicates bison were widely distributed in intermountain valleys, with a major regional concentration spanning parts of Idaho, Montana, and Wyoming. However, several interacting factors caused large spatial and temporal variation in bison abundance. Native American predation was likely a major influence on bison distribution and abundance during and shortly before 1805-1845. The area where bison were observed by early explorers underestimates the area where restoring productive herds of wild bison is possible.

**Confronting the Challenge of Whale Detection from Large Vessels (Poster)

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Paul M. Lukacs, Wildlife Biology Program, University of Montana, Missoula
Sara H. Williams, Wildlife Biology Program, University of Montana, Missoula
Scott M. Gende, Glacier Bay National Park & Preserve, National Park Service, Juneau, AK

As a result of a moratorium on commercial whaling, most populations of large whales are increasing across the globe. However, concurrent growth in shipping means that lethal ship-whale collisions constitute a significant threat to whale conservation efforts. This study investigates the ability of ship operators to detect and avoid whales by quantifying the predictability of whale surfacing behaviors, which are the cues used to determine whale presence. Whale avoidance is challenging because whales spend most of their time underwater and thus unavailable to be detected (the "availability process"), but must be detected at sufficiently large distances (the "detection process") to enact an effective avoidance maneuver. We quantified one of the main characteristics of whale behavior that governs detectability – time breaking the surface – to create a novel model of whale surfacing patterns around ships while accounting for the detection process. We then estimated the frequency with which cues go undetected (i.e. whales break the surface but ship operators are unaware of them), as well as the frequency with which whales are present but unavailable for detection (i.e. below the surface of the water). This work will enable the prediction of close ship-whale encounters given different combinations of detected and/or missed cues at varying ship speeds. It will support ship operators' avoidance efforts by quantifying the availability and detection processes in a way that facilitates the development of whale avoidance protocols.

**Estimating Migratory—Resident Elk Populations and Juvenile Recruitment Using Remote Cameras in the Canadian Rockies (Poster)

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Mark Hebblewhite, Wildlife Biology Program, University of Montana, Missoula

The use of remote cameras has been at the forefront of debate in the sphere of wildlife population estimates. There is research suggesting camera surveys underestimate ungulate populations, however, with a second component of estimation, such as years of GPS points from collared elk, modeling a population and estimating resident elk calf recruitment and juvenile survival can become quantifiable. During the summer of 2016 I initiated an undergraduate research project under Dr. Mark Hebblewhite's ungulate ecology lab. Over the span of the summer, I deployed 28 remote cameras in a previously sampled large carnivore occupancy grid. The study area is the Ya Ha Tinda Ranch, adjacent to Banff National Park, Alberta. The purpose of my project is to estimate migratory—resident elk populations and juvenile recruitment utilizing remote cameras. Estimating ungulate populations is technical, expensive, and often a dangerous (helicopter surveys) task. As the ecology community evolves into safer, less invasive and more cost effective methods for population estimates, it is up to the wildlife research community to produce evidence that such methods are effective. My research is attempting to do just that with 88 collared individuals inhabiting the study area, *spatially explicit mark re-sight models* can be quantifiable in measuring non-uniquely identifiable ungulate populations across a landscape. The potential scientific impacts and applications resulting from my research project would be significant. A publication detailing how an elk population— with collared and uncollared individuals can be estimated strictly with remote wildlife cameras and would be a contribution in the desired direction of population ecology for less invasive, yet highly accurate and efficient population studies.

Bighorn Sheep Male Versus Female Use of Mineral Licks Within Glacier National Park (Poster)

Brandon L. Kittson*, Salish Kootenai College, Pablo, MT and USGS Northern Rocky Mountain Science Center, West Glacier, MT
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Little is known about the behavior of bighorn sheep when it comes to their use of mineral licks, including which groups frequent and utilize these licks the most. In the research, we used for this poster, we deployed a remote camera at a mineral lick within Glacier National Park near the Blackfeet Reservation. We analyzed 6124 photos using the Timelapse2 software. We then classified visits by ten minute intervals. We counted the maximum number of sheep by age class and sex within the ten-minute period, for sampling in 2014 and 2015. The results show a clear indication that this lick is used far more heavily by ewes and lambs than rams. This implies that this mineral lick is a particularly important resource for ewes and juvenile sheep. Further studies could provide more information on population dynamics and provide invaluable information that could possibly aid in management strategies.

Using Emerging Technologies to Bolster Long-Term Monitoring of Wetlands (Poster)

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Andrew Ray, Greater Yellowstone Network, National Park Service, Bozeman
Andrea R. Litt, Ecology Department, Montana State University, Bozeman
Adam Sepulveda, United States Geological Survey, Bozeman
Shan Burson, Grand Teton National Park, Moose, WY
Robb Diehl, United States Geological Survey, Bozeman, MT
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Freshwater wetlands support a disproportionately high diversity of species relative to other ecosystems and they are particularly vulnerable to climate change. Across Grand Teton and Yellowstone National Parks, wetlands represent just 3% of the landscape, yet 70% of Wyoming bird species and all native amphibians in the region use wetlands for some stage of their life. The Greater Yellowstone Inventory and Monitoring Network has monitored amphibians in wetlands since 2006 and found that over 40% of the region's isolated wetlands are dry in years with above average temperatures and reduced precipitation. Adding novel technologies to these monitoring efforts will increase our understanding of species diversity in wetlands susceptible to drying. We outfitted three wetland sites in Grand Teton National Park with acoustic (i.e., audible and ultrasonic) monitoring technology and wildlife camera traps in summer 2016. We collected data over a four-week period to test the efficacy of automated technology for wetland monitoring. Based on preliminary results from the ultrasonic monitoring and wildlife cameras, we detected four times more species with these tools, when compared to visual surveys of amphibians alone. Additionally, automated methods allowed us to detect species over a longer time window than feasible with visual surveys. We will continue our work in 2017, using environmental DNA, acoustic monitoring, and wildlife camera traps to capture information about a broader diversity of taxa using wetlands, to expand and enrich current monitoring efforts.

Restoration Plan for Sharp-Tailed Grouse Recovery in Western Montana (Poster)

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Sharp-tailed grouse are abundant east of the continental divide in Montana, however western populations were extirpated during the last century. Previous translocations of sharp-tailed grouse to prevent the collapse of western populations were unsuccessful. Interest in restoring sharp-tailed grouse to western Montana has persisted and spurred preliminary habitat evaluations of potential restoration sites. However, information is needed to inform recovery goals and develop a restoration program for the species in western Montana. At the request of Montana FWP, we developed a restoration plan that 1) evaluates the potential of identified restoration sites to support a reintroduced population of sharp-tailed grouse, and 2) describe actions needed to establish and manage a successful reintroduction of populations in western Montana. Our analyses of ecological and demographic requirements, suitability of available and potential habitat conditions, and population viability of sharp-tailed grouse indicated that a viable population of sharp-tailed grouse is likely not possible at identified recovery sites under current habitat conditions. However, population restoration in western Montana is possible with a concerted and sustained effort by multiple entities, and that the most suitable site for initial recovery efforts is within the Blackfoot Valley. We identified habitat limitations that should be addressed prior to reintroductions and developed prescriptions for population translocations and recovery, including protocols that minimize translocation-related mortalities, reduce movements away from the initial release sites, facilitate the quick establishments of leks, and assure sufficient genetic variation of founders to prevent genetic bottlenecks and inbreeding.

**Sparrow Dispersal as an Agent of Disease Transmission (Poster)

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Hannah Butorovich, Biology Department, Montana Tech, Butte
Stella Capoccia, Biology Department, Montana Tech, Butte

This project tracks the movement of the Eurasian House Sparrow (*Passer domesticus*) as a potential vector for disease, specifically between backyard chicken coops. Controlled studies show that sparrows and chickens easily transmit a host of diseases between species, including the avian flu, E.coli (Escherichia coli), and Salmonella, many of which are also transmittable to humans. There hasn't been a lot of research that tracks the movement of sparrows, especially between chicken coops as feeding stations. Our hypothesis is that sparrows use multiple chicken coops as feeding sites, thereby serving as a vector for disease. This research will help improve the scientific understanding for the potential impact sparrows could have, by being a vector for transmission to chickens, as well as other species, by the use of the different coops as feeding sites. Using traps designed specifically for sparrows,

we captured the birds at 15 sites in the urban area of Butte-Silver Bow County. We then used colored leg bands to identify the birds based on location and age, and developed a number system to account for individuals. As the research progressed, increased movement between locations was observed. In conclusion, by tracking the movement of sparrows we can explain the extent to which backyard chicken coops are connected, and thereby investigate the vulnerability of the chickens to disease transmission

**Targeted Cattle Grazing to Enhance Sage-Grouse Brood-Rearing Habitat (Poster)

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Often, greater sage-grouse (*Centrocercus urophasianus*) brood-rearing habitats dominated by dense mountain big sagebrush (*Artemisia tridentata vaseyana*; >10-25% canopy cover) limit important forbs and arthropods sage-grouse rely on during summer. We investigated whether protein supplementation could concentrate cattle during fall to reduce sagebrush canopy cover and increase the diversity and abundance of forbs and arthropods. We applied targeted cattle grazing within three large, contiguous pastures in the Beaverhead Mountains of southwestern Montana. In each pasture, we selected one 4-ha macroplot of dense sagebrush (>30%). Within each macroplot, we placed low-moisture block protein supplement in four microsites (78.5-m2) and compared cattle response to four untreated control microsites. The following summer we measured herbaceous canopy cover and composition, shrub canopy cover, ground cover, forb and arthropod diversity, and arthropod density for each treated and untreated microsites. Mountain big sagebrush canopy cover was 71% less in treated vs. untreated microsites (11% vs. 38% canopy cover, respectively; $P < 0.001$). Bite count observations indicated that sagebrush cover was reduced by cattle trampling rather than browsing, as sagebrush comprised <1% of cattle diets. Forb diversity was 13% greater in treated microsites ($P = 0.094$), forb species richness was 16% greater in treated microsites ($P = 0.044$), and forb composition trended higher in treated microsites (45% of herbaceous composition in treated microsites vs. 32% in untreated microsites; $P = 0.106$). Lepidoptera density trended 18% greater in treated microsites ($P = .133$). Our results indicate that protein supplementation during late fall can concentrate cattle to enhance sage-grouse brood-rearing habitat.

**Assessing Habitat Quality for Four Grassland Songbird Species of Concern in Northern Philips County Montana (Poster)

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Over the last 40 years, grassland bird populations have declined faster than any other avian guild in North America. In northern Montana, four species are experiencing particularly dramatic population decline, Baird's Sparrow (*Ammodramus bairdii*), Sprague's Pipit (Anthus spragueii), Chestnut-collared Longspur (*Calcarius ornatus*), and McCown's Longspur

(*Rynchophanes mccownii*), all four are classified as species of concern in Montana. The primary threat to grassland birds is thought to be habitat degradation and fragmentation due to conversion of native prairie to farmland, energy development, and exurban development. The majority of the remaining native prairie is maintained for cattle grazing, either on private ranches or on public land that is then leased out to private ranchers. Informed management on native prairie has the potential to maximize habitat value for vulnerable species, however, currently we are still lacking the necessary information to design management strategies. Previous studies have attempted to describe quality habitat for grassland songbirds, defining quality, as conditions supporting a high density of adults successfully producing offspring. However these studies typically focus at the individual nest scale, habitat quality definitions at a scale useful to management are still poorly described. This study will attempt to fill this gap in knowledge, its objectives are 1) evaluate how local and pasture-level vegetation conditions affect nest survival for our focal species, 2) evaluate the effects of vegetation composition and structure on bird abundance and nest density, and 3) Evaluate the functional relationships among abundance, nest density, and nest survival.

**Testing an eDNA marker for Common Snapping Turtles (Poster)

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Common snapping turtles (*Chelydra serpentina*) are a species of concern in southeastern Montana and some southern states; however, they are invasive to the Crown of the Continent ecosystem. Although raccoons and foxes destroy over 90% of the eggs, the few remaining survivors that reach adulthood are enough to raise serious concern as they prey upon many native species and have no natural predators. According to the Montana Natural Heritage Program, there have been only three documented reports of snapping turtles in the Flathead Valley, yet we have observed an additional 19 unreported individuals. We tested a previously developed environmental DNA (eDNA) marker for common snapping turtles to help determine their distribution in the Flathead Valley. We extracted DNA from snapping turtle tissue samples collected in the Flathead Valley to verify marker effectiveness. We hypothesized McGilvray Lake and a nearby small pond would be positive for snapping turtle DNA, while Spencer Lake would be negative. Painted turtles (Chrysemys picta belli) were visually detected in all of the waterbodies while snapping turtles have not been observed in Spencer Lake. We collected eDNA samples via water filtration in December 2016. All of the eDNA samples were negative for snapping turtle DNA. We believe our analysis produced negative results because during the winter the turtles bury themselves in the mud and the DNA can degrade or that we did not capture enough DNA. We plan to sample in the summer when the turtles are more active to increase our probability of detection.

**Carnivore Territoriality: Simulating Economic Selection of Territories (Poster)

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We are developing theoretical models of territorial behavior of carnivores. This work will be useful for predicting the abundance of wolf (*Canis lupus*) territories in Montana and Idaho. Coupled with a patch occupancy model, it will provide more accurate estimates of abundance of wolves in each state. Ultimately, our work will also provide a better understanding of territorial behavior of a large carnivore. We are simulating the territory selection process for carnivores choosing patches on a landscape based on benefits of prey, where prey distribution ranges from overdispersed to highly clumped. Simulated carnivores will also consider hypothesized costs of patch ownership, including travel, competition, and mortality risk. In each simulation, carnivores will acquire patches for a territory as economically as possible based on these benefits and costs. Simulating various combinations of these hypothesized benefits and costs of patch ownership will provide predictions of territorial behavior. We can then compare these predictions to the territories of real wolves to determine which model is most predictive of actual wolf behavior. Starting with a model for benefits of prey and costs of travel, we found that prey distribution may influence mean size, quality, and fragmentation of simulated territories. Based on these preliminary results, we might expect differences in size or quality of territories in regions with different prey communities. Most importantly, this work provides a foundation from which we will build more complex models of territorial behavior of carnivores.

Birds, Herps, and Small Mammals! Oh, My! Help FWP Find Rare and Elusive Species (Poster and Oral Presentation)

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In 2014, Montana Fish, Wildlife & Parks (MFWP) expanded their Nongame Program to include a Wildlife Biologist specializing in nongame species work in every region. Although each region has different priorities, the goals within the Nongame Program are universal: (1) Keep common species common, (2) Reverse population declines for species of concern, and (3) Foster awareness and enhance public knowledge and appreciation of nongame species. Our efforts are guided by the State Wildlife Action Plan (SWAP) which prioritizes work on habitats and species of greatest conservation need. These efforts include anything from developing habitat conservation projects to surveying single species. Within the SWAP there are a number of species considered Species of Greatest Inventory Need because they lack

sufficient data to determine their status. Often these species are rare, elusive, or difficult to observe. Consequently, we seek the help of others to provide incidental observations in addition to our structured survey efforts. Some of our high priority species include: (1) black rosy-finch, a small high-alpine songbird, (2) greater short-horned lizard, a cryptic reptile dependent on sparse habitat, (3) black-tailed jack rabbit, a lesser-known lagomorph found in open country habitat, and (4) black swift, the largest of the swift species, nesting secretively in shallow caves and behind waterfalls. People interested in assisting with surveys should contact the appropriate FWP nongame lead. By working together, we can provide managers and regulatory agencies with vital information to make well-informed decisions about our valued resources in Montana.

**Understanding how Characteristics of the Nest Site Affect Nest Success of Wild Turkeys (Poster)

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Wild turkeys (*Meleagris gallapavo*) are a highly-desirable game species throughout the United States, but harvest records in the northern Black Hills, South Dakota suggest that this population is declining. We wondered whether vegetation characteristics at the nest site would affect nest fate (success/failure). We monitored 40 nests during summer 2016 to determine nest fate and 27 were successful (≥1 egg hatched). At the actual or expected hatch date, we quantified characteristics of the understory vegetation at the nest bowl, namely total cover, shrub cover, woody debris, and the degree of visual obstruction. We compared these characteristics between successful and unsuccessful nests. Successful nests had slightly less woody debris and total cover than unsuccessful nests. We did not detect differences in shrub cover or the degree of visual obstruction. Our results suggest that there may be some optimal amount of total cover and woody debris at the nest bowl that contributes to a higher chance of nest success. We recommend additional research that focuses on how vegetation characteristics found at nest sites compares to what is available. This information in conjunction with our findings could provide guidance for managers regarding vegetation characteristics that may be optimal for nest success. Although these data may help manage turkey populations, nesting represents only one part of the life cycle of a wild turkey. We recommend that managers strive for a mosaic of vegetation characteristics to accommodate the needs of turkey populations throughout their life history.

** Effects of Livestock Grazing Management on Grassland Bird Abundance in the Northern Mixed-Grass Prairie (Poster)

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Grassland bird populations have been declining throughout a majority of their range in the United States and Canada over the past 40 years, and currently have the most accelerated declines of any guild of terrestrial birds in this region. Rangelands used for domestic cattle grazing are important for maintaining large tracts of native grassland that may otherwise be converted to agricultural use or other human development. In addition, grassland birds respond well to livestock grazing systems that increase habitat heterogeneity by mimicking

historic grassland disturbance, such as fire and bison grazing. Montana Department of Fish, Wildlife, and Parks (FWP) implements a rest-rotation grazing system within conservation easements to increase structural heterogeneity of grassland vegetation on the landscape. However, the rest-rotation grazing system administered by Montana FWP was developed for more arid, bunchgrass-dominated rangelands and has not been evaluated as a management tool for creating structurally diverse wildlife habitat in the northern mixed-grass prairie. This study examines the effect of a rest-rotation grazing system on breeding season habitat selection and abundance of four native grassland songbird species, Baird's sparrow (*Ammodramus bairdii*), grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Pooecetes gramineus*), and western meadowlark (*Sturnella neglecta*), relative to traditional season-long or rotational grazing systems on a Montana FWP conservation easement in eastern Montana. Our objectives for the study are: 1) evaluate how abundance and space-use of four focal grassland bird species are affected by grazing treatment; 2) estimate the importance of habitat and vegetation characteristics for focal species within pasture treatments; 3) offer management recommendations to agencies and private landowners for improving grassland bird abundance and habitat quality.

**Combining Radio-Telemetry with Stable Isotope Techniques to Determine Wintering Origin of Greater Sage-Grouse (Poster)

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Much of Greater Sage-grouse conservation is focused on improving habitat around lekking areas, but distant wintering habitat may contribute equally to the viability of populations, a pattern that has been shown with other avian taxa. On-going research in the Centennial Valley in southwestern Montana has tracked 182 female Sage-grouse throughout the year with VHF radio-telemetry collars. Based on this work, we have observed individuals move as little as 0.73 km or as far as 79.2 km from their lek to wintering grounds (mean distance = 23.8 km). We also have learned that some individuals exhibit high fidelity to wintering sites across years. We aim to better understand the importance of wintering grounds on life history of Greater Sage-grouse. We will identify wintering origin of individual females using radio telemetry and stable isotope techniques and assess the influence of wintering grounds on reproductive success. Our findings will help managers identify seasonal habitats contributing to reproductive success, areas critical to Sage-grouse conservation in southwestern Montana and southeastern Idaho that may have been previously overlooked. These techniques also could be effective in other regions where Sage-grouse exhibit long distance, seasonal movements.

In-Hand Measurements of Adult Bats in the Northern Great Plains and Rocky Mountains (Poster)

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Researchers rely on keys and other published records of pelage and morphological characteristics to identify bat species in the field. However, these records may not reflect the variability of measurements taken in a field setting, particularly if they are based upon museum specimens or a small number of live individuals. To assist in the identification of

similar bat species, we created a supplement to the "Key to Idaho, Montana, and South Dakota Bats." We compiled 3,222 records of 11 species of adult bats captured between 1994-2016 in Montana, northern Idaho, and northwestern South Dakota. Using this dataset, we have provided distributions of body measurements as well as insight into the timing of reproduction, parturition, and seasonal body condition for 14 of the 15 species occurring within Montana. Following data analyses, we concluded that: (1) lengths of smaller appendages such as the thumb and tragus show substantial variation, demonstrating that more precise measurements are required; (2) parturition dates appear similar across all species present in the study area, including migratory bats; (3) trends of low body mass in late summer captures may represent older juveniles that are difficult to distinguish from adults by current methods; and (4) we require more data to analyze the traits of species that are infrequently captured. This document will be available on the Montana Natural Heritage Program website (mtnhp.org) to assist researchers in the field.